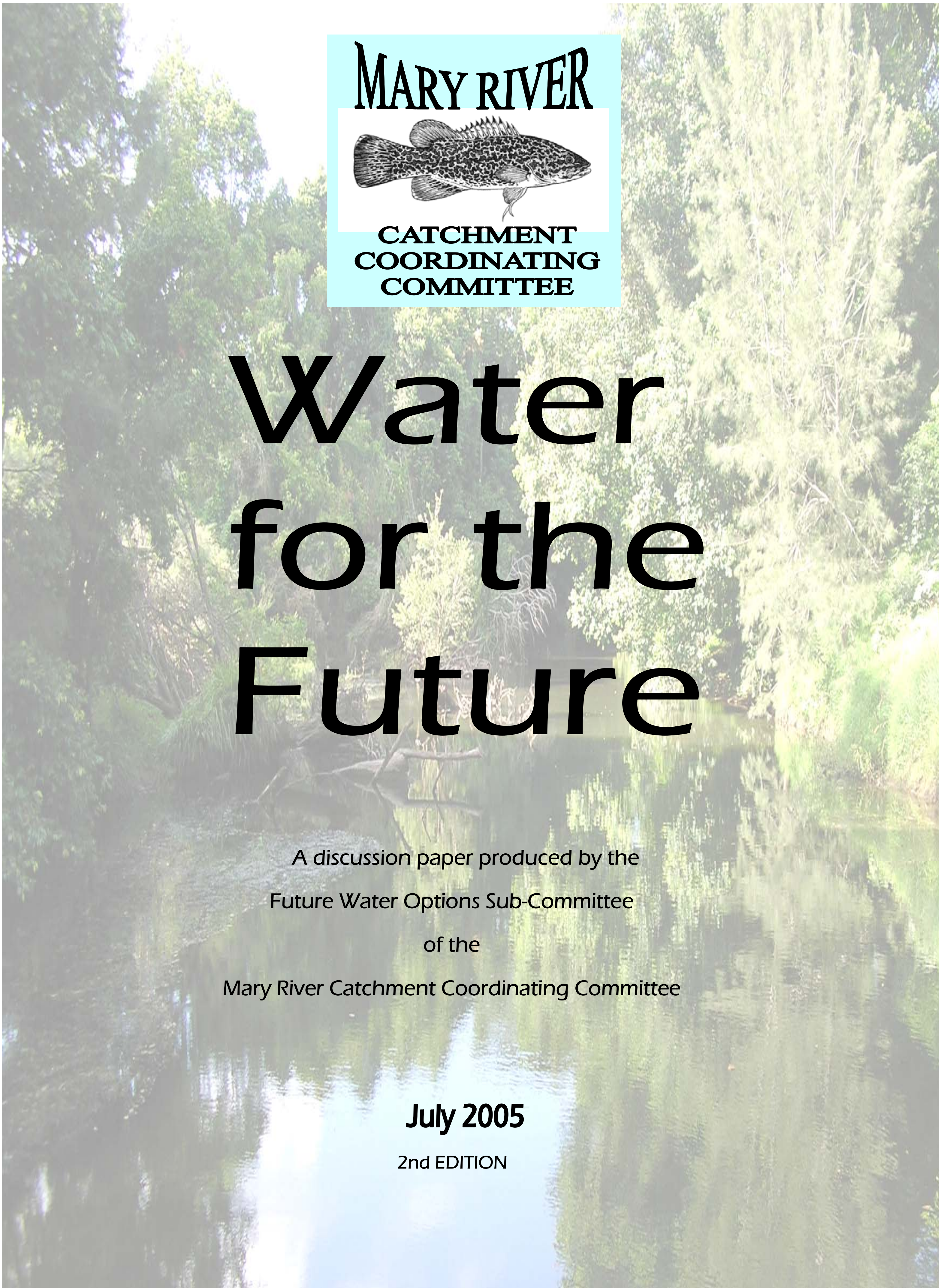

MARY RIVER
CATCHMENT COORDINATING COMMITTEE

Water for the Future

A discussion paper produced by the

Future Water Options Sub-Committee

of the

Mary River Catchment Coordinating Committee

July 2005

2nd EDITION

Water for the Future Discussion Paper

Introduction

The Mary River Catchment Coordinating Committee (MRCCC) aims to stimulate debate on long term, sustainable water supply strategies and highlight that water is a finite resource, which needs to be carefully managed. Unless major changes are implemented in the way water is managed, competition between urban water users and irrigators will intensify in the Mary Basin. The community needs to be aware that there are alternatives to building more dams.

This document provides information on sustainable options for reticulated urban water supply including rainwater tanks, recycling and desalination.

The Mary Basin incorporates the whole of the Mary Catchment from Maleny to Hervey Bay, the Sunshine Coast catchments (Mooloolah, Maroochy and Noosa), the Burrum River catchment, and the Cooloola Coast (Rainbow Beach and Tin Can Bay).

Recent figures compiled by the MRCCC show that the current population of the Mary Basin is close to 400,000. Some of the towns in this region are among the fastest growth-rate localities in Queensland. Projections by the Department of Local Government and Planning indicate the population of this region will double in 20 years. This growth is already placing significant pressures on the catchment's natural resources and the provision of community services.

The MRCCC is dedicated to achieving a sustainable and productive catchment. In achieving this vision, our members hope to ensure that we will not be judged by what we take from the catchment, but by how we leave the catchment so that it's capacity to support our future generations is enhanced.

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Water for the Future

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Dams are letting us down.
We are polluting our rivers & wasting our resources

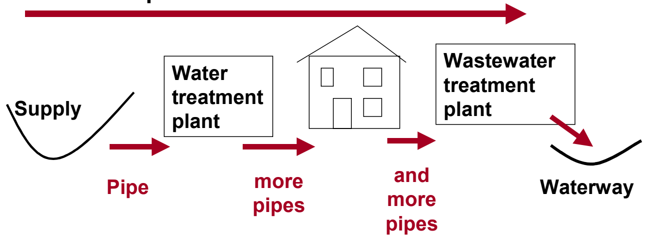
Water supply sources

- dams and weirs provide most of the water supplied for urban use on the Sunshine Coast
- their catchments are unprotected
- groundwater is not a major contributor
- little is known about groundwater

Water Treatment Plant

- water is treated so that it is safe to drink
- amount of treatment required (and cost) depends on raw water quality
- risk should be identified and managed
- technology is available to treat water of any quality to virtually pure

The current Urban Water Cycle is a straight line from dam to disposal with a shortage of water at one end and pollution at the other



Water at work

- drinking water is used in industry, institutions and in our homes where half is used inside the house and half outside
- only 1% of the drinking quality water we are supplied with is consumed

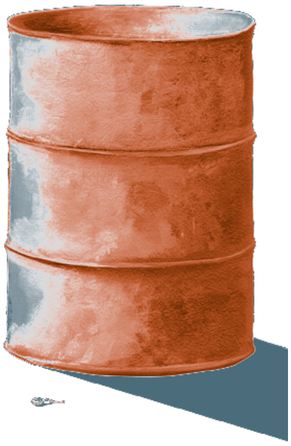
Demand management

- demand management is a cost effective way of making existing water supplies go further
- more efficient appliances are needed - changes to community behaviour are difficult to maintain
- it can provide "breathing space" but will not be sufficient to provide for projected populations in the longer term

Demand management includes:

- WaterWise programs and education
- unaccounted-for water and leakage reduction
- pricing incentives
- restrictions
- water-efficient appliances
- pressure management

Wastewater management



- wastewater contains one tablespoonful of dirt in a 44 gallon drum of water
- it is treated to separate the water (effluent) from the dirt (biosolids)
- the amount of treatment depends on how the effluent is to be managed
- effluent is disposed of in a waterway or the ocean in accordance with an EPA licence
- EPA licences are becoming more rigorous
- pollutants of concern to the receiving environment are carbon containing chemicals and nutrients

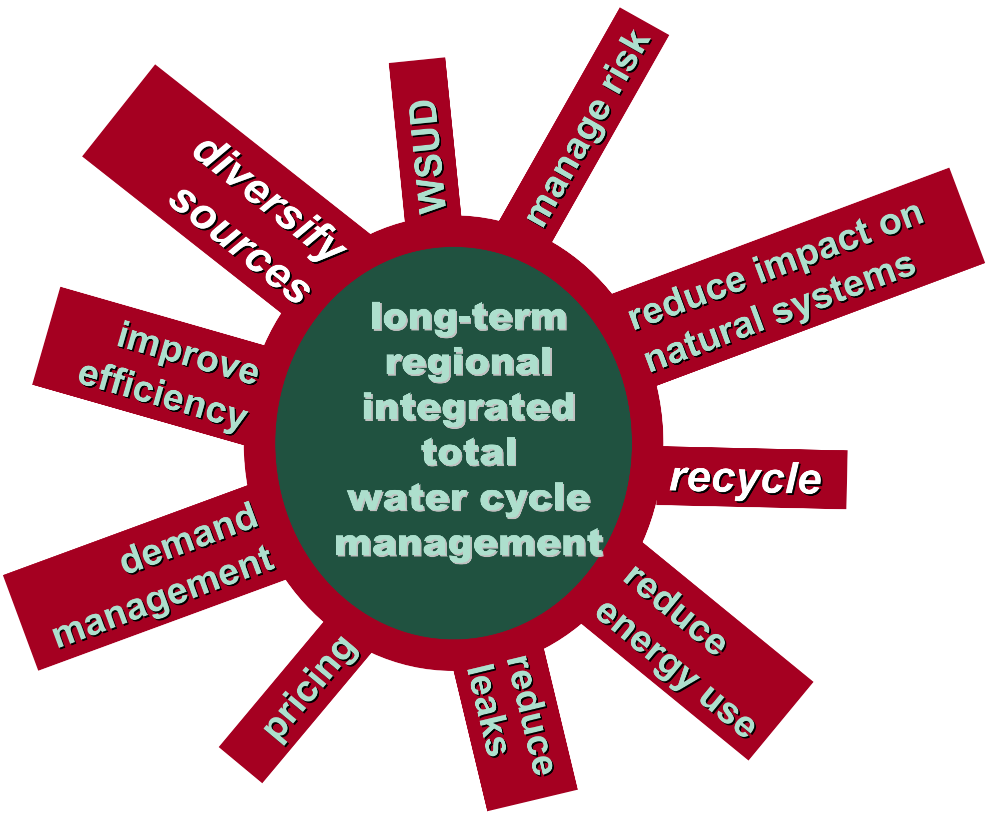
Senate Inquiry into Urban Water Management 2002

- we do not use water sustainably
- we know we have to change
- we have the technology and expertise

but we are not doing it !

Sustainable urban water management involves:

- quality fit-for-purpose - safeguarding public health
- the security of a diversity of sources
- water-use efficiency
- reducing impact of waste discharge
- reducing energy use



Water supply options

- dams
- rainwater tanks
- desalination
- recycled water

Dams

- dams have been a traditional strategy to cope with our unpredictable and uncertain climate – but they are letting us down
- are a barrier to the flow of water, sediments, oxygen and energy
- inundate good agricultural land
- have social and cultural impacts
- change a river's hydrology
- the best dam sites have already been developed
- new sites are in lower rainfall areas and further from where the water is needed
- yield of dams is less than previously thought due to environmental flow requirements and lower rainfall
- building a dam doesn't make it rain
- an advantage of dams is that they are a "short term" political fix
- some dams provide a source of power, flood mitigation and recreational opportunities

Rainwater tanks

- If rainwater is the only source of quality water, the bigger the rainwater tank, the better – limited only by the size of the roof catchment and rainfall
- If a trickle-top-up system is used, models are available to work our the optimum size.

Advantages of rainwater tanks

- tanks in coastal urban towns are generally in a higher rainfall area than more inland dams
- they fill from small and medium rain events as opposed to dams that require larger events before run-off into the dam is significant especially after a dry spell

Optimum use of rainwater tanks

- they must be used constantly and regularly – not just on the garden
- studies on the Gold Coast show 25 – 30% of household demand can be provided by a 10,000 litre tank with a trickle top-up system

Rainwater tank size

Choice of tank size is determined by a number of factors:

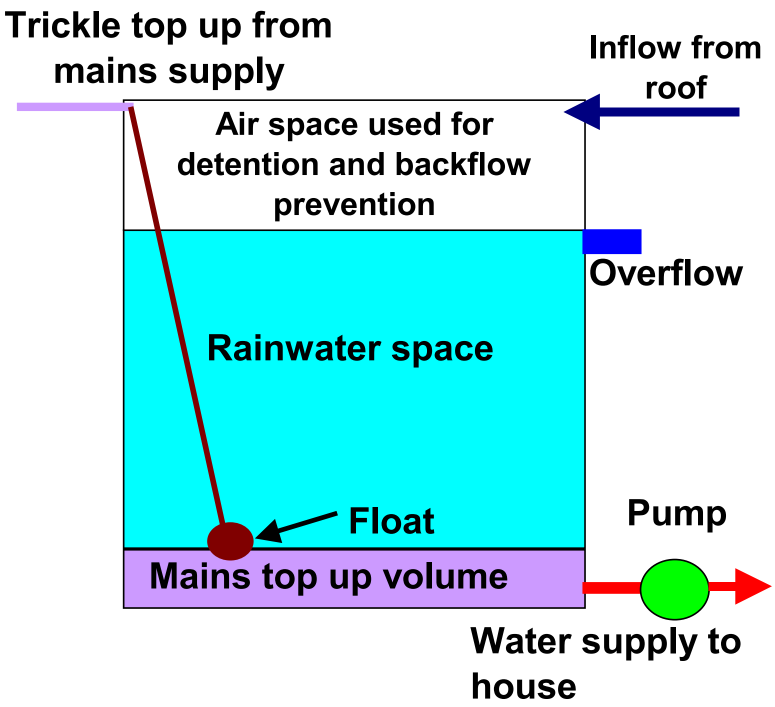
- the volume of water required each day
- the rainfall
- the size of the roof
- the security of supply required – if there is a prolonged drought the amount of water stored in the tank may not be sufficient to avoid buying water

There is a point at which additional increases in tank capacity will have only a marginal effect on yield but significantly increase cost.

> The size of the tank you will need depends on your roof area, rainfall, how much water you use each day and whether you are prepared to buy water if you run out.

This table shows the tank sizes required to provide 99% security of supply

Volume required (l/d)	Annual rainfall (mm)	Roof area (m^2)						
		100	150	200	300	400	500	600
		Minimum tank size (kl)						
100	200						*40*	
	300				*20*	*17*		
	600	*19*	*12*	*10*	*8*			
	1200	*10*	*8*	*7*				
200	300							*47*
	600			*36*	*26*	*22*	*20*	*18*
	1200	*34*	*24*	*19*	*16*	*14*		
400	500							*51*
	600							*47*
	1200				*47*	*39*	*34*	*31*



The Trickle Top-up system (Diagram courtesy of Dr Peter Coombes)

The trickle 'top up' system

- the tank is topped up by a low flow from the mains when water levels in the tank are low
- the tank tops up to a minimum level until rainfall fills the tank again
- mains supply
- the tank water is used for toilet flushing, the hot water service and outside uses
- a second pipe provides water for drinking
- the constant flow takes the daily peaks out of household demand enabling cost savings at the water treatment plant and the use of smaller pipes

Disadvantages of rainwater tanks

- microbiological quality is not as high as reticulated water
- potential to be a breeding place for mosquitoes
- regular maintenance and cleaning required
- profits of the water providers reduced

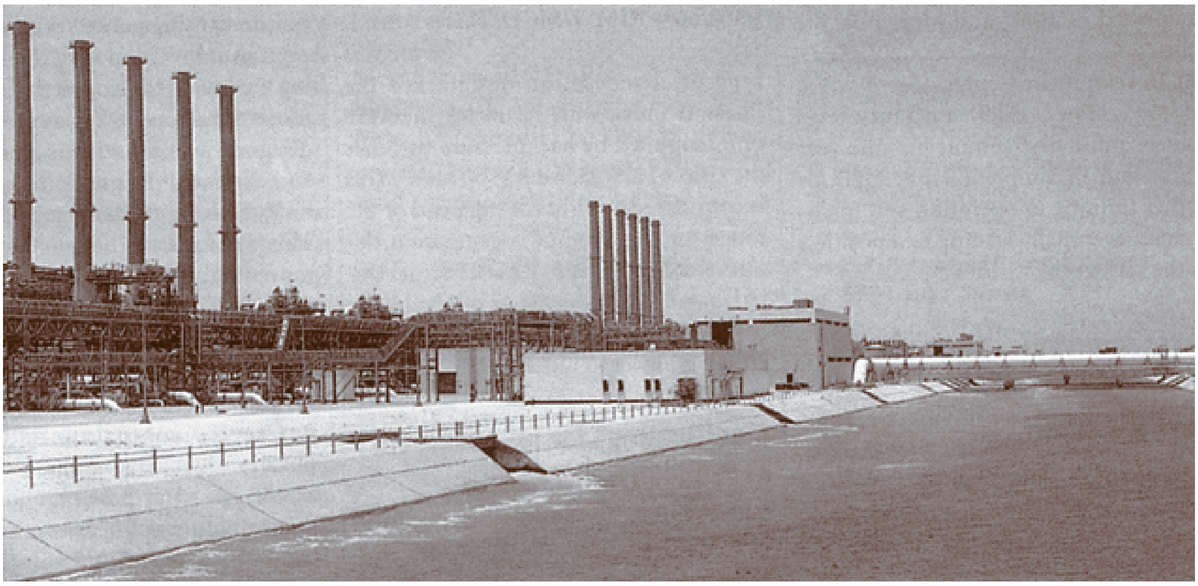
To find out more about rainwater tanks, visit this website:

http://www.dhs.sa.gov.au/pehs/publications/monograph-rainwater.pdf.

Desalination

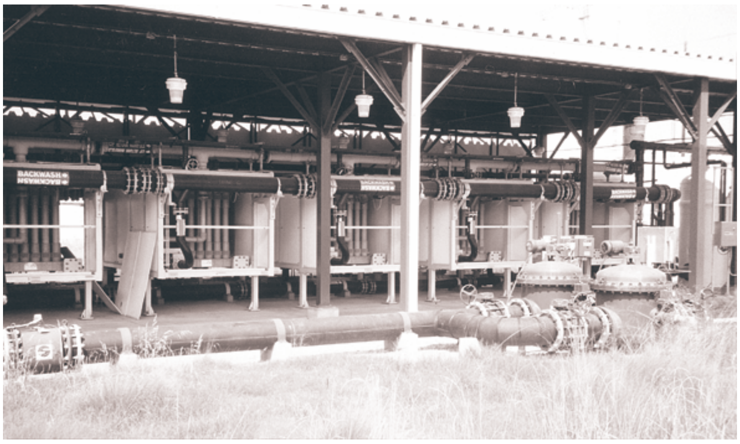
- fresh water can be recovered from seawater using "multi-stage flash" or membrane technology
- multi-stage flash is used mainly in the Middle East where there is an abundant quantity of energy from oil

The Al-Jubail "multi stage flash" desalination plant in Saudi Arabia is the largest in the world



Desalination – reverse osmosis

- reverse osmosis membranes produce water that is virtually "pure"
- they require a lot of energy and the waste stream is expensive and difficult to manage
- membrane technology has advanced over the last decade. The cost of production has fallen
- the same technology can be used to reclaim wastewater



The reverse osmosis desalination plant at West Basin in California produces 10 mega litres of water daily for use in an oil refinery

Recycled water

- the water we use inside our homes (50% of demand) goes to a wastewater treatment plant where it becomes available for recycling
- water available for recycling increases with population
- a recovery rate of 70 – 80% is technically feasible using nutrient reduction, ozonation and membrane technologies

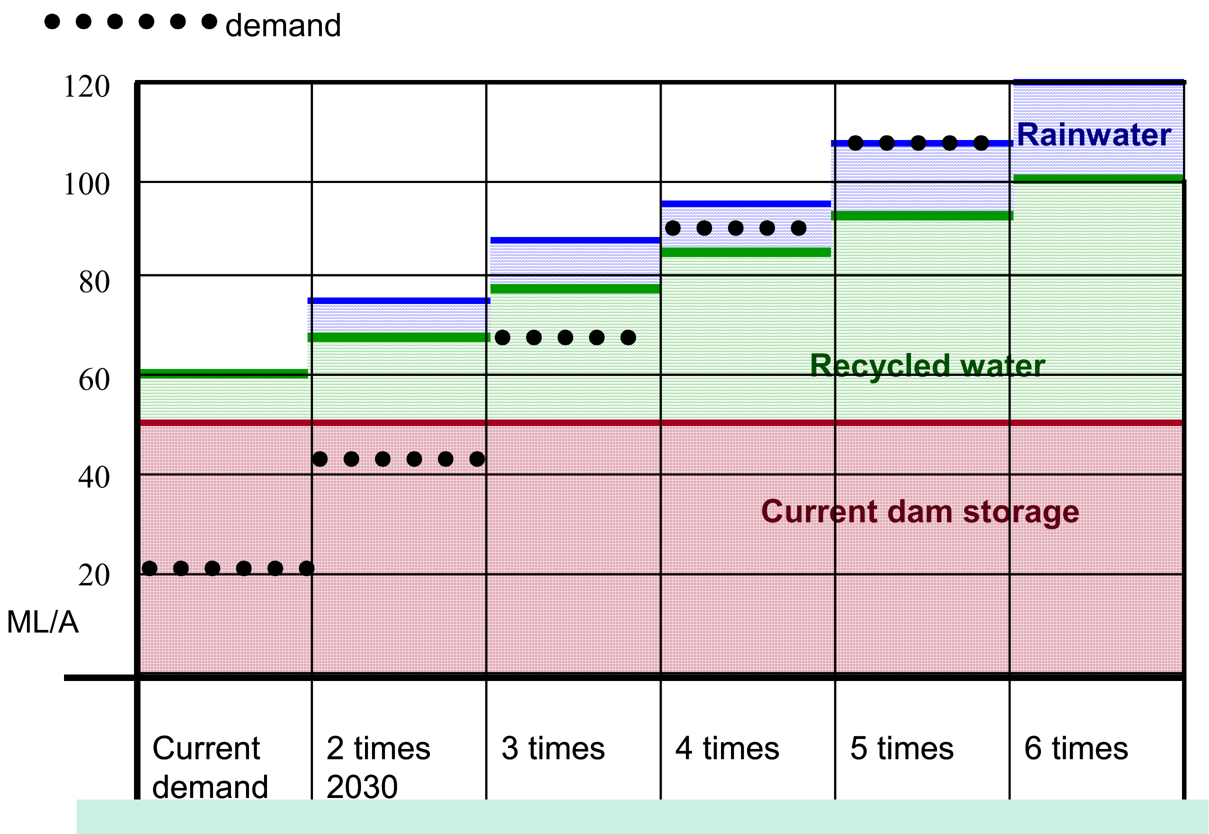
Case Study

Caloundra/Maroochy water cycle management

- the current way of disposing of our waste is unsatisfactory
- the Maroochy River had a D grade (poor) in 2004 due, at least in part, to effluent discharges to the river
- the outfall at Kawana has long been a source of controversy and a waste of water
- current dam storages will meet the needs of Caloundra and Maroochy for approximately another 30 years
- increasing population is occurring at the same time as climate change resulting in decreased run-off to refill dams
- current production from Landershute is 21,000 ML per annum
- over 50% of this goes to a wastewater treatment plant (assume 50%)
- 85 - 90% can be reclaimed (assume 70%)
- expected yield from rainwater tanks with trickle top-up is 25 – 30% on Gold Coast (assume 20%)

Current storage ML/a	52,000	52,000	52,000	52,000	52,000	52,000
demand	21,000 current	42,000 X 2	63,000 X 3	84,000 X 4	105,000 X 5	126,000 X 6
50% at STP	10,500	21.000	31,500	42,000	52,500	63,000
70% recovery	7,000	14,700	21,700	29,400	36,400	44,100
Current + recycled	59,000	66,700	73,700	81,400	88,400	96,700
Rainwater 20%		8,400	12,600	16,800	21,200	25,200
Current + recycled + rainwater		77,100	86,300	98,200	109,600	121,900

Caloundra/Maroochy water supply with recycled water and rainwater tanks



Benefits of recycling at both ends of the pipeline

- recycled water and rainwater could supply four to five times the present population in Caloundra and Maroochy without any restrictions on demand
- it reduces waste and pollution caused by present disposal practices

Benefits of recycling water to the urban supply

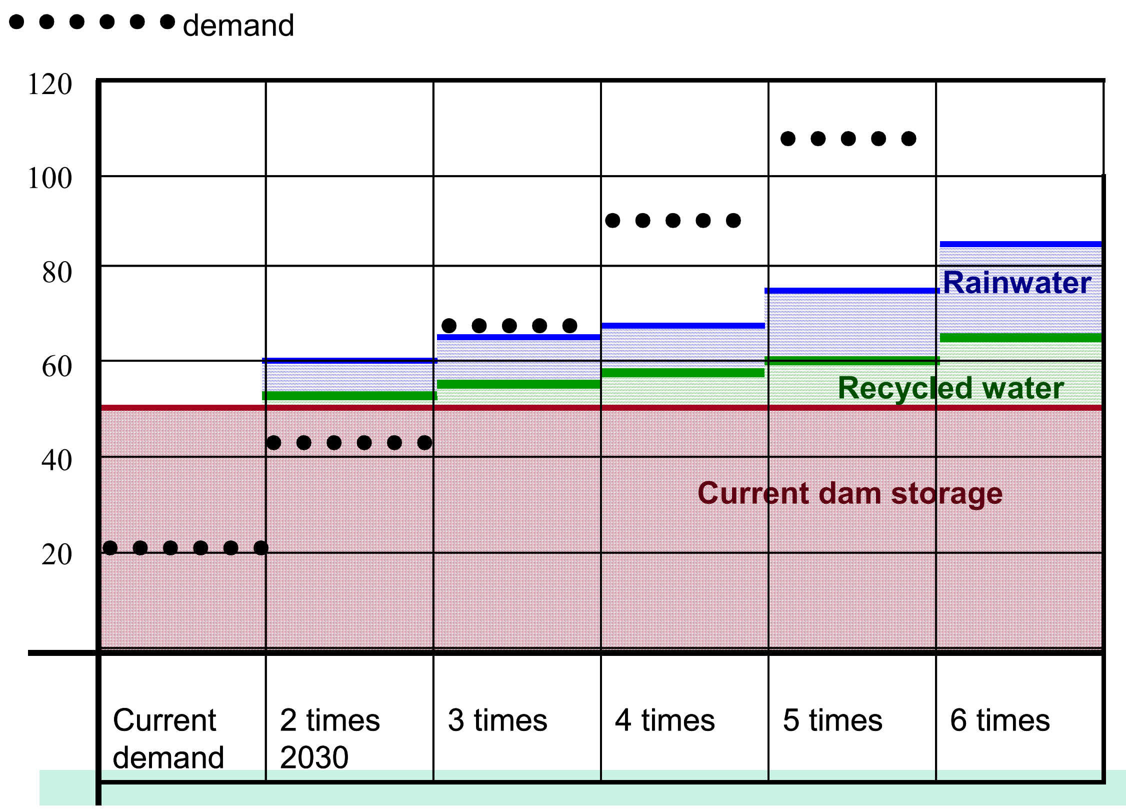
- an alternative *secure* supply that reduces our dependence on dams
- not affected by climate change
- demand and availability coincide – unlike the mismatch when recycled water is used to meet the seasonal needs of plants

Dual reticulation

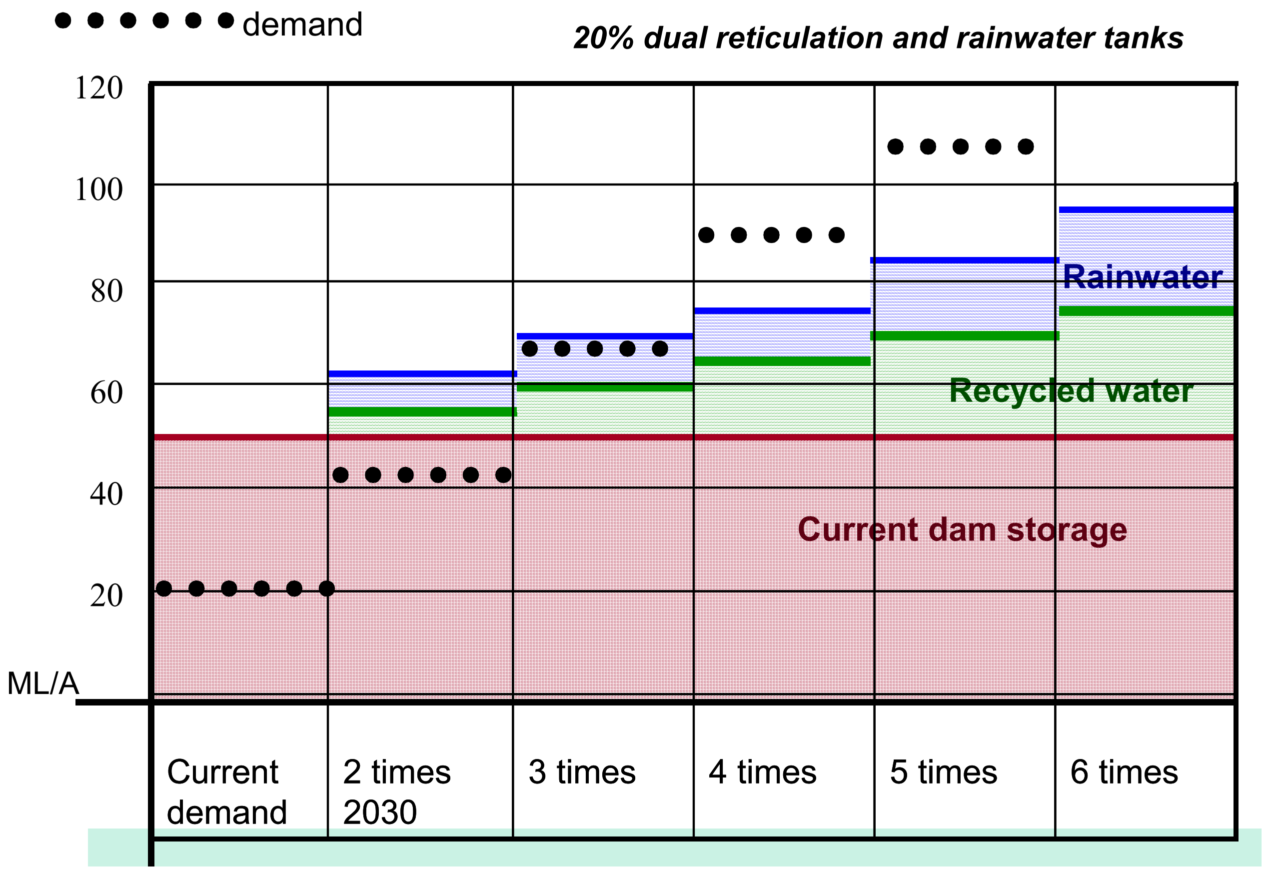
- unacceptably high capital cost to lay the second pipe in areas already developed
- higher infrastructure costs are met by developers
- nutrient management facilities required when excess effluent is discharged to a waterway
- Salinity is a potential problem
- precautions needed to avoid cross-connection
- re-use potential not maximised - 20% of demand supplied by recycled water is very optimistic
- cost of recycled water is higher than current reticulated water
- competes with greywater and stormwater recycling

Current storage	52,000	52,000	52,000	52,000	52,000	52,000
Demand	21,000 current	42,000 X 2	63,000 X 3	84,000 X 4	105,000 X 5	126,000 X 6
10% dual retic. usage		2,100	4,200	6,300	8,400	10,500
20% dual retic. usage		4,200	8,200	12,600	16,800	21,000
70% recovery	7,000	14,700	21,700	29,400	36,400	44,100

Above: Caloundra/Maroochy Water supply with dual reticulation



Above: 10% dual reticulation and rainwater tanks



Desalination v reclamation

- the amount of energy required to purify water depends on the concentration of pollutants in the water
- wastewater contains a lower concentration of pollutants than seawater
- the operating cost, energy use and greenhouse gas emission are three times more for desalination than for reclamation
- desalination does not prevent pollution and waste at the 'other end' of the pipeline
- further expense could be incurred if upgrades to wastewater management are needed

Effluent discharge reduction options for Melbourne (CSIRO)

OPTION	Cost $/kL	Volume used %
Demand management	0.10	1 - 12
Industrial recycling	0.16	<1
Land irrigation	0.20	8 - 10
Aquifer storage	0.31	10 - 20
Cardinia Reservoir	0.39	95
Woodlot irrigation	0.42	2
Constructed wetlands	0.59	2 - 2.5
Sewer mining with local re-use	0.66	0.2
Untreated greywater re-use	0.72	<1
Dual reticulation new lots	0.99	5
Dual reticulation refit	1.99	5
Treated greywater re-use	9.86	<1

If it is clean enough to put in the river, it is clean enough to put in the dam

Examples of water recycling

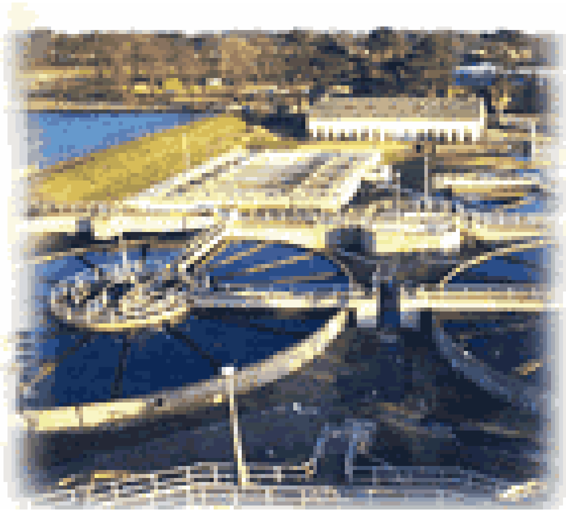
- Upper Occoquan, Virginia
- Hanningfield, Essex
- NEWater, Singapore
- Windhöek, Namibia

Upper Occoquan

- the Occoquan Reservoir is a large water supply source in Northern Virginia
- the Occoquan Watershed was largely rural until the 1960s, when the opening of a highway created a rural/suburban area convenient to people working in Washington, D.C.
- the resulting development led rapidly to water quality problems in the reservoir
- the main culprits were eleven secondary wastewater treatment plants that discharged into the reservoir
- water quality dramatically improved in 1978 when the plants were replaced by a water reclamation plant
- treatment processes include nutrient reduction, filtration, activated carbon and flocculation water has been successfully reclaimed for more than 20 years
- it supplies 50% of the water for the Fairfax Water Authority, which serves a population of 1 million people

Hanningfield

- Essex water supply area is one of the driest in England and currently imports over 50% of its water from outside its shire boundary.
- as no additional water is available, water is recycled
- effluent is taken to a purpose-built recycling plant for further tertiary treatment
- the reclamation plant treats effluent from Chelmsford STP, removing phosphates, nitrates, ammonia, oestrogen and pathogens
- the recycled water is discharged to augment the flow of the Chelmer River upstream of the Essex & Suffolk Water intakes to Hanningfield Reservoir
- water from Hanningfield Reservoir is given further treatment, including ozonation, before it is supplied to customers
- the scheme can provide up to 40Ml of water a day or 8% of additional water resources



NEWater in Singapore

- Water recycling has been successfully introduced in Singapore to reduce their dependence on supplies from Malaysia
- NEWater is treated used-water that has undergone stringent purification processes using dual-membrane (microfiltration and reverse osmosis) and ultraviolet technologies
- it was monitored and assessed by a team of experts who unanimously agreed that NEWater is a safe and reliable product, "ready to drink"
- NEWater is used by carbon chip manufacturers who require very pure water and the rest is discharged to the reservoir
- water from the reservoir has conventional treatment before it is supplied to the public
- NEWater currently supplies 1% of total daily water consumption. This will gradually increase
- much of the technology and expertise for the NEWater plants comes from Australia
- the Visitors Centre is an important feature and responsible for the community's wide-spread and enthusiastic acceptance of recycled water

Windhöek, Namibia

- Windhöek, the capital of Namibia, has a population of approx 250,000
- it lies between the Kalahari and Namib deserts
- it has an annual average rainfall of 360 mm and an annual evaporation of 3,400 mm
- The only perennial rivers are 750 and 900 km away on the northern and southern borders of the country
- local springs and dams on ephemeral rivers are insufficient for the town
- Windhöek has been successfully recycling water directly to its reticulated supply for more than 30 years
- water quality in the local dam has been seriously compromised by informal settlements (squatters) in the catchment

- it is sometimes not as good as the effluent from the wastewater treatment plant
- the effluent is therefore discharged to the dam
- a new reclamation plant, completed in 2002, treats the blended water
- the plant was designed on the basis of a multi-barrier system
- it includes ozonation, activated carbon filtration, dissolved air flotation and membrane ultra-filtration
- various safeguards are in place to manage any variation in raw water quality

- water quality monitoring is undertaken in a sophisticated water laboratory
- as well as the final product, the incoming wastewater, treated effluent, water in the dam and the blended water are all frequently tested

Comparitive risks