PARKES SHIRE COUNCIL

INTEGRATED WATER CYCLE MANAGEMENT STRATEGY

PART B – IWCM STRATEGY

Final Draft

April 2017

Lake Endeavour Dam Safety Upgrade – July 2014

Document Control

This is the final draft of the *Parkes IWCM Strategy 2015 – Strategy Paper*.

Version	Authors	Reviewer	Approved for Issue	
			Name	Date
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Contents

Abbreviations

Abbreviation	Description
ADWG	Australian Drinking Water Guidelines
AWRF	Advanced Water Recycling Facility
BOD	Biochemical oxygen demand, a measure of 'strength' of organic pollutants in wastewater/ sewage.
Centroc	Central Regional Organisation of Councils – consisting of Bathurst, Blayney, Boorowa, Cabonne, Cowra, Forbes, Harden, Lachlan, Lithgow, Oberon, Orange, Parkes, Upper Lachlan, Weddin, Wellington, Young and Central Tablelands Water.
EPA	Environment Protection Authority
EIS	Environmental impact statement
EP	Equivalent population
GIS	Geographical Information System
IDEA	Intermittently Decanted Extended Aeration
IPR	Integrated Planning and Reporting
IWCM	Integrated Water Cycle Management
LEP	Local Environment plan
LGA	Local Government Area
LOS	Levels of Service
NOW	NSW Office of Water
NWI	National Water Initiative
SBP	Strategic Business Plan
POS	Parks and Open Space
STP	Sewage Treatment Plant
WELS	Water Efficiency Labelling and Standards
WHS	Work Health and Safety
WTP	Water Treatment Plant
TAM	Total Asset Management
TBL	Triple Bottom Line
TCM	Total catchment management
TRB	Typical Residential Bill

1 Executive Summary

The Parkes Integrated Water Cycle Management Strategy (IWCM) 2015 builds on the IWCM Strategy 2005 and incorporates the outcomes of the significant efforts and investigations undertaken by Council as it implements its' adopted water cycle solutions.

There are two parts to the Strategy.

Part A is the Issues Paper, which focusses on capturing the key water and sewerage issues currently faced by Parkes Shire, the changes that have occurred since 2005 and forecasts water demands and other issues and opportunities likely to emerge over the 30 year forecast period (to 2046).

The Issues Paper is a key information source for the development of Part B – The Parkes IWCM Strategy 2015 (this document). The two documents should be read in conjunction.

This Strategy develops and assesses a wide range of potential options for addressing current and potentially emerging water related issues. The goal is to develop several suites of solutions, called Scenarios, that address the issues and meet the levels of service expected by the community, and then determine which of the Scenarios is the most cost effective.

The water cycle elements considered in the Issues Paper and Strategy include:

- Bulk Water Supply
- Climate Change Impacts
- Treatment and Water Quality
- Reservoirs and Reticulation
- Sewage treatment
- Recycled water
- Stormwater
- Rainwater
- Demand management
- Community engagement and social amenity
- Waterway health and effluent management

The *Parkes IWCM Issues Paper 2015* and this *Parkes IWCM Strategy 2015* have been developed in accordance with the Check List published by the NSW Office of Water (NOW) in July 2014.

1.1 Key Issues Identified

The Parkes IWCM Strategy 2016 – Issues Paper, identified and documented the water cycle issues that need to be addressed by this Strategy.

The issues relate to compliance with a wide range of water, OH&S and other legislation, meeting the community's needs and goals for water as identified in the Levels of Service, Corporate Planning Documents and through workshops held with agencies, staff and a community based Project Reference Group.

A summary of the unresolved and emerging issues, including whether those issues are compliance, Levels of Service or capacity related is outlined in the table below:

Table 1.1: Key Issues and NOW Classification

Identified Issue	Compliance	LoS	Capacity
Security of Supply in Drought	x	x	
Potable Water Quality – Iron and Manganese	x	x	
Potable Water Quality – Bacteria and DBP	x	x	
WTP - Capacity		x	x
WTP – Condition and Occ Health and Safety	x		
Potable Water - Storage		x	x
STP	x		x
STP – Condition and Occ Health and Safety	x		
Recycled Water Quality	x	x	

1.2 Potential Solutions

A wide range of potential solutions to the identified issues was developed and shortlisted. Shortlisted infrastructure and non-infrastructure options were costed and then grouped into logical Scenarios.

The Scenarios have many common elements, with the major differences being potential sources of raw water, and the potential options for effluent management and recycled water.

These Scenarios were then assessed against a range of Environmental, Social and Financial Criteria that were chosen by the project team in conjunction with council and recognise the aspirations of the Community Strategic Plan. Weightings were assigned to the 10 environmental and social assessment criteria (as shown in Table 3).

In determining the Scenarios, options from the 2005 IWCM Strategy (Scenarios 1 to 5) were re-evaluated against the same assessment criteria, and Councils preferred option, Scenario 5 was carried forward for re-evaluation in this Strategy.

The table on the following page shows the key elements and capital and operating costs of Scenario 5, along with new Scenarios 6 through to 9:

Table 1.2: Summary of the Scenarios Developed for the Parkes IWCM Strategy 2016

	IWCM 2005	IWCM 2015				Capex	Delta Opex
	RW Ring Main	RW to Golf Club + some PoS	Raw to PoS Ag Re-use plus Bores	RW Ring Main Sub No Bores	Ring Main plus Centoc Grid		
	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Scenario 9	$M	$K/annum
WATER SOURCES							
Permanent river intake and Bore 8	✓	✓	✓	✓	✓	2.75	0
Dam Safety Works - Endeavour	Extra	✓	✓	✓	✓	11.7	0
Connection to Forbes Bore 3 (or new bore SE)			✓		✓	2.6	40
Connection to CENTROC Grid - Gooloogong					✓	43	200
TRANSFER SYSTEM							
Modification of the existing transfer capacity	✓	✓	✓	✓	✓		0
WATER TREATMENT							
New 28 ML/day WTP	✓					45	3020
New 16 ML/day WTP		✓	✓	✓	✓	44.9	2420
New 15 ML/day WTP						33.9	2370
DEMAND MANAGEMENT							
Community Education	✓	✓	✓	✓	✓	0	
Larger Usage Pricing Adjustment	✓	✓	✓	✓	✓	0	
Showerhead Retrofit	✓	Program Complete					
Active Leak Detection	✓	✓	✓	✓	✓	0.45	-10
Rainwater Tanks as per BASIX	✓	✓	✓	✓	✓	0	
Rainwater Tanks 20% Retrofit	✓	Program Complete					
Permanent Water Conservation Measures	✓	✓	✓	✓	✓	0	
RECYCLED AND RAW WATER							
Raw Water to Northparkes, Pioneer, Spicer		✓	✓			0.2	-5
Raw Water to Golf Club, Racecourse, Cheney McGlynn			✓			0.5	20
Recycled Water to Crop Irrigation			✓			0.3	-40
Recycled Water to Golf Club, Rececourse, Cheney McGlynn		✓				0.3	
Recycled Water Ring Main (excl AWTP)	✓			✓	✓	12.5	
New 2 ML/day Class A AWTP	✓	✓		✓	✓	5.2	233
Solar 300 kW Commercial System		✓		✓	✓	0.5	-25.6
SEWAGE TREATMENT							
New 3 ML/day Parkes STP	✓	✓	✓	✓	✓	26.8	250
Sewering of Villages	Extra	✓	✓	✓	✓		

1.3 TBL Assessment of Options

The Environmental and Social assessment criteria used, relevant weightings, and rankings of the scenarios based on a Triple Bottom Line (TBL) assessment are shown in the following table:

Table 1.3: TBL Assessment of Options and Rankings

		RW to Golf Club + No Ring Main	RW Ring Main + 28 ML WTP (2005 IWCM)	RW to Golf Club + some PoS + 16 ML WTP	Raw to PoS + Ag Re-use + New Bores	RW Ring Main incl Solar	Ring Main + Bores + Centroc Grid
	Weighting	**BAU**	**Scenario 5**	**Scenario 6**	**Scenario 7**	**Scenario 8**	**Scenario 9**
ENVIRONMENTAL CRITERIA							
Impact on Local Waterway Health	0.3	6	8	6	10	8	8
Impact on Raw Water Sources	0.3	6	7	7	6	10	9
Minimises GHG Emissions	0.2	9	6	7	8	10	8
Minimises flood risk	0.1	7	7	7	7	7	7
Protects Biodiversity	0.1	6	7	7	7	7	7
Total Weighted Environmental	1	6.7	7.1	6.7	7.8	8.8	8.1
SOCIAL and GOVERNANCE CRITERIA							
Protects Public Health	0.2	2	8	6	10	8	8
Facilitates Economic Development	0.2	6	9	7	6	9	9
Improves water supply security	0.2	5	6	7	4	9	10
Minimises Risk / Operational Simplicity	0.2	6	6	6	10	6	4
Impact on public amenity / greenspace	0.2	5	9	8	6	10	10
Total Weighted Social	1	4.8	7.6	6.8	7.2	8.4	8.2
ENVIRONMENTAL AND SOCIAL SCORE (ESS)							
		11.5	14.7	13.5	15	17.2	16.3
	Rank	**6**	**4**	**5**	**3**	**1**	**2**
COST CRITERIA							
Capex NPV ($M)			14.56	6.90	7.46	8.73	9.77
Opex NPV ($M)		N/A	9.71	3.78	1.79	4.48	5.07
Benefits NPV ($M)			- 1.29	- 0.77	- 2.04	- 1.61	- 1.61
Total NPV (-$M) at 7% & 30 Yr		N/A	22.98	9.91	8.70	11.60	13.23
COMBINED TBL ASSESSMENT							
ESS/$M		-	0.6	1.4	1.7	1.5	1.2
TBL Ranking		**6**	**5**	**3**	**1**	**2**	**4**

The non-cost assessment strongly favours Scenario 8, which includes the construction of an Advanced Water Recycling Facility (AWRF) and a ring main to distribute recycled water around the Parkes Urban area for irrigation of public open space.

However, the financial assessment clearly favours Scenario 7 (Recycled Water for Ag Irrigation) as it avoids the substantial capital and operating costs associated with the AWRF and Ring Main, even though $8.75M of Commonwealth funding has been incorporated into the calculations for Option 8.

It should be noted that Scenario 7 and 9 includes $2.6M towards linking the Eugowra Road Raw Water Pump Station with expanded borefield extraction as part of the Centroc Water Grid. This part of the scenario will only proceed if Centroc is fully funded through State or Commonwealth funding.

Scenario 8 is the preferred option for future proofing the water supply of Parkes and providing a more sustainable alternate supply to bore extraction. The borefield has been under stress in past drought periods, and this scenario serves to alleviate that, while also reducing sewer discharges and enabling parks and open space irrigation throughout drought periods.

The two preferred Scenarios have multiple common infrastructure and non-infrastructure elements, including:

- New 16 ML/day Water Treatment Plant for the Parkes – Peak Hill Supply Scheme
- New 3.15 ML/day Sewage Treatment Plant for Parkes
- Permanent Lachlan River Intake
- Connection to Bore 8
- Continuing to plan for potential Centroc Water Grid Connections, commencing with the connection to Forbes Bore 3.

- Delivering the System Loss Management Plan, and
- Minor changes to the Permanent Water Conservation Measures.

The proposed layouts of Scenarios 7 and 8 are shown in Section 4.4 of this Strategy.

1.4 Other Key Summary Information

The Parkes IWCM 2016 Strategy and Issues Paper present a large volume of information. However, the following two tables reflect the relative performance of the different scenarios against some key environmental measures, and the comparative levelised cost ($ per ML supplied) of the various options to increase raw water supply.

Table 1.4: Environmental Outcomes of the Scenarios

	RW to Golf Club and Race Course Only	RW Ring Main 28ML WTP	RW to Golf Club + some PoS 16 ML WTP	Raw to PoS Ag Re-use plus Bores 16 ML WTP	RW Ring Main incl Subsidy No Extra Bores	RW Ring Main plus Centoc Water Grid
	BaU	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Scenario 9
Increase in Raw Water Yield (ML/annum)	0	870	36	1825	870	**4520**
Change in Raw Water Demand (% v BAU)	0	**-4.1**	-0.5	5.2	**-4.1**	**-4.1**
Reduction in Peak Day Potable Demand (ML)	0	**1.0**	0.35	0.35	**1.0**	**1.0**
Recycled Water (ML/annum)	130	233	143	**450**	233	233
Percentage of Effluent Recycled (%)	17	30	19	**59**	30	30

Introduction

The Parkes Integrated Water Cycle Management Strategy (IWCM) 2016 builds on the 2005 Strategy and incorporates the outcomes of the significant efforts and investigations undertaken by Council as it continues to implement its adopted water cycle solutions.

There are two parts to the Strategy.

Part A is the Issues Paper, which focusses on capturing the key water and sewerage issues currently faced by Parkes Shire, the changes that have occurred since 2005 and forecasts water demands and other issues and opportunities likely to emerge over the 30 year forecast period (to 2046).

The Issues Paper is a key information source for the development of Part B – The Parkes IWCM Strategy 2016 (this document). The two documents should be read in conjunction.

This Strategy develops and assesses a wide range of potential options for addressing current and potentially emerging water related issues. The goal is to develop several suites of solutions, called Scenarios, that address the issues and meets the agreed levels of service expected by the community, and then determine which of the Scenarios is the most cost effective.

The water cycle elements considered in the Issues Paper and Strategy includes:

- Bulk Water Supply
- Climate Change Impacts
- Treatment and Water Quality
- Reservoirs and Reticulation
- Sewage treatment
- Recycled water
- Stormwater
- Rainwater
- Demand management
- Community engagement and social amenity
- Waterway health and effluent management

The *Parkes IWCM Issues Paper 2016* and this *Parkes IWCM Strategy 2016* have been developed in accordance with the Check List published by the NSW Office of Water (NOW) in July 2014.

2 Issues Paper Summary

The *Parkes IWCM 2016 – Issues Paper* identified the key water cycle issues faced in the LGA both now and into the future through:

- Analysis of Performance against Level of Service (LoS) Objectives
- Analysis of the NOW Benchmark Performance Dataset to identify worsening trends in any of the criteria, and/or performance that is significantly below that of similar sized water utilities.
- Customer and Stakeholder Satisfaction Surveys
- Operational Plans including the Drinking Water Management Plan Parkes-Peak Hill Total Scheme Operational Strategy Discussion Paper
- Condition Assessment Reports
- Review of Licence Compliance
- Comparison of WSUD initiatives with other similar sized communities.
- Demand Forecasting
- Analysis of secure yield
- Workshops with agencies, council and the community based Project Reference Group.

A full description of the issues identified, and the sources of this information, is contained in Section 3 of the Issues Paper.

A summary of the unresolved and emerging issues, including whether those issues are related to compliance, Levels of Service or capacity is presented in Table 2.1 below:

Table 2.1: Key Issues and NOW Classification

Identified Issue	Compliance	LoS	Capacity
Security of Supply in Drought	x	x	
Potable Water Quality – Iron and Manganese	x	x	
Potable Water Quality – Bacteria and DBP	x	x	
WTP - Capacity		x	x
WTP – Condition and Occ Health and Safety	x		
Potable Water - Storage		x	x
STP	x		x
STP – Condition and Occ Health and Safety	x		
Recycled Water Quality	x	x	

3 Feasibility Review of Options

In this section, the options that were developed for the Parkes IWCM Strategy 2005 are reviewed, and potential new options and changes that have emerged since are described in detail. The options cover a wide range of measure to increase water supply security (river, dams, groundwater, alternate sources), manage demands, and address the social and environmental issues identified through the development of the Parkes IWCM 2016 Issues Paper.

Broadly, options will be assessed in the following general categories:

1. **Previous Options and Scenarios Overview**, to determine whether the adopted scenario (Option 5) is to be shortlisted, or whether one of the other solution sets may now be more appropriate for Parkes;
2. **Demand Management Options**, including pricing, leakage reduction and permanent water conservation measures;
3. **Bulk Water Supply Options**, including new groundwater and surface water sources, rainwater tanks, and connection to a potential Central West water supply grid;
4. **Water Treatment and Distribution Options,** focussed primarily on determining the appropriate size and treatment standards for the new WTP, extensions of raw water mains and ensuring Levels of Service and appropriate emergency storage volumes for each water supply zone;
5. **Sewerage Treatment Options**, including improving discharge standards and reducing the loads of pollutants released into Goobang Creek;
6. **Stormwater Harvesting and WSUD Options**, mostly focussing on options to reduce potable demands, but recognising social and environmental benefits;
7. **Recycled Water and Raw Water Options**, that could either improve water security and social amenity, improve waterway quality and/or reduce costs.

A number of the potential solutions have been identified and evaluated in recent studies that have supported the development of this IWCM. Consequently, some solutions will only briefly be described in this paper, with more detail available in these supporting studies.

The Parkes Integrated Water Cycle Management Strategy 2016 evaluates options considered in the previous (2005) IWCM strategy together with several new options against the following criteria:

Environmental

- Impact on Local Waterway Health
- Impact on Raw Water Sources
- Minimises GHG Emissions
- Minimises flood risk
- Protects Biodiversity

Social and Governance

- Protects Public Health
- Facilitates Economic Development
- Improves water supply security
- Minimises Risk / Operational Simplicity
- Impact on public amenity / greenspace

Economic

- Capital Cost ($M)

- NPV Capital Cost ($M at 4, 7 and 10% Discount Rates)
- NPV Operation and Maintenance Cost ($M)

The criteria are based on the criteria used in the 2005 Strategy, but also takes into account the requirements of the *IWCM Checklist* and NOW Information Sheet 6, and the community values outlined in the Parkes Community Strategic Plan. The rationale behind the choice of environmental and social assessment criteria were developed in conjunction with Council with reference to previous IWCM Criteria, the Parkes Community Strategic Plan and the NOW IWCM Information Sheet 6 as described in Section 4 of this Strategy.

3.1 Previous Scenarios

Table 3.1 summarises the key elements of, and differences between, the shortlisted options considered in the Parkes IWCM Strategy 2005. Scenario 5 was adopted by Parkes Shire Council as the preferred solution set. The key elements of the preferred scenario were:

- A new (permanent) river intake to be constructed on the Lachlan River
- Modification of the existing raw water transfer network to increase capacity
- New 28 ML/day capacity Water Treatment Plant (WTP) in Parkes
- A comprehensive demand management program
- Permanent Low Level Restrictions
- A recycled water ring main for irrigation of Public Open Space and dual reticulation to new residential estates
- Stormwater harvesting
- New 3 ML/day capacity Parkes Sewage Treatment Plant

Table 3.1: Solutions considered in the IWCM Strategy 2005

Option	Traditional	Integrated Solutions 1	2	3	4	5
WATER SOURCES						
A new river intake pump and pipe to bore field	✓	✓	✓	✓	✓	✓
TRANSFER SYSTEM						
New additional transfer capacity	✓	✓				
Modification of the existing transfer capacity			✓	✓	✓	✓
WATER TREATMENT						
New water treatment plant	✓	✓	✓	✓	✓	✓
DEMAND MANAGEMENT						
Community Education		✓	✓	✓	✓	✓
Larger Water Pricing Adjustment		✓	✓	✓	✓	✓
Showerhead Retrofit		✓	✓	✓	✓	✓
Active Leak Detection		✓	✓	✓	✓	✓
Recycled Water to New Development						✓
Rainwater Tanks new Development			✓	✓	✓	
Rainwater Tanks 20% Retrofit				✓	✓	✓
Permanent Restrictions				✓	✓	✓
RECYCLED WATER						
Recycled Water Ring Main					✓	✓
Brick pit stormwater harvesting						✓
SEWAGE TREATMENT						
New Parkes Sewage Treatment Plant (STP)	✓	✓	✓	✓	✓	✓
Improved Peak Hill STP	✓	✓	✓	✓	✓	✓
CAPITAL WORKS ($ Million)	**$108**	**$107**	**$97***	**$96***	**$97***	**$100***
Typical Residential Bill Per Year	**$935**	**$925**	**$835**	**$825**	**$820**	**$833**

The assessment of the previous IWCM scenarios based on the updated criteria given above is summarised in Table 3.2 below. Scenarios 4 and 5 clearly have better environmental and social outcomes than the others. Scenario 5 has superior outcomes than Scenario 4 for all criteria with the exception of Minimising Risk and Maximising Operational Simplicity due to the dual reticulation component of this option.

Table 3.2: Environmental and Social Assessment of the 2005 IWCM Solutions

		No Perm Water Conservation New Transfer Main + 28 ML WTP & STP	No Perm Water Conservation Mod Transfer Main + 28 ML WTP & STP	Perm Water Conservation Rain Tanks Mod Transfer Main + 28 ML WTP & STP	RW Ring Main for POS Rainwater Tanks + 28 ML WTP & STP	RW Ring Main incl Dual Retic with Stormwater Harvest + WTP & STP
	Weighting	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**
ENVIRONMENTAL CRITERIA						
Impact on Local Waterway Health	0.3	5	5	7	7	8
Impact on Raw Water Sources	0.3	5	5	7	7	7
Minimises GHG Emissions	0.2	9	9	6	6	6
Minimises flood risk	0.1	7	7	8	7	8
Protects Biodiversity	0.1	6	6	6	6	7
Total Weighted Environmental	1	6.1	6.1	6.8	6.7	7.2
SOCIAL and GOVERNANCE CRITERIA						
Protects Public Health	0.2	8	8	8	8	8
Facilitates Economic Development	0.2	6	6	6	9	9
Improves water supply security	0.2	4	4	6	8	9
Minimises Risk / Operational Simplicity	0.2	5	5	4	6	3
Impact on public amenity / greenspace	0.2	5	5	6	9	9
Total Weighted Social	1	5.6	5.6	6	8	7.6
ENVIRONMENTAL AND SOCIAL SCORE (ESS)						
	20	11.7	11.7	12.8	14.7	14.8
	Rank	**5**	**4**	**3**	**2**	**1**

Scenario 5 will be carried forward for further assessment in this IWCM, which is appropriate given that it was the preferred option of Council and the component options have undergone comprehensive further study in recent years. In addition to this, the potential for retrofitting rainwater tanks in existing urban areas (part of Scenario 4) will also be further evaluated.

Supporting studies, together with the development of new population and demand projections for this 2016 IWCM Strategy, have identified that whilst a new WTP is urgently required, a 28 ML/day peak capacity cannot be justified. Thus all new solution sets developed for comparison with the 2005 scenario are to incorporate a WTP option with 16 ML/day capacity instead of 28 ML/d; although some new scenarios will recommend substituting alternative water sources for various end uses to minimise potable water demands.

Several key infrastructure solutions are now in the advanced stages of planning and construction, these are:

- The Lachlan River Intake
- 16 ML/day capacity Parkes Water Treatment Plant
- 3.15 ML/day capacity Parkes Sewage Treatment Plant

Significant water supply and sewerage infrastructure investment has already occurred in the Parkes LGA since 2005, even though these measures were not identified in the previous IWCM Strategy.

In particular, a flood safety upgrade to Lake Endeavour Dam is underway, and the villages of Trundle and Tullamore now have reticulated sewerage services. The flood safety upgrade is being undertaken

to comply with the requirements of the Dam Safety Act. Although the sewering of Trundle and Tullamore was not specifically identified as part of the solution set adopted in the previous IWCM Strategy, it does addresses local environmental and community health concerns that were identified at the time.

All demand management measures adopted in 2005 have been implemented, with the exception of a dual reticulation scheme to new development areas via a recycled water ring main, and the system leakage control plan.

The recycled water ring main as originally proposed, along with several cost-effective variations, are described and evaluated in Section 3.7 (Recycled Water Options).

Council offered a rainwater tank rebate during the last drought but that program was suspended in July 2007 when the State Government introduced a similar state-wide rebate program. The NSW rainwater tank rebate program concluded in 2009. Rainwater tanks are now being installed as a requirement under BASIX for all required new developments and renovations over $50,000.

3.2 Demand Management Measures

Parkes Shire Council is yet to finalise its Demand Management Strategy however is working to implement a range of demand management solutions either independently or in partnership with other councils in the region through Centroc.

Recent analysis of options and demand management recommendations are contained in the following documents:

- Centroc Regional Drought Management Plan, HydroScience Consulting, Jan 2012
- Parkes Shire Drought Management Plan, HydroScience, Oct 2014
- Parkes Water Loss Management Plan, Watergroup, May 2012

PSC continues to run demand management measures identified in the 2005 IWCM including:

- Permanent Water Conservation Measures (Level 1 Restrictions)
- On-going community education programs
- Increased usage charges offset by lower connection charges
- Active leak detection program

It is also undertaking a water mains renewal program to reduce losses from leaks and breaks.

Development of the Demand Management Strategy will consider new residential and commercial water conservation programs such as:

- Evaporative air conditioner system maintenance and optimisation
- Rainwater tank optimisation

A summary of each of the major demand programs or opportunities follows in this section. The cost/benefits of each option are described and from this, the decision to include the measure in the shortlisted scenarios is made.

3.2.1 Community Education

The “Millennium drought” of 2003 to 2008 required most councils and water utilities in Eastern Australia to actively seek ways to either develop new sources of water or seek ways to reduce demands.

Demand reduction through community education about the importance of water and the potential consequences if the drought was to continue proved to be one of the most cost effective ways to stretch limited resources.

The councils in the Central West region worked collaboratively, and in conjunction with the State Government and industry agencies to deliver a wide range of community education campaigns.

PSC now maintains a lower level education (and pricing) campaign, aimed at reinforcing the importance of saving water even in non-drought periods and helping ratepayers reduce their bills.

Council works closely with other Centroc councils and uses the resources developed by the now defunct Savewater! Alliance program. That program ran a range of education measures including shower head exchange, and produced advertising and bill inserts on behalf of council.

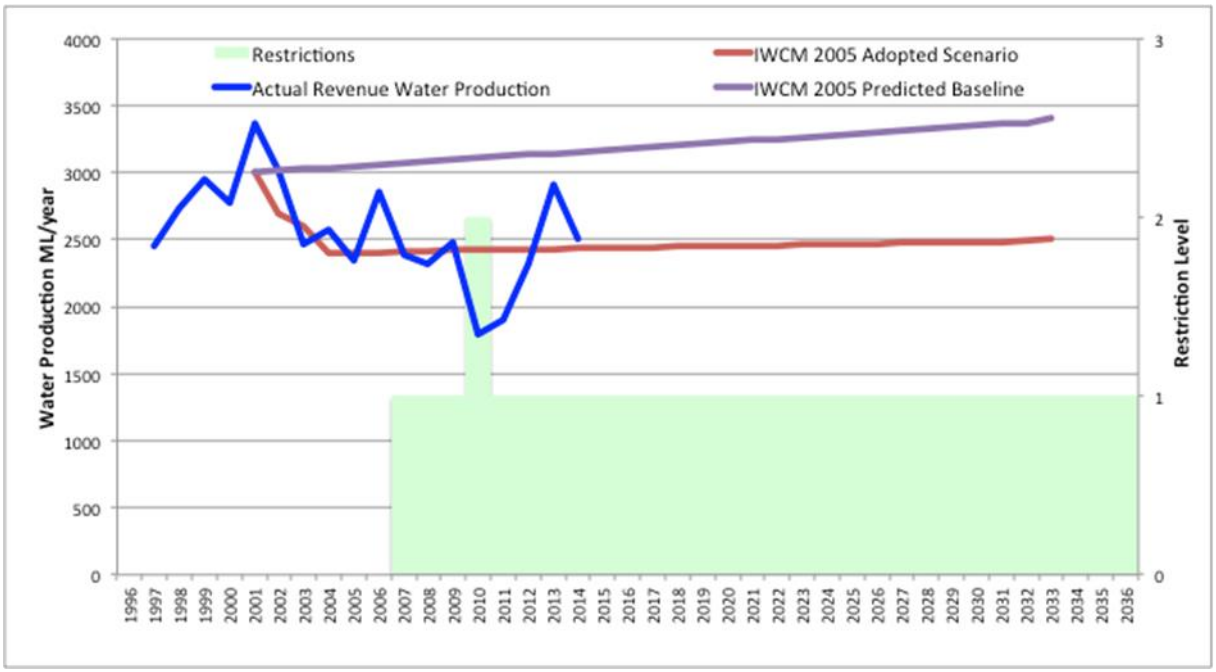
Council also employs a wide range of on-going measures to encourage and promote water saving initiatives throughout the Shire including:

- Website and social media information including tips to conserve water both outside and inside the home.

- Regular media releases and articles in the local newspaper about restrictions, water supply levels, major projects and changes to fees and charges.
- Active participation in the Regional Drought Management Strategy initiatives, including substantial media campaigns during periods of extreme drought.

This IWCM Strategy recommends that these campaigns be continued. Not only is it a cost effective way to manage demands but failure to do so could eventually result in per capita demands rising towards the very high levels of the early 2000's, which would undermine the basis of planning that has been assumed for the infrastructure solutions proposed in both the 2016 and the 2005 IWCM Strategies (refer to Figure 3.1).

Figure 3.1 IWCM projections and Actual Usage Comparison



3.2.2 Pricing Mechanisms

Council made significant changes to its water charges in 2010-11 to increase the proportion of income derived from usage charges in line with the State Government policy on "Best Practice Water Pricing". A subsequent drop in demand meant that the benchmark 75% of water income from usage charges was not achieved. Council significantly increased usage charges again in 2013, bring the proportion on income recovered from usage up to 66%, still below the benchmark criteria.

In the 2015/16 Financial Plan Update, council has again altered the connection and usage fees.

Council has already adopted a two-part water supply tariff structure comprising an access charge and a usage charge, including an inclining block usage charge structure for residential customers.

Pricing data for 2013/14 is presented in Table 3.3.

Table 3.3: Water Supply Pricing Summary

	2013/14
Average annual residential water supplied (kL/connected property/year)	279
Usage charge ($/KL):	

	2013/14
Residential (up to 400KL) Residential (above 400KL) Non-Residential	$1.55 $3.00 $1.90
Typical Residential Bill	$629
Residential revenue from usage charges	66%

Parkes Council Chief Financial Officer confirms with data shown in Table 3.4 that the Best Practice Guideline of 75% of Water Residential Revenue to be raised through water consumption charges has been achieved with margin to spare with fees & charges changes minimising the access charge to its lowest possible which is administrative practical and increasing the water usage charges to replace lost revenue through access charges.

Table 3.4: Recorded Water Residential Revenue

	2014/15	2015/16
Water consumption	$3,658,432.69	$4,211,801.60
Water Access Residential Charges	$1,178,956.44	$974,050.74
Consumption Ratio	75.63%	81.22%

3.2.2.1 Active Leakage Detection

The Parkes Water Demand Strategy System Loss Control Plan[1] builds on a report prepared by Wide Bay Water Corporation in 2008.[2]

The Control Plan establishes and describes:

- Proposed district metered area boundaries
- proposed location and installation of boundary valves and flow meters
- typical designs of flow meter arrangements.

The cost of implementing the System Loss Control Plan has been estimated at $450,000, and is expected to result in annual water savings of 200 ML. This is one of the most cost effective supply or demand management options available to council. Over 30 years at a 7% discount rate the cost is $160 per ML saved. This excludes the savings (marginal costs) of pumping and treating that water which is will be $580 per ML with the new WTP in operation[3]. Implementing the System Loss Control Plan in full is one of the few options available to council with a positive NPV.

This demand management option will be common to all Scenarios evaluated in this IWCM Strategy.

[1] Draft Parkes Water Demand Management Strategy: System Loss Control Plan, Watergroup, May 2012
[2] Proposal for the Establishment of Water Demand Management Trial Area within the Parkes Shire Water Supply Network, Wide Bay Water Corp, 2008.
[3] See supporting spreadsheet, IWCM Summary Costs and Rankings.xls, Sloan, August 2015.

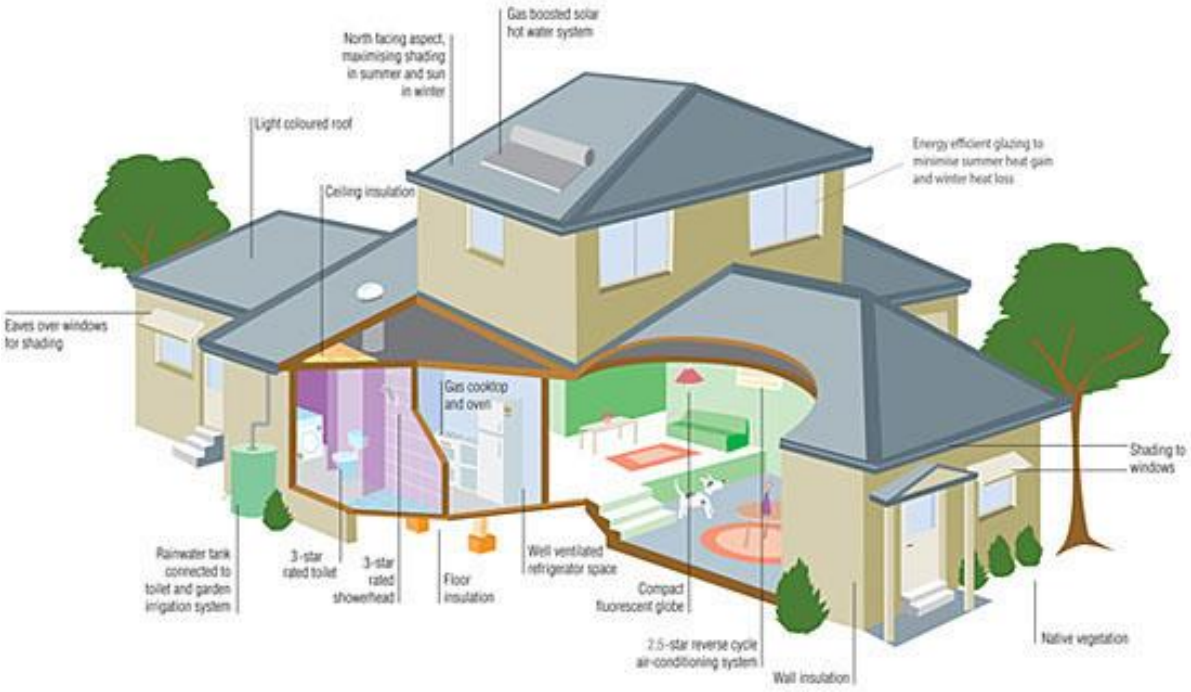
3.2.3 Rainwater Tanks

3.2.3.1 BASIX

The Building Sustainability Index (BASIX) aims to deliver equitable, effective water and greenhouse gas reductions across NSW. BASIX is an integrated part of the State (and thus PSC) planning system. It applies to all residential dwelling types and is part of the development application process in NSW. The BASIX Water target for Parkes seeks to achieve a 20 to 30% reduction in mains-supplied potable water consumption, compared to the average 'pre-BASIX' home benchmark. The benchmarks are determined from NSW average residential water, electricity and gas consumption data collected from state-wide energy utilities by government departments.

The NSW benchmark is expressed in terms of potable water consumption and is equal to 90 kL of water per person per year (averaged across the State). Per EP consumption in Parkes is approximately 160 kL per person per year, or about 130 kL excluding leakage and other non-revenue water.

Figure 3.2 Typical Options for Single Dwelling Compliance with BASIX



BASIX water targets can be achieved for new homes using a range of measures, in particular:

- Landscape design, using native vegetation, drought tolerant plants and minimizing lawn area
- Using water efficient fixtures, in particular 3 star or better shower heads, toilets and washing machines
- Use of alternative water sources such as rainwater tanks or recycled water for some end uses.

All new homes built in Parkes are required to demonstrate compliance with the Building Sustainability Index.

As installation of rainwater tanks is one of the options under BASIX, the most suitable tank size for Parkes was estimated. Analysis for Dubbo City[4], which has almost identical annual rainfall patterns, indicated that the optimum tank size for Parkes is approximately 10,000 L, both for external use only and also if used for external and toilet use. However, there was limited additional benefit for tank sized over 10,000 L.

[4] Dubbo City Council IWCM Evaluation Study, Worley Parsons, 2009

The modelling showed that:

- Harvesting of rainwater for outdoor use would result in 43% reduction of corresponding (outdoor) water needs currently supplied by town water;
- The reduction would be 48% of the corresponding water needs if the water is used for both outdoor and toilet flushing; and
- A 10,000 L tank would collect 95,000 L of water in a typical rainfall year.

This analysis highlights the need to continue to require rainwater tanks in new developments as a complementary way to save water (as part of the BASIX scheme).

Whilst the potential contribution of a rainwater tank to water savings for an individual dwelling in the LGA is significant, the relatively low growth rate of 0.2 to 0.4% in Parkes means that tanks on new homes will only have a small impact on overall scheme demands, and no impact in terms of designing infrastructure for peak day demands as tanks are likely to be near empty.

3.2.3.2 Retrofits

Rainwater tank rebates were offered to residents of Parkes Shire from 2006, initially by council and then the NSW State Government, until the program ended in June 2011. The 2005 Parkes IWCM Strategy recommended that a goal of achieving a 20% uptake of rainwater tanks in existing residential areas be adopted.

Whilst that target was achieved with the help of the rebate schemes the economics of rainwater tanks in low rainfall areas means that retrofits are not being recommended in this IWCM Strategy. 10,000 L tanks cost approximately $5,000 to install and to plumb into toilets and the laundry. Retrofitting tanks into an additional 800 (or 20%) of homes would cost $4M, and increase the overall water supply yield by 76 ML/annum.

The energy consumed by rainwater tank pumps used in residential settings ranges from 1 to 3 kWh/kL[5], which corresponds to approximately $0.50 per kL. Over a 20 year lifespan at a 7% discount rate, the overall cost from this source is $6,800 per ML.

Other far more cost-effective solutions are available to council as outlined in Section 3 of this Strategy, in particular, connection to Forbes Bore 3 or a new bore east of the current borefield. Either of these groundwater options are estimated to yield 1,800 ML/annum at a capital cost of $2.6M.

Other more cost-effective solutions such as showerhead replacement have been proven to effectively reduce water consumption[6].

Hence subsidising the retrofit of rainwater tanks to existing homes in Parkes cannot be justified in terms of the capital or on-going energy costs compared with other options, and thus will not form a part of any of the shortlisted scenarios.

3.2.4 Evaporative Coolers

The demand analysis completed for the issues paper estimated 12% of residential demand, 179ML/year, is used in evaporative coolers or swampies. At the 2016-17 water charge of $1.85/kL, this is worth $330,000 in potential savings. A program to educate home owners and service technicians on the common issues with swampies, and including a water audit element will help to reduce leakage and continuous water use.

[5] *Water and Energy Nexus of Residential Rain Water Tanks at an End Use Level: Case of Australia,* Talebpour and Stewart, Journal of Energy and Building, 2014
[6] The Case for Water Efficiency Position Paper AWA 2012

Replacing swampies with efficient reverse cycle air conditioners can reduce water use to zero for a similar energy demand. Installing solar panels to supplement the energy demand can ultimately result in savings of both energy and water.

Investing in promoting swampy maintenance and replacement will be further investigated as part of each scenario.

3.2.5 Permanent Water Conservation Measures

Centroc member councils including Parkes considered adopting a standard set of restriction level definitions[7] developed jointly by Bathurst, Orange and Dubbo City Councils in 2009.

These restrictions were proposed to be applied in each central west Council area with increasing severity as the drought worsened, depending on the particular town's water supply and demand requirements.

The advantages of Parkes participating in this common regional approach were expected to include:

- Common water restrictions provide standardised definitions for residents across the region.
- Such standard definitions offer an opportunity to educate the regional community as to the standard definitions and therefore utilise regional media (in particular TV and radio) to communicate the current water restrictions levels in each Council.

Permanent Water Conservation measures have been in place in Parkes since October 2012, and a comparison with the proposed Regional Level 1 Restrictions for residential end uses is in Table 3.5[8]:

Table 3.5: Comparison of Restrictions Measures

Measure	CENTROC Level 1 Restrictions	PSC Permanent Water Conservation Measures
Watering of Residential Gardens	Microsprays, drip systems, soaker hoses, non-fixed sprinklers, and hand held hoses only. Summer: Between 1800 - 0900 only. Winter: Between 0600 - 1000 and 1600- 2200 only.	Microsprays, sprinklers and drip systems are not permitted between 10:00am and 5:00pm.
Washing down walls or paved surfaces	Not Permitted	Permitted
Washing cars at home	Permitted with bucket and rinse with trigger hose on lawn at any time.	Permitted

Whilst most of the low level restrictions and water conservation measures are similar, the table above shows the differences between the two, and that there some opportunities to better align the Parkes water conservation measures with those of the central west region.

It is recommended that Council consider placing conditions on the washing down of paved surfaces and on the washing of cars at residential premises in line with those proposed by Centroc (2009).

[7] Centroc Regional Drought Management Plan, HydroScience for Centroc, Jan 2012.
[8] PSC Website, accessed 1 August 2015.

With regard to the irrigation of gardens at residential premises, Parkes Shire has simplified the Centroc restrictions, which will ensure easier communication and understanding of the rules surrounding garden watering without compromising on the potential to save water.

Non-residential water use has an important role in urban communities for industrial and commercial production, cooling for commercial and public premises, and for the provision of playable sporting and recreational facilities.

Recognising this, the permanent water conservation measures in place in Parkes also restrict irrigation during the hottest periods of the day. However irrigation can start from 3 pm, 2 hours earlier than allowed for residential irrigation purposes.

The non-residential sector must also contribute to reducing water use for long term sustainability, and in particular during drought periods. It is recommended that the term “Level 1 Restrictions” be replaced with “Permanent Water Conservation Measures” in all future documentation.

3.2.6 Drought Response

During the preparation of the IWCM Strategy, extensive consideration has been given to how Parkes should respond in the event of the next extreme drought.

The draft Drought Management Plan[9] has been prepared for Parkes that closely aligns with the Centroc Regional Drought Management Strategy. The raw water availability triggers for higher levels of water restriction have more recently been reconsidered and are presented in the Parkes Peak Hill Water Supply – Total Scheme Operation Strategy[10].

There is a significant difference between the two documents, with the Operation Strategy simplifying the levels of restriction and reserving a greater proportion of water stored in Lakes Endeavour and Metcalfe for emergency supplies.

During lower levels of restrictions, the Centroc Regional Drought Management Strategy envisaged that a range of measures would be employed to reduce water use, including:

- Restrictions on irrigation that mirror those in the residential sector, except in the case of key sporting and recreational facilities with consideration of exemption for turf suppliers
- Mandatory walk-through water audits of the top 20 non-residential water users to identify any obvious and immediate measures.
- Increase thermostat settings for properties utilising evaporative cooling systems (with the exception of health and aged care facilities);
- The mandatory preparation of Water Savings Action Plans for certain types of businesses.

At higher levels of drought restriction, additional measures are proposed. These measures should wherever possible protect or substitute water sources for key industrial users. The non-residential water savings measures proposed by Centroc include:

- Restrictions on water use that again mirror those in the residential sector;
- More detailed water audits for the top 20 users to identify specific conservation and source substitution measures that can reduce water use;
- Investigation of the substitution of recycled wastewater (or stormwater if available) for the maintenance of key commercial, sporting and recreation facilities;
- A ban on the use of evaporative cooling systems (again with the exception of health and aged care facilities);
- Restrictions on shower times in industrial, commercial and tourist accommodation facilities that mirror those in the residential sector; and

[9] Parkes Shire Council Drought Management Plan (draft), Hydroscience for PSC, October 2014
[10] Cardno for PSC, June 2015

- The mandatory implementation of Water Savings Action Plans prepared under lower levels of restrictions.

Of the above restrictions, all except the ban on evaporative cooling systems are feasible. For Parkes, it is not considered feasible or safe to prohibit the use of evaporative cooling systems at any time, due to this being the predominant method of cooling commercial premises and schools throughout the region.

The recommended common Centroc permanent water conservation measures and higher levels of water restrictions are outlined in Appendix A of the Regional Drought Management Plan, and PSC should consider tailoring these definitions and measures slightly and updating and finalising the Parkes Drought Management Plan[11] to better align with the new Parkes-Peak Hill Water Supply Scheme – Total Scheme Operation Strategy[12] and the demand forecasts contained in the Parkes IWCM Strategy 2015 – Issues Paper.

A key benefit of adopting the Centroc definitions wherever possible is that it simplifies the coordination and reduces the cost of community education campaigns as part of a regional response to extreme drought events.

The following table outlines the Drought Triggers for restrictions as outlined in the Scheme Operation Strategy, with estimated daily demands based on the findings of the comprehensive demand analysis undertaken for this IWCM Strategy. Note that the water demand targets are the anticipated average day demands for all end uses excluding the Northparkes Mine (NPM), and that Level 1 restrictions are to be replaced with Permanent Water Conservation Measures (PWCM). The constant demand targets for the NPM reflect the current agreement Council has in place with the mine, which is now being renegotiated.

Table 3.6: Proposed Water Restrictions and Total Demand Targets

Restriction Level	Potable Water Demand Target [ML/d]	Total demand target per capita [l/d]	Total flow to mine [ML/d]
None	13.14	381	5.62
PWCM	8.10	343	5.62
Level 2	7.50	302	5.62
Level 3	6.73	258	5.62
Level 4	5.86	208	5.62
Level 5	5.24	177	5.62
Level 6	4.69	152	5.62

A significant change to the priority of using the three primary sources of raw water has been proposed in the Scheme Operations Strategy. Historically, council has used dam water first when available to avoid the cost of pumping water long distances (currently $0.27 per kL in energy costs). Parkes Shire Council now considers that the dams should be considered a security source of supply, with the level not to be drawn below 70% except in circumstances of drought. This change will require the draft Drought Management Plan (DMP) to be updated. The current DMP suggests six levels of flow from

[11] Parkes Shire Council Drought Management Plan (draft), Hydroscience for PSC, October 2014
[12] Cardno for PSC, June 2015

the surface water dams before going to zero flow. The Scheme Operation Strategy proposes three levels of supply from the dams for simplicity:

- Scenario A - Full flow of 5 ML/d (assuming a lower elevation for the WTP), until the dam is at 70% capacity.
- Scenario B - No flow below 70%, except when other sources are limited, then a reduced flow of 4 ML/d, until the dam is at 20% capacity
- Scenario C - No flow below 20% capacity, except in extreme situations.

The proposed priority for the use of raw water sources is as follows:

- dam water preferred until storage levels reach 70%
- bore water at sustainable yields for as long as possible, and river water to Northparkes mine.
- use river water for WTP supply to avert use of greater than sustainable yields from the borefield.
- re-introduce dam water when the other two sources are not available to deliver usual volumes.

The Parkes Peak Hill Water - Total Scheme Operation Strategy outlines the proposed triggers for the introduction of higher level water restrictions during extreme drought events[13]. The triggers are a guide only, and are related to the availability of raw water from the dams, the Lachlan River and the Borefield.

In summary, the circumstances where Level 2 Water Restrictions may need to be introduced for the Parkes-Peak Hill Water Supply Scheme are when the dams are at less than 70% capacity AND either Lachlan River High Security Allocations are reduced OR the borefield has been drawn down to a level such that it can only supply less than 9 ML/day.

For the B-Scheme, (Forbes to Tottenham Pipeline), it is recommended that water restriction triggers be determined by Forbes Shire, and that the Permanent Water Conservation measures and the higher level of restrictions be aligned with the Centroc definitions, again without prohibiting the use of evaporative cooling systems.

3.3 Bulk Water Supply Options

A wide range of options to improve the security of water supplies for the Parkes/Peak Hill Scheme were considered during the preparation of the Parkes IWCM Strategy 2005. The options devised for improving groundwater security were outlined in Section 7 of the 2015 Issues Paper.

Other new bulk water supply options include the Centroc Water Grid concept outlined in the Centroc Regional Water Security Study, and local recycled water and stormwater options. Many of these options have been extensively investigated during 2014 and 2015 to support the development of the this IWCM Strategy.

This section describes and provides a preliminary evaluation of the new raw water supply options that could improve the security of supply for the Parkes LGA.

3.3.1 Belubula and Lachlan River Dam Site Investigations

The Centroc Regional Water Security Study[14], completed in 2009, investigated and recommended solutions to improve water supply security across the Centroc region. A climate corrected WATHNET

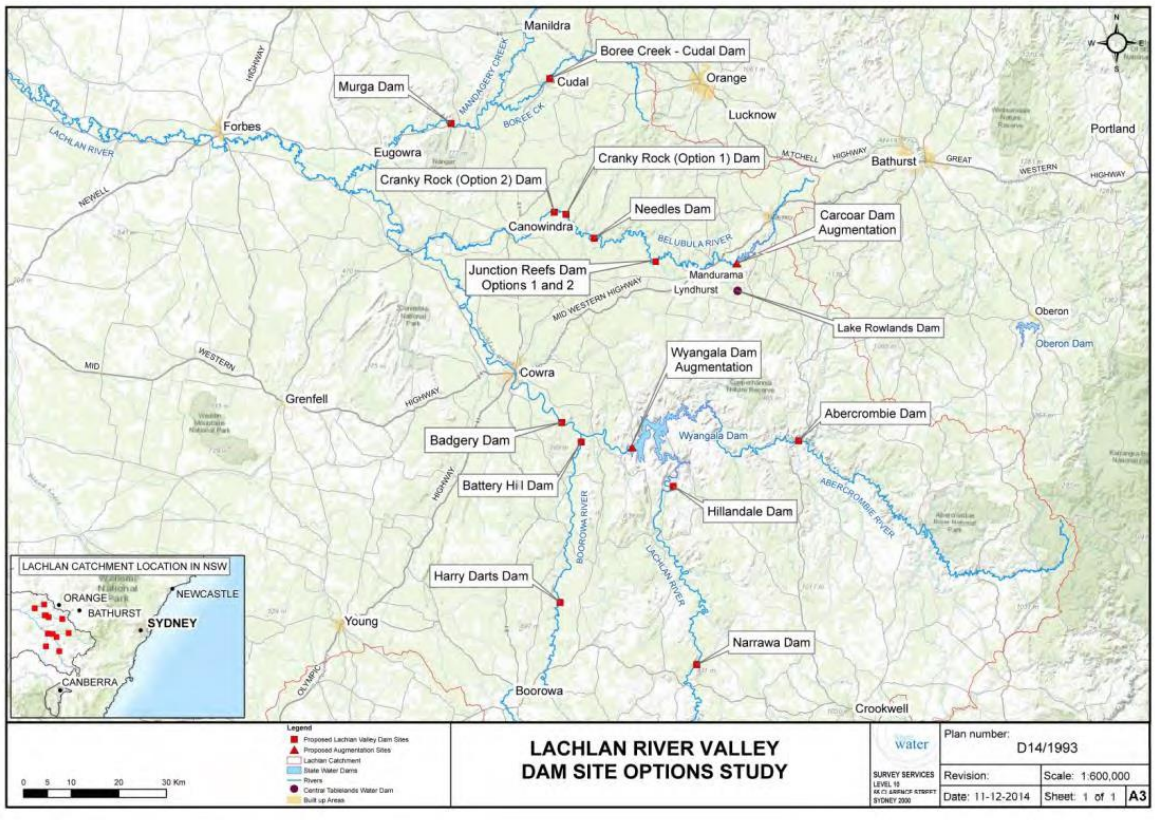
[13] See Table D, page 23 of the Operation Strategy.
[14] Centroc Water Security Study Component 2 - Options Paper, MWH Oct 2009

model of all water sources and demands in the region predicted that Parkes and Peak Hill would face water shortages over the next 30 years, with the probability of restrictions being 11% in any year and of total system failure being less than 0.1%. To combat future water scarcity, the Study recommended a region-wide strategy that involved the augmentation of Lake Rowlands (located on a tributary of the Belubula River, east of Carcoar Dam) from current capacity of 4,500 ML to 26,500 ML. The additional 22 GL storage together with an associated distribution network would act as a core regional supply to provide supplementary water requirements of Cowra, Forbes, Orange and Parkes.

A subsequent study by Central Tablelands Water in 2013 concluded that construction of a larger dam on the Belubula would provide a greater increase in secure yield and be more cost effective when compared to enlargement of Lake Rowlands. A site for the dam upstream of Canowindra in an area known as “The Needles” was initially identified based on hydrology alone. Subsequently the geology (limestone karst) and significant environmental features (Clieften caves) prompted a review of the feasibility of this site and a wider investigation into potential alternatives.

Water NSW is investigating these alternatives in detail and has shortlisted sites at Cranky Rock, upstream of Canowindra on the Belubula River, and on the Abercrombie River for new dams, and/or a major increase in capacity for the Wyangala Dam as preferred alternatives.[15] The locations of existing storages and the dam sites being investigated by Water NSW are shown in Figure 3.3.

Figure 3.3 Location of State Dam Site Investigations



The three options combined would increase available storage by 700 GL, compared to the 22 GL increase in capacity that was proposed for Lake Rowlands. The purpose of the dams, however, is not to increase the total water diversions from the catchment but improve the reliability of supply. Modelling shows that the secure yield in the Belubula catchment would improve by 21.9 GL/annum[16]

[15] Water Security for Regions: Belubula and Lachlan River Dam Investigation Report, Water NSW, December 2014

[16] See Appendix D, of the Belubula and Lachlan River Dam Investigation Report

with the Cranky Rock option. The Lachlan River options would improve secure yields by 20.9 GL/annum for a raised Wyangala Dam and by 23.1 GL/annum for a new dam on the Abercrombie.

The report notes that the Belubula River options offer a greater benefit to the urban water supplies in the Central West due to closer proximity to larger centres and Central Tablelands Water infrastructure, and flagged that 5 GL/annum from a new storage at Cranky Rock could be specifically preserved for high security town water supplies in the region. For comparison purposes, the total annual demand for raw water for the Parkes and Peak Hill water supply scheme is only 2.5 GL/annum. Taking into account that high security town water supplies will continue to be sourced from the Lachlan Regulated River scheme, and from the Upper Lachlan Aquifer, the proposed Cranky Rock dam site has the potential to ensure a secure water supply for Parkes for many decades.

However, Parkes could similarly benefit from the Lachlan River dam proposals that would increase the security of supply for the existing High Security Town Water entitlement of 3,225 ML/annum from the current Lachlan offtake. This entitlement alone can service the urban demand for water in Parkes until well beyond 2046.

High level cost estimates have been provided for each of the shortlisted dam options as follows:

- Raising Wyangala Dam $592.5M
- New dam at Cranky Rock $768.5M
- New dam on Abercrombie River $785.7M

Taking into account the improvements in secure yields associated with each option, Wyangala Dam appears to be slightly more cost-effective than the other two shortlisted options.

However, at a 7% discount rate and 100+ year lifespan of the asset, the cost of raw water supplied by the Wyangala Dam option (and the alternatives) will exceed $2,000 per ML. In addition, a pumping cost of $180 per ML would be incurred by Parkes to lift this water from the Lachlan River to Parkes. The Water NSW Report also notes that there are significant environmental constraints associated with each of the potential dam sites and that these are to be investigated further. On account of the above concerns, increased yields or security of supply from the various dam options have not been included as options in this IWCM Strategy.

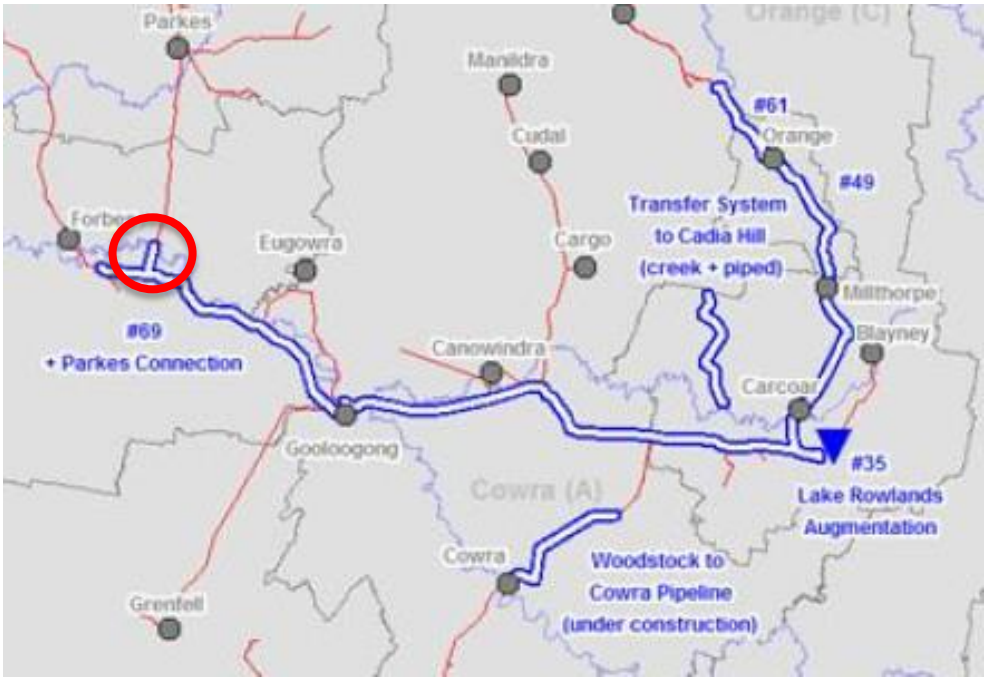
3.3.2 Centroc Water Grid

In addition to the Lake Rowlands augmentation, a range of infrastructure and non-infrastructure solutions and were developed and finalised in consultation with the various working groups and the Centroc Board for the Centroc Regional Water Security Study. The options fall broadly into the following categories:

1. Policies, Water Conservation and Demand Management.
2. Infrastructure:
    - Recycling;
    - Groundwater;
    - Supply Amplification; and
    - Transfer Systems.

The preferred solution is the establishment of a Centroc 'Water Grid' as shown in Figure 3.4.

Figure 3.4 Centroc Regional Water Security Preferred Option (Source: Centroc Regional Water Security Strategy)



The Centroc Water Grid is evolving as other water supply sources are now favoured by the State as discussed in section 3.3.1. However, the portion of the Grid that Parkes Shire Council has committed to investigating in more detail is Section #69 on the map above.

It involves constructing a link from the Parkes Shire's Eugowra Road raw water pump station to the Forbes Shire Network (Forbes Bore 3) and also a link to the Central Tablelands Water network at Gooloogong. These pipelines would allow transfer of potable chlorinated bore water between the three separate supply schemes, increasing the overall reliability and security of supply for each of the three schemes without developing any new raw water sources and reducing the impact on the aquifer.

The benefit of having a back-up supply of potable water from these other sources in the event that the Parkes WTP becomes in-operable for any reason is not as significant as it would usually be for water utilities, as the average daily demand for the Parkes-Peak Hill scheme can be supplied from the existing bores if necessary in the short term or emergency situations.

Layouts of the two potential connections are shown below in Figure 3.5 and Figure 3.6.

Figure 3.5 Centroc Water Grid Connection to Forbes Bore 3

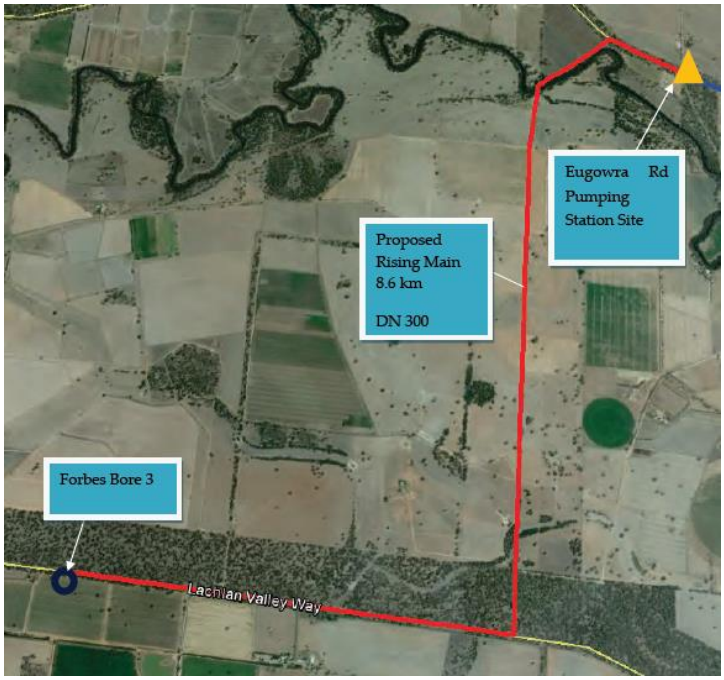


Figure 3.6 Centroc Water Grid Connection to CTW at Gooloogong

The Gooloogong-Parkes section of the pipeline route has been chosen specifically so that it traverses the length of the Upper Lachlan Aquifer, potentially offering an option for Parkes to stage the pipeline and link the existing Parkes borefield with new bores located upstream and outside the influence of the existing bores. To facilitate additional bores in the Lachlan Valley paleochannel, the first 10km of pipeline to Eugowra Road would be a larger diameter (375 mm) than the rest of the pipeline (300 mm). Potential new bore sites have been identified, for discussion purposes only, in Figure 3.7 below.

Figure 3.7 Parkes, Forbes and Gooloogong Grid Connection (Original Map courtesy of NOW, modified to include abstractions and potential investigation areas)

The Water Grid option is currently being investigated and costed to support the implementation of the IWCM Strategy. Full details can be found in the Centroc Water Grid Connection Investigation Report[17] and in the CENTROC Pipeline - Forbes to Gooloogong Operational Strategy Investigation Report[18].

Table 3.7 shows that the capital cost per annual ML of potential water yield is low, particularly for the Forbes Bore 3 Connection. At a 7% discount rate, 30 year lifespan of the asset and $0.20 per kL transfer cost, the cost of raw water supplied by the Forbes Bore 3 option (or similar) is approximately $300 per ML. The Gooloogong Connection raw water cost will be approximately $1,000 per ML, assuming full utilisation.

Table 3.7 Centroc Regional Water Option Costs and Yields

	Length Of Transfer Main (km)	Potential Transfer Yield (ML/annum)	Change in PSC Secure Yield	Capex ($M)	Opex ($K/annum)
Forbes Bore 3 Connection	8.6	1825	NIL	2.6	40
Gooloogong Connection	39	1825	NIL	17.6	200

Given that the intention of the grid is not to increase yield for Parkes but rather to alleviate pressure on the borefield, the raw water cost is from a Gooloogong Connection is a notional amount and completion of other Grid assets will be required before this volume of water can be supplied.

Both Parkes and Forbes Shire Councils support the Centroc Water Grid Concept as a long term emergency water security solution. Offering an improved sustainable groundwater yield and the relatively low cost for the Forbes Bore 3 connection, the Centroc Water Grid has been included in IWCM Scenario 9 (see Section 4) for more detailed assessment. However, on account of the magnitude of the capital cost, the Centroc Water Grid Gooloogong Connection component cannot be implemented without external funding. Moreover, PSC is not solely responsible for investigating or delivering these bulk water options, and cannot rely on the options to improve the water security for the LGA yield until further environmental investigations are carried out by the State Government and a funding commitment made.

3.4 Water Treatment Option

3.4.1 Proposed Parkes-Peak Hill Water Treatment Plant

Following the adoption of a new 28-ML water treatment plant (WTP) in the 2005 IWCM, several studies have informed the development of a WTP concept design, including:

- Parkes WTP Concept Reports, PWD, May 2012
- Economic Appraisal of the Parkes Water Security Project, AEC for PSC, June, 2014
- Parkes WTP - Water Quality Analysis & Jar Testing Report, Banerjee Associates, Dec 2014
- Parkes WTP Process Options Discussion Paper, Banerjee and Associates, Jan 2015
- Parkes WTP – Preliminary Design Report, HunterH2O, April 2015
- Hydraulic analysis of Trunk Mains from High Level Reservoir, Memo, NSW PWD July 2015

[17] Parkes Water Supply Augmentation Centroc Water Grid Connection Investigation Report, HydroScience, Jan 2015
[18] CENTROC Pipeline - Forbes to Gooloogong Operational Strategy Investigation Report, DGP Water, April 2016

The Preliminary Design Report[19] was prepared in conjunction with this IWCM Strategy and provides full details of the proposed WTP, including further justification of the size and position of the plant, along with proposed treatment standards and indicative process layouts.

Both the draft IWCM Strategy and the Preliminary Design Report have been presented to NOW in a workshop in May 2015 with agreement reached on the capacity and proposed treatment standards.

The existing 8 ML/day Parkes/Peak Hill Water Treatment Plant (WTP), comprising coagulant dosing, clarification, filters, chlorination, fluoridation and pH correction, is to be abandoned. A new WTP is to be constructed on the north east edge of Parkes, approximately due north of the existing culmination of Danilenko Street. The selected site provides the following advantages;

- Greenfield location simplifies / streamlines construction processes whilst limiting operational interruptions at the existing treatment plant;
- The size of the parcel of land provides significant additional land area for future expansion;
- It is located on sloped terrain which aids in the WTP hydraulics without the need for interstage pumping.

Raw water sources for the new water treatment plant will remain unchanged from that which feeds the existing WTP. The choice of which source water to utilise is multifactorial and as such the new WTP will be designed to manage the individual sources and blends thereof.

The NSW Department of Public Works (PWD) developed a concept design for the new treatment plant which proposed a filtered water capacity of 16 ML/d with provisions to upgrade to 24 ML/d in the future[20]. The PWD concept allowed for a lime and soda ash softening process, associated chemical storage and dosing systems, two softening clarifiers, four gravity filters, sludge and wastewater handling system and plant buildings.

Since completion of the PWD concept, Parkes Shire Council (PSC) has reviewed the need for softening during the development of the IWCM Issues Paper, which showed that hardness from all sources generally satisfies the Australian Drinking Water Guidelines. Accordingly, a preliminary design report that formed part of the tender package released in August 2015 comprised conventional coagulation, lamella clarification and filtration. The locations of the proposed and existing Parkes WTP's and trunk mains are shown in Figure 3.8. The general layout of the new WTP is depicted in Figure 3.9.

This new design is featured as a common option to four of the five scenarios considered in this IWCM Strategy.

[19] Parkes Water Treatment Plant Preliminary Design Report Final, Hunter H2O Pty Limited for PSC, April 2015

[20] Parkes / Peak Hill Water Supply – Parkes New Water Treatment Plant Concept Design Report (Final) Report No. WSR 13062, Nov 2014 (PW CDR)

Figure 3.8 Proposed Parkes WTP Location and General Arrangement

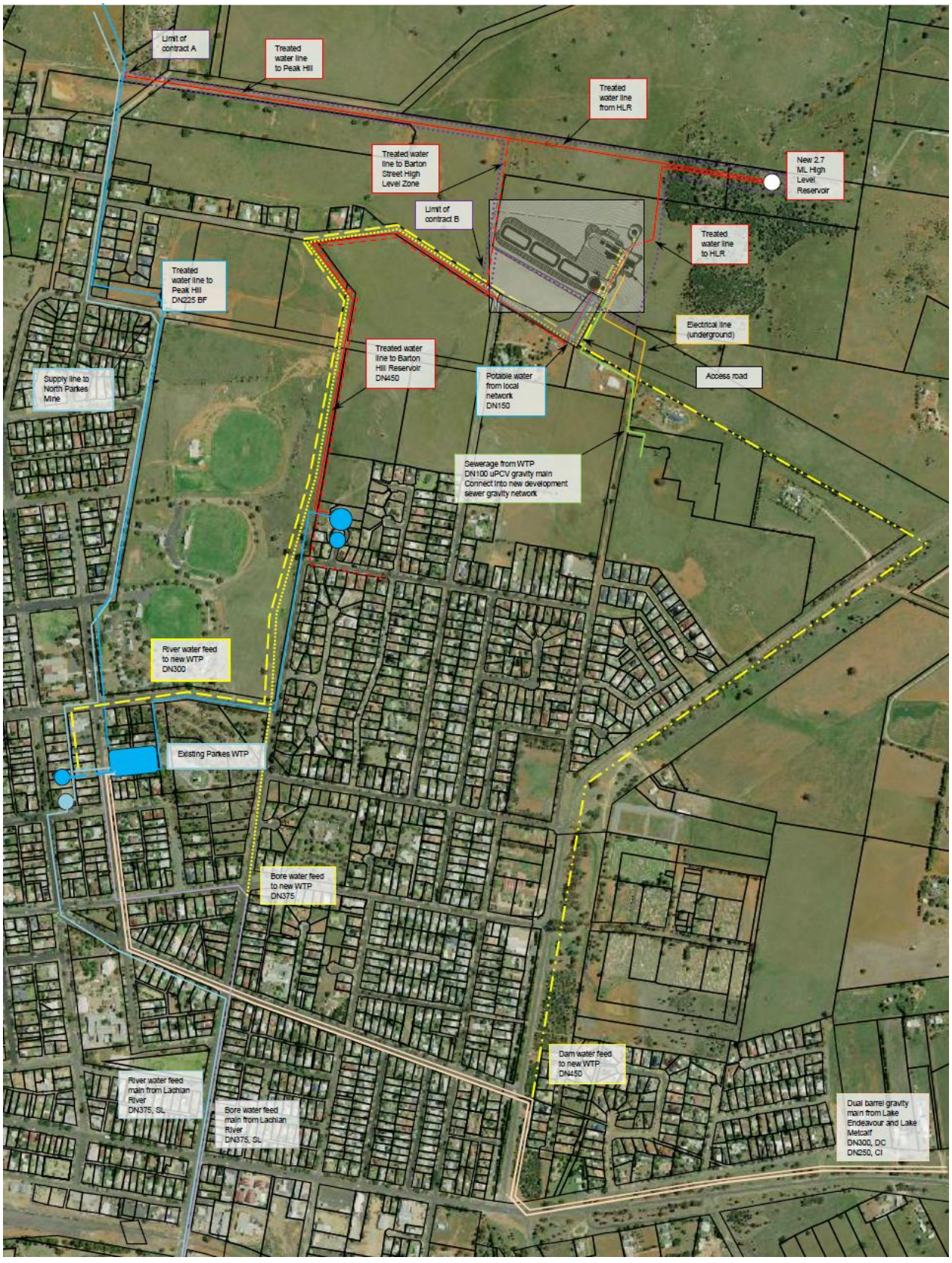
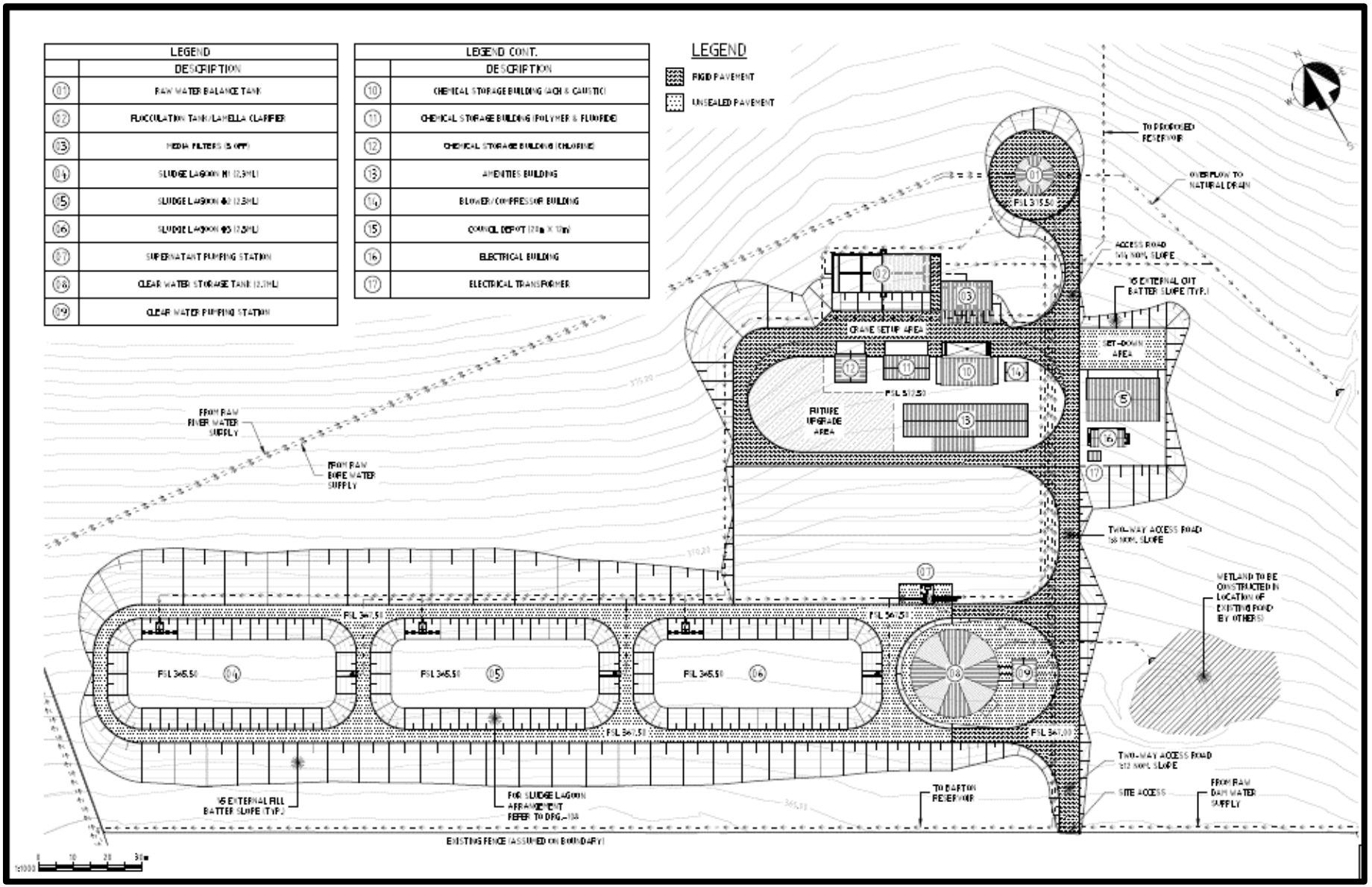


Figure 3.9 Proposed Parkes Water Treatment Plant General Arrangement



3.4.2 WTP Costs

Indicative costs were provided for earlier WTP designs were provided in the following reports:

- Parkes STP Concept Report, PWD, May 2012
- Economic Appraisal of the Parkes Water Security Project, AEC for PSC, June, 2014
- Water Treatment Plant Design Development Report, August 2015

Comparative costs of the different WTP options are outlined in the Table 3.8. The construction of a 16ML treatment plant has progressed with a contractor now engaged, therefore the Capex value in Table 3.8 is more accurate than the budget estimates for the other sizes.

Table 3.8 Summary of WTP costs

WTP Option	BAU	15 ML	16 ML	28 ML
Opex ($K/annum)	1380	2370	2420	3020
Capex ($M)	Nil	33.9	44.9	45
Annual Production (ML)	2500	2370	2500	2500
Production Cost ($/kL)	0.55	1.00	0.97	1.21

As discussed in previous sections and the IWCM Issues Paper, the Business as Usual (Existing Treatment Plant) is not considered a viable option due to capacity constraints, OH&S issues, infrastructure age and water quality concerns. The option of a 28 ML WTP has been costed to allow the preferred scenario from the 2005 IWCM to be fairly compared with the new IWCM Scenarios shortlisted in Section 4 of this Strategy.

The decision by Council, supported by NOW during a workshop in May 2015, to proceed with a 16 ML WTP was based on the following rationale:

- Marginal extra capital cost compared to the 15 ML capacity alternative.
- Reduces risk associated with faster than anticipated population growth and/or unexpected increases in per capita demands.
- Caters for the irrigation of public open space in the event that the ring main does not proceed or recycled water is unavailable for any reason.
- Caters for an additional 10 years of population growth, through to 2056 instead of 2046.

The 28 ML WTP option is included in Scenario 5 of this IWCM Strategy. The 16 ML WTP is included in Scenarios 6 through to 9, and is subject to a full TBL analysis in Section 4 of this Strategy.

3.5 Sewage Treatment Option

As outlined in the IWCM Issues paper, detailed planning for the new Parkes STP is to adopt a growth rate of 0.4% for the Parkes Urban area and a design flow of 200 L/EP/day. The new STP will therefore need to be designed to have a dry weather capacity of 3 ML/day to cater for current and future population growth through to 2046. It must also be noted that in 2031 it is anticipated that the Nash Street area will be connected to the sewerage system, adding 670 EP. Associated peaking factors are examined in the Detailed Design Report[21].

3.5.1 Proposed Parkes Sewage Treatment Plant

As with the new WTP, a preliminary design for the new STP has been developed in conjunction with this IWCM Strategy. Several studies have informed the development of an STP concept, including:

- Parkes STP Concept Report, PWD, May 2012
- Economic Appraisal of the Parkes STP, AEC for PSC, June, 2014
- Parkes STP – Preliminary Design Report, HunterH2O, April 2015
- Parkes STP – Detailed Design Development Report, Banergee and Associates, May 2015

Negotiations with the NSW EPA about proposed discharge criteria have occurred in parallel with the development of this Strategy. The Detailed Design Report and the EIS for the STP document the standards required to be met for discharge from the plant:

Table 3.9: Environmental Discharge Requirements

Parameter	Value	Unit
Biochemical Oxygen Demand	< 10	mg/L
Suspended Solids	< 15	mg/L
Total Nitrogen	< 10	mg/L
Ammonia Nitrogen	< 2	mg/L
Total Phosphorus	< 0.3	mg/L
pH	6.5 – 8.5	pH units
Faecal Coliforms	< 200	cfu / 100 mL
Oil & Grease	< 2	mg/L

These limits represent the accepted modern technology criteria for discharge to inland waters as published by the NSW EPA.

The treatment process at the new STP will include:

- Primary Treatment – Screening and grit removal, including screening and grit washing and dewatering (including septage receival chamber)
- Secondary Treatment – Intermittently Decanted Extended Aeration (IDEA) activated sludge process for organic oxidation, biological nitrogen removal and chemical dosing (alum) for

[21] Parkes STP – Detailed Design Development Report (DRAFT), Banerjee and Associates, May 2015

chemical phosphorus removal. Sodium hydroxide dosing is to provide for pH correction if required.

- Tertiary Treatment – UV disinfection
- Effluent Reuse – Chlorine disinfection

All flow entering the STP will receive primary and secondary treatment:

- Flows up to 3 x ADWF will receive UV disinfection prior to Goobang Creek discharge or transfer to the effluent reuse system; and
- Flows above 3 x ADWF will receive primary and secondary treatment and bypass the UV disinfection for discharge to Goobang Creek.

A schematic of the proposed new STP process is presented in Figure 3.10. The general layout of the new STP design is shown in Figure 3.11.

Figure 3.10: Proposed Parkes STP Process Schematic

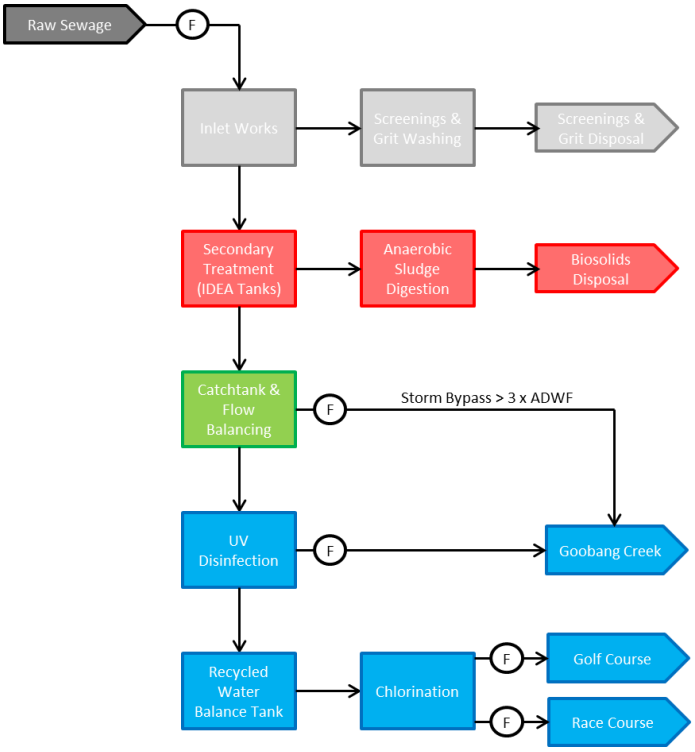
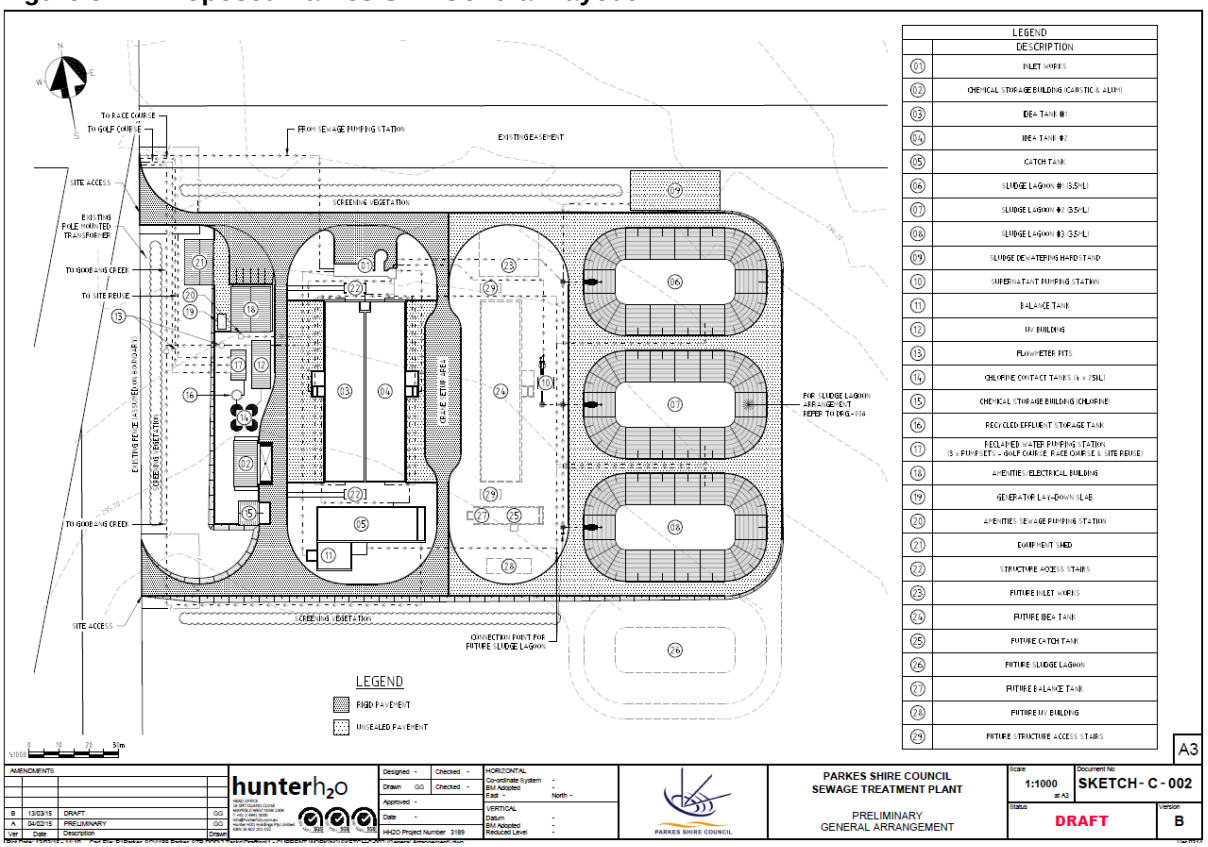


Figure 3.11: Proposed Parkes STP General Layout



3.5.2 STP costs

The new STP option described above is common to all scenarios investigated in this Strategy. The 2005 IWCM similarly included a new STP in all scenarios based on an appraisal of the existing plant that recommended the plant be replaced to meet current and future discharge standards and recycling needs.[22] The new STP option, however, did not specify a size for the plant (only a capital cost), hence the sizing outlined above has been adopted for the 2005 preferred scenario and the new scenarios explored in this Strategy. The costs of the new STP option are presented in Table 3.10.

Table 3.10 Summary of new STP option costs

Opex ($K/annum)	250
Capex ($M)	26.8
Annual dry weather flow (ML)	1095
Treatment Cost ($/kL)	0.23

3.6 Stormwater Harvesting and WSUD Options

3.6.1 WSUD Principles

The principles of water sensitive urban design (WSUD) to mimic the natural hydrological cycle of stormwater and to utilise all elements of water supply efficiently have been adopted widely in urban centres around the world. WSUD is often used as a means to achieving liveability through increasing green landscapes and celebrating water in urban areas.

In regional areas, the concept of managing water using the technical and ideological precepts of WSUD are mainly applicable to the urban centres where development density and road runoff can be concentrated through connection to formalised stormwater drainage to have a negative impact on waterways.

In Parkes urban area, the impact of development on stormwater runoff has been minor, with the exception of PAC Park waterway, which has a defined channel due to bank erosion. The Parkes Stormwater Management Plan (2001) outlines how Council has progressively been managing urban runoff impacts by installing gross pollutant traps, slowing and widening the flow of water through open channels and monitoring water quality. There are also ongoing programs of bush regeneration along riparian zones and greening the streets through tree planting and green road verges.

While neither the stormwater management plan nor the Parkes Shire Council Development Control Plan (2013) mention WSUD specifically, the principles are evident in the following clauses, repeated in various sections throughout the plan, relating to commercial, industrial and residential development:

- *The stormwater system design is to optimise the interception, retention and removal of water-borne pollutants through the use of appropriate criteria prior to their discharge to receiving waters.*

[22] Parkes Integrated Water Cycle Management Strategy Technical Memorandum - Parkes Sewage Treatment Plant, MWH, March 2005.

- *The stormwater system design should minimise the environmental impact of urban run-off on other aspects of the natural environment (creeks and vegetation) by employing techniques which are appropriate and effective in reducing run-off and pollution.*

These principles are in direct agreement with WSUD and provide a sound basis for managing development in an ecologically sustainable way.

Broader policies such as BASIX, managed by the NSW Department of Planning and Environment, provide clear guidance on water efficiency for new development and renovations. One element that is missing, however, is the setting of stormwater quality targets for subdivisions and large to medium sized development sites. Section 5.6 of the PSC stormwater management plan includes a table for the parameters of coarse and fine sediments, litter, total nitrogen, total phosphorous and hydrocarbons, although the "*Benchmark needs to be set, further investigation required*." This investigation would likely result in adopting an industry standard targets and require the use of MUSIC software to model the development designs for compliance. This would be beneficial to managing the proposed land release developments with clear direction for developers.

3.6.2 Stormwater Harvesting Options

In 2011 Council applied for grant funding from the Federal government for $6.4M towards a stormwater harvesting scheme costed at $13.2M. The scheme proposed to construct wetlands at the lower end of each for the three urban stormwater catchments to collect and treat approximately 300ML per year for irrigating Councils parks and gardens through a ring main that is similar in size and route to that proposed in some of the shortlisted recycled water options.

Stormwater runoff within the Parkes urban area could be treated by localised wetlands and stored in current basins. A 200ML holding pond will be constructed downstream of Parkes, to capture and store stormwater runoff. The water will be allowed to drain through Pac Park (improving amenity) for treatment and storage at the 200ML holding pond. When required the water will be pumped through a 13 km ring main to service the basins as refill or top-up to meet the town irrigation demands.

The capital cost of the project was estimated at $13,205,000 (in 2010). This option was estimated to supply an average of 306 ML/year for irrigation; however the detailed demand analysis undertaken for this IWCM Strategy has indicated that the typical potable demands that would be replaced are more like 130 ML/annum.

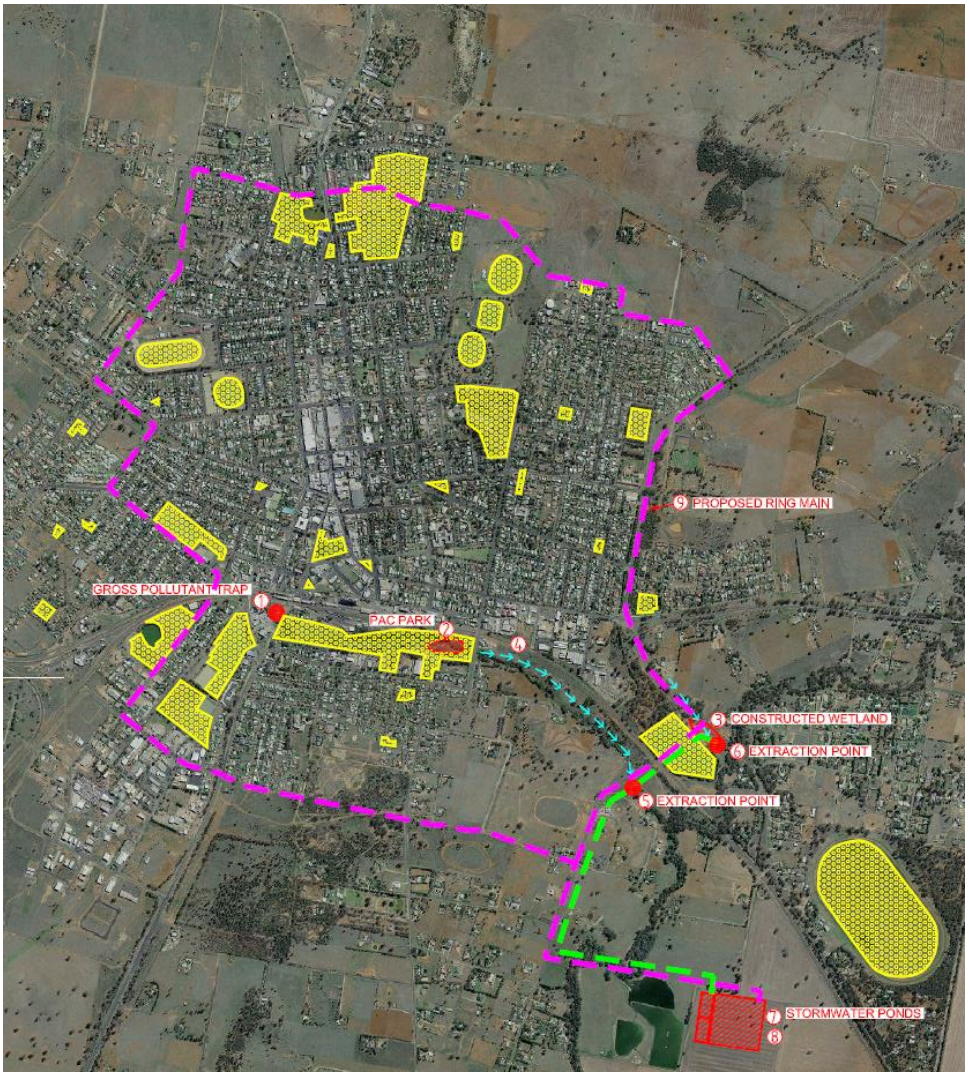
The concept layout and costs were prepared for council by Geolyse and refined by the NSW Public Works Department (PWD) in the following reports:

- Stormwater Harvesting and Re-use Concept, Geolyse, Dec 2011
- Masterplan for Stormwater Harvesting & Reuse System – Concept Report for Grant Funding Application, PWD, Dec 2011

The concept layout[23] is shown in Figure 3.12 below.

[23] From Geolyse 2011.

Figure 3.12 Concept Stormwater Harvesting Options for Parkes



The studies identified benefits to Council and the community from the Stormwater Harvesting & Reuse project including:

- Provision of an additional water supply source;
- Better awareness and waterwise education on potable water usage and cost savings;
- Reduction in the likelihood of nuisance flooding downstream, especially within downstream areas of the Parkes township;
- Utilisation of existing storages and retrofitting them as wetlands to capture, store treat and supply water to local parks and sports fields by utilising identified existing drainage basins. This will involve approximately 15 hectares of additional wetland and tree planting, which will further reduce the carbon footprint;
- Contribute approximately 33% reduction in potable water consumption, which will relieve the pressure on Parkes' potable water demands;
- Reduction in the raw-water/treated water pumping requirements and hence reducing Council's electricity consumption by approximately 400 MWh per annum. This will reduce approximately 430 tonnes in greenhouse gas emissions to the environment.

Whilst there are significant environmental and social advantages with harvesting of water for Public Open Space Irrigation, the report overstates some of these advantages. In particular, the scheme would reduce demand for potable water by 130 ML/annum or 5% (rather than 33%) and the energy savings would be approximately 100 MWh per annum from avoided pumping costs, assuming there is no additional treatment required.

The treatment proposed is very similar to that implemented and in operation as a pilot scheme at Orange NSW. That scheme is yet to obtain regulator approval however it is functioning well.

The cost of the scheme has not been updated for this IWCM Strategy. However, at a 7% discount rate and 50+ year lifespan of the assets, the cost of raw water supplied by the stormwater harvesting scheme would be $7,800 per ML. With a 50% subsidy from other levels of Government, the cost would reduce to $3,700 per ML supplied. Including the avoided marginal production cost savings ($130,000 per annum) at the WTP further reduces the supply cost to $2,700 per ML supplied.

Ultimately this proposal was not funded and other options for alternate water supplies contributing to liveability outcomes, as outlined in the IWCM Strategy, will be pursued.

There is the potential to use the brick pit, near the Golf Course as a storage basin as stormwater already flows to it. Because the demand from the golf course is nearby, there would be less expensive infrastructure. Negotiations with the Golf Course on their future supply are ongoing, depending on the outcomes of the recycled water and ring main option.

It is considered that the use of recycled water in the ring main has several advantages over the stormwater harvesting scheme including:

- Greater reduction in nutrient loads discharged from the STP into Goobang Creek
- More certain regulatory environment making it easier to gain the necessary approvals
- More reliable source of water. Stormwater may not be available in extreme droughts.

Elements of the stormwater harvesting scheme may be incorporated into a solution for the golf course supply in conjunction with the recycled water ring main option.

3.7 Recycled and Raw Water Options

A wide range of water recycling and raw water substitution options that may potentially reduce the Average and Peak Day demands for potable water have been identified for the purposes of this IWCM Strategy. Recycled water and raw water options are key differentiators among the shortlisted IWCM Scenarios that are evaluated in this Strategy.

Informing the development and shortlisting of Options are the following key reports:

- Stormwater Harvesting and Re-use Concept, Geolyse, Dec 2011
- Parkes Effluent Management Strategy Report, PSC, July 2013
- A Recycled Water Scheme for Parkes - Discussion Paper, ISF, Sept 2014
- Recycled Water Scheme for Parkes Technical Paper, Banerjee for PSC, September 2014
- Briefing Note Recycled Water Treatment Options, Atom, Jan 2015
- Effluent Irrigation at Golf Course and Racecourse: Briefing for PSC, May 2015
- IWCM Strategy 2015 – Ring Main Optimisation Options Paper, Bowden Sloan, May 2015
- IWCM Strategy 2015 – Recycled Water Options Discussion Paper, Bowden Sloan, June 2015
- IWCM Strategy 2015 – Recycled Water Demand Analysis, Butler and Yee, May 2015, updated by Butler and Fyfe, June 2016.

The original recycled water ring main concept (described in section 3.7.1 below) was developed for the Parkes IWCM Strategy 2005 and adopted by council as part of Scenario 5. The concept has evolved and been re-tested extensively by others and again as part of the development of this IWCM Strategy 2015. Other options have been developed and considered in the report *Recycled Water Scheme for Parkes,* prepared by ISF for Council in September 2014. The options considered in that report included the ring main, agricultural re-use and the potential for industrial re-use by the Northparkes Mine.

These and other options have been optimised and shortlisted at workshops involving the IWCM Team, Infrastructure Project Management Team and Designers, Senior Council staff, key agency representatives and the Project Reference Group using key social and environmental outcomes, risks and costs. The shortlisted options have been bundled into Scenarios with other water, sewerage and stormwater management options for detailed TBL analysis in Section 4 of this Strategy. Table 3.11 summarises the various recycled and raw water supply options that have been considered. Refer to the supporting documentation for more information on the options, particularly those that are not shortlisted.

Table 3.11 Summary of Recycled and Raw Water Options

Option Description	Demands ML/annum	AWRF Size ML/day	Solar 200 kW	Benefits	Risks / Issues	Excludes Other Options	Include in Scenario
Recycled Water Ring Main							
a) POS irrigation, smaller AWRF	155	2	Yes	Social Amenity, Reduced Raw Water Demands	Dry Weather STP Flows Less than 2 ML/day	Excludes all Raw Water Substitution Options and RW for Agriculture	No
b) Including Feeder Lines, smaller AWRF	175	2	Yes	Cost reduction from smaller AWRF	Creating new demand, no increase in LOS for additional CAPEX.	Excludes larger AWRF Option	No
c) POS irrigation, Golf Club and Racecourse, larger AWRF	317	3	Yes	Minimises Discharges from the STP	Peak Demands could exceed supply. Golf Club and racecourse unable to pay for recycled water.	Excludes Feeder Line Ring Main Options	No
d) Including Golf Club and Racecourse, smaller AWRF, bore water injection	317	2	Yes	Minimises Discharges from the STP. Can meet peak demand.	Golf Club and racecourse unable to pay for recycled water.	Excludes feeder lines, all Raw Water Options and RW for Agriculture	Yes Scenarios 5, 8 & 9
e) Including commercial and Institutional Customers after 5 years	333	2	Yes	Provides income and reduces STP discharge additional 30ML/a	Managing water quality, maintaining pipeline	Excludes feeder lines, all Raw Water Options and RW for Agriculture	Yes Scenarios 5, 8 & 9

Option Description	Demands ML/annum	AWRF Size ML/day	Solar 200 kW	Benefits	Risks / Issues	Excludes Other Options	Include in Scenario
Using Existing Golf Club Main							
a) BAU, Golf Club and Racecourse	162	None	No	BAU Saves $5.2M by removing need for AWRF	No demand reduction or pollutant load reduction. Public Health Risk at Golf Club	Excludes all Public Open Space Irrigation Options due to residual risks	No
b) Golf Club and Racecourse with AWRF	162	2	Yes	Removes Risk	Costs $5.2M	Excludes Ag Irrigation and some Raw Water Options	Yes Option 6
c) Add Cheney and McGlynn Ovals	185	2	Yes	Reduces 20ML/a potable demands and STP discharge		Excludes Ag Irrigation and some Raw Water Options	Yes Option 6
d) Add Harrison Park	225	2	Yes	Further reduces potable demands and STP discharge	Length of main - cost effectiveness	Excludes Ag Irrigation and some Raw Water Options	No
Treated Effluent to Crop Irrigation	700	None	No	Low risk, low cost, no need for AWRF. Seasonal storage required. Provides small income from agriculture	Need to convert Golf Club to Raw Water, increasing demands by 5%	Excludes all Ring Main Options, however cost-effective Raw Water Options can be considered	Yes Option 7

Option Description	Demands ML/annum	AWRF Size ML/day	Solar 200 kW	Benefits	Risks / Issues	Excludes Other Options	Include in Scenario
Recycled Water to Northparkes Mine	888	2	Yes	Reduces overall demand for Raw Water by re-using 700 ML/annum (100%) of treated effluent. Reduces pumping costs from Lachlan River.	Cost. Water Quality concerns from the mine (process water). Medium term solution only. Potential for significant stranded asset.	Excludes all other RW Options	No
Raw Water							
a) Raw Water to Northparkes, Pioneer, Spicer Ovals	31	None	No	Low risk, low cost. Reduces annual potable demand by 25 ML.			Yes Option 7
b) Add Raw Water to Golf Club, McGlynn and Cheney Ovals	216	None	No	Overcomes salinity and nutrient loading issues identified at the Golf Club. Reduces health risks.	Increases raw water demands by 5%		Yes Option 7
c) Raw Water to supply all Ring Main Demands	317	None	No	Supply to POS reduces peak demands on the WTP by 1 ML/day.	Does not reduce overall demand on raw water sources. Risk remains for Golf Club unless also converted to Raw Water. Pumping costs are $0.18 per kL higher.		No

3.7.1 Original Recycled Water Ring Main Concept

The 2005 Parkes IWCM Strategy nominated irrigation of public open space (POS) via a ring main as the preferred end use for recycled water. After adoption by Council in 2005, the ring main concept was developed further as part of investigations by Geolyse[24], Public Works[25] and ISF[26]. These further investigations recommended that recycled water, sourced from a new 3 ML/day Advanced Water Recycling Facility (AWRF) be used to irrigate all public open space (POS) in Parkes via a new ring main, with opportunities to expand to service to the proposed Transport Hub industrial area.

In September 2014, a Technical Paper[27] was prepared that described this scheme in detail and provided the first reliable preliminary cost estimates. The recycled water scheme as described in the Technical Paper had the following components:

- Construction of a 3 ML/day Class A Advanced Recycled Water Facility (ARWF) with raw and product water storage at the new Parkes Sewage Treatment Plant, and
- Construction of a Recycled Water Ring Main to service Public Open Spaces (POS)

The Ring Main to consist of the following:

- DN 250 ring main of approximately 14.5km (10.5km of new pipeline);
- DN 150 approach route feeder mains of approximately 12km;
- DN 150 industrial estate feeder mains of approximately 3 km;
- Monitoring Equipment; and
- Residual Chlorine Dosing system.

The cost estimate for this original ring main and AWRF concept was $17.7M. This is based on an ARWF facility cost of $5.2M and ring main cost of $12.5M. Further details are in the Technical Paper from September 2014. Note that the ring main and AWRF have been optimised to reduce costs, as discussed in the following section.

3.7.2 Recycled Water Ring Main Demands

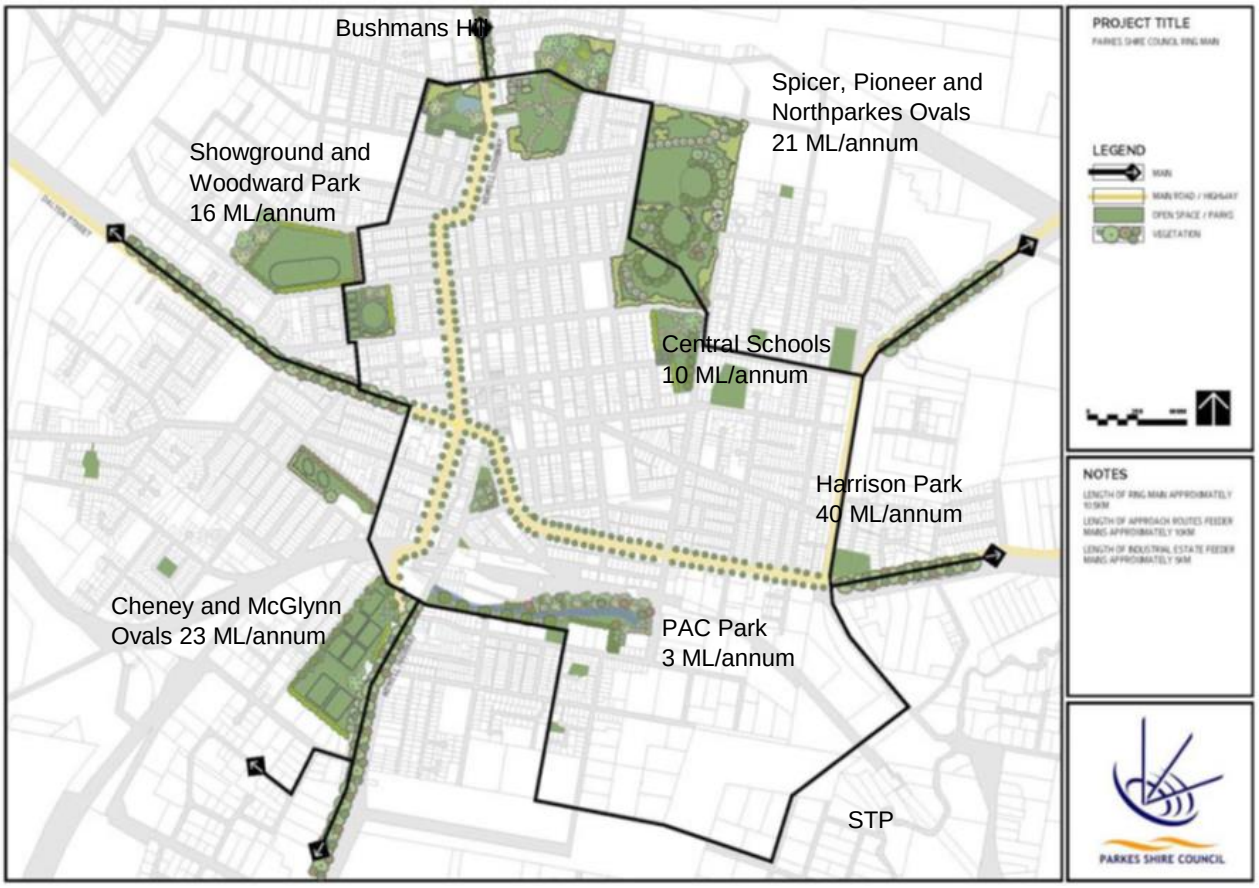
Meetings with PSC staff have re-affirmed that the ring main should seek to substitute recycled water wherever possible for existing potable water demands, and potentially supply new industry in the transport hub zone. Anticipated recycled water demands have been determined based on refined modelling and checked against metered annual demands at sites for which data is available. Total demand for the scheme is significantly lower than that presented in the ISF Recycled Water discussion paper (total 383 ML/year), which assumed that irrigated open space would include small parks and playgrounds.

Average demand for the combined POS sites is estimated to be 155 ML/year. The Golf Club and Jockey Club create an additional 162 ML/year demand if they continue to be supplied with recycled water. In addition, if commercial and institutional customers (bowling clubs and showground) could be connected to the scheme, then the potential demand for recycled water will increase by 17 ML/annum. Key POS demands are Harrison Park (40 ML/annum), the Cheney/McGlynn ovals cluster (23 ML/annum), the Pioneer/Northparkes/Spicer ovals cluster (21 ML/annum), and parks and reserves (25 ML/annum).

[24] Parkes Stormwater Harvesting Scheme, Geolyse, Feb 2010
[25] Stormwater Harvesting and Re-use Concept, Public Works NSW, Dec 2011
[26] Institute of Sustainable Futures (ISF), Recycled Water Options Study, Sept 2014.
[27] Recycled Water Scheme for Parkes - Technical Paper, Banerjee & Associates for PSC, September 2014

The Ring Main concept and key open space irrigation areas are shown Figure 3.13, overlaid with average demands derived from the last 3 years.

Figure 3.13 Recycled Water Ring Main Proposal



3.7.3 Optimised Ring Main Proposal

Recent flow monitoring data at the Parkes STP indicates that the current ADWF is just under 2 ML/day. Whilst sewage generation forecasts provided in Section 3.5 of this Strategy are conservative, based on per capita flows remaining static, the water demand analysis in the Issues Paper indicates that there is some likelihood that per capita sewage flows will fall with the uptake of more water efficient appliances and fixtures. Consequently, the size of the recycled water AWRF in short-listed scenarios 8 and 9 has been reduced to 2 ML/day. As a result of the detailed evaluation of actual open space irrigation demands and this smaller capacity AWRF, the ring main size has also reduced in size from DN 250 to DN 200. This size reduction has reduced the cost of the main by almost $1.4M.

This AWRF and Ring Main concept has received a 50% subsidy (up to $8.725M) under the Australian Government's National Stronger Regions Fund. This funding subsidy will be included in the economic assessment of this option in Section 4.

During the preparation of the Parkes IWCM Strategy 2015, the costs and benefits of the proposed recycled water plant and ring main scheme have undergone a full review. The POS irrigation ring main is costly, but delivers multiple community and environmental benefits, and recent calculations have determined that it would reduce annual demand on the existing raw water sources by 4.8% and peak demands by almost 1 ML/day. The project now includes a $500k allowance for a 300 kW solar

photovoltaic (PV) array that will provide more than 600,000 kWh of electricity per annum, closely matching the likely daytime power demands from the proposed AWRF and STP.

The annual operational cost for the recycled water AWRF, ring main and bore water top-up (Options 8 and 9) is $276,000 for 317 ML/annum. These costs are offset by the reduced need to pump raw water (saving $53,000 at $0.27 per kL) and the marginal costs (chemicals and electricity and sludge disposal) of treating 155 ML/annum to potable standards of $62,000 (at $0.40 per kL). The total annual operating cost of the Ring Main, AWRF and 300 kW Solar PV array compared with Business as Usual is $237,000 per annum, excluding borrowing costs and depreciation.

Whilst these costs are higher than the cost of additional bores, there are substantial environmental and social benefits arising from the implementation of the Recycled Water Ring Main when compared to BaU, and compared to other recycled water options considered by ISF, AEC[28] and in this Strategy. These are outlined and assessed in Section 4.

AEC undertook a quantitative analysis that shows the positive benefits that a secure water supply (through supplementing non-human uses with recycled water) can bring to Parkes. In addition to economic evaluation of the impacts of greater tourism and employment opportunities AEC noted that a secure water supply will also benefit levels of service, visual amenity, sporting facilities, population, population age structure, business sustainability, economic development, employment opportunity, recruitment difficulties, property prices, visitation, health & wellbeing, regulatory compliance and regional participation. Many of these criteria are reflected in the IWCM Scenario assessment criteria.

The 2 ML AWRF and the Recycled Water Ring Main form part of Scenarios 8 and 9 in this Strategy. The option of re-using the existing golf course supply line to provide recycled water (from the AWRF) to limited Public Open Space areas is part of Scenario 6.

3.7.4 Further Optimisation Options

Savings of $1.9M could be made to the Recycled Water Ring Main concept by deferring the proposed “feeder lines” that are to be used for irrigation of roadside verges. Although council is keen to extend the areas of POS to be irrigated to include all major road verges on the entrances to Parkes, and to other sports fields that are currently unirrigated.

A potential option for Parkes is to construct the Ring Main in two phases if it decides that the cost of the feeder lines is difficult to justify:

- Phase 1 – Central DN200 Ring Main, connections to Public Open Space, bore water top up at peak demands with a dedicated bore water tank (incl. air break) and pumping facility with injection direct into ring main. Capital cost $11.1M.
- Phase 2 – Construction DN63 “feeder lines” for irrigation of roadside verges on all main roads into Parkes. Capital cost $1.9M.

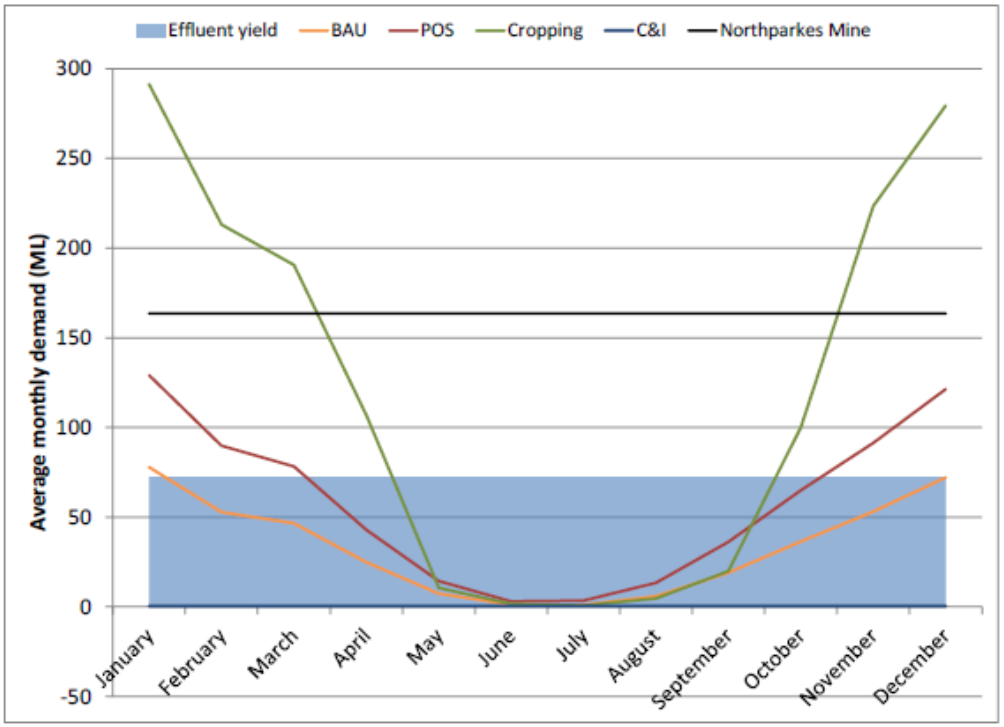
3.7.5 Agricultural Re-use

Many NSW councils prefer the operational simplicity of using recycled water for irrigation of agricultural crops. Dubbo and Tamworth Councils have recently installed centre pivot irrigation schemes to re-use treated effluent and produce an income, typically from lucerne hay. ISF determined that the demand for recycled water for crop irrigation (lucerne) significantly exceeds the combined annual demand of the Golf Course, Racecourse and all Public Open Space, and for approximately 7

[28] Economic Appraisal of the Parkes Wastewater Treatment Plant – Recycled Water Facility, AEC, September 2014

months in each year there would be no discharge of treated effluent to Goobang Creek as shown as the green line in Figure 3.14 below.

Figure 3.14 Projected Recycled Water Demands (ISF 2014)



Whilst soils would need to tested before this option is developed further, there is more than 200 ha of council owned and relatively flat land available adjacent to the new STP site. The cost of a centre pivot is $178k fully installed (budget quote), and potential net income from the sale of the lucerne hay is estimated to be around $126,000 p.a.[29]

This concept is further evaluated as part of Scenario 7.

3.7.6 Raw Water Option for Northparkes, Spicer and Pioneer Ovals

The proposed extension of the raw water mains to the new WTP will pass beside Northparkes, Pioneer and Spicer Ovals. This cluster of ovals has an average annual demand for 25 ML of water, primarily for the irrigation of playing fields. The summer demands contribute 0.25 ML/day to the 5 day persistence peak. If raw water was substituted for potable water it would reduce the peak demands on the WTP by 0.25 ML/day.

Two options are likely for supply:

- Irrigate directly from the raw water main with a booster pump, utilising existing raw water storage at the current or proposed WTP sites.
- On-site tank storage, filled from the raw water main only when water is being pumped.

A nominal amount of $200,000 has been allowed for the offtake, storage and pump. The avoided (marginal) treatment cost at the WTP is $10,000 per annum assuming an annual demand of 25 ML. This option is likely to have a slightly negative NPV, depending upon actual usage and the cost of the

[29] DPI Spray Irrigated Lucerne – Farm Enterprise Budget Estimation Tool, accessed May 2015

connection, however proceeding with this option will reduce the likelihood that the capacity of the WTP (and associated storage) will be exceeded during peak demand periods.

The option is included in Scenarios 6 and 7 for further evaluation and should be investigated and costed further if no recycled water ring main option is adopted.

3.7.7 Raw Water Option for the Golf Club and Cheney McGlynn Ovals

This option, which forms part of Scenario 7, involves using the existing golf course main to provide raw water instead of recycled water, which would also help to overcome public health and other water quality concerns (nutrient and salt loading). Public open space located close to the main could also be irrigated with raw water rather than potable water. The Cheney and McGynn ovals are located only 100m north of the existing golf club recycled water main and could be have raw water substituted for the current potable irrigation demands of 10 ML/annum.

The primary benefit is the low capital cost of this Option compared with the AWRF and Ring Main Options. The most significant disadvantage is that it will increase demands for raw water by 130 ML/annum, or approximately 3%, which lowers the secure yield of the water supply system and may bring forward new supply options.

4 IWCM Scenarios

In this section, the potentially viable options described in Section 3 of this Strategy have been "bundled" into logical scenarios. All scenarios developed have been designed to address the key issues and LoS objectives as outlined in the Parkes IWCM 2015 Issues Paper and shown in Table 2.1 of this Strategy.

Scenarios 1 to 5 were developed for the Parkes IWCM Strategy 2005. Scenario 5 was adopted at that time and is the only one carried forward for TBL evaluation in this strategy.

The technically feasible options described in Section 3 were bundled initially in a workshop involving the project team, council and infrastructure designers in April 2015. The scenarios were then tested and modified slightly in workshops held with the Project Reference Group and the key agencies in May, and reviewed again by the IWCM project team in June 2016.

Some of the options are mutually exclusive. In particular, the economic viability of any recycled water scheme requires demands to be maximised, and thus these schemes should not be coupled with other raw or stormwater supply options.

The following scenarios have been developed and defining features noted:

- Scenario 5 - 28 ML WTP, AWRF and Recycled Water Ring Main
- Scenario 6 - 16 ML WTP, AWRF but no Ring Main, Recycled Water to limited POS
- Scenario 7 - 16ML WTP, Agricultural Re-use, Raw Water to Golf Club and limited POS, Connection to Forbes bore 3
- Scenario 8 - 16ML WTP, AWRF and Ring Main
- Scenario 9 - 16ML WTP, AWRF, Ring Main and full connection to the Centroc Water Grid

The sizes of the WTP and STP have been justified in early demographic and demands analysis undertaken for this IWCM Strategy and agreed to by the Regulator.

The scenarios being assessed all include common elements of enabling Parkes Council to improve integrated planning and management of water. Many of these elements, as defined in the 2005 IWCM, have been adopted and have successfully reduced demand across the LGA. There are management and administrative areas that still need improvement and the present IWCM is a part of that process.

Common elements of each scenario and their current status are presented below:

Table 4.1: Activities included in all Scenarios

Water Management Activity	Status
Development of a permanent river intake (24 ML/d capacity) to improve supply reliability.	Complete
New 3.07 ML/d Sewage Treatment Plant for Parkes to meet water quality objectives associated with effluent reuse within the urban environment.	Design and construction underway
Education program to improve water efficiency and consumption practices.	Education materials prepared and continual community engagement on water scarcity and efficient use of water being undertaken.
Showerhead retrofit program.	Program implemented in 2010

Water Management Activity	Status
Release wet weather flows from the sewage treatment plant at a suitable standard to the local creek.	Objective to be achieved as a result new STP works
Evaporative Air Conditioner Education and Audit Program	Scope and details to be investigated
Release wet weather flows from the sewage treatment plant at a suitable standard to the local creek.	Objective to be achieved as a result new STP works
Water sensitive urban design.	Council to include WSUD planning controls in DCP
Assess opportunities to harvest and treat water from the brick pit within town to supplement the recycled water supply network.	Geolyse Stormwater Harvesting report completed in 2010.
Pricing adjustment in line with NSW government guidelines and subject to consideration of equity issues and billing systems.	Tiered pricing adjustment for high water users.
Consideration of permanent restrictions on irrigation times primarily driven through education.	Permanent Waterwise rules implemented.
A subsidised but voluntary rainwater tank program.	Rebate program complete. BASIX program now applies to all eligible new developments.
A leak detection and rectification program to reduce water wastage from the supply network.	Pilot project undertaken in 2014. Further leak investigations proposed, pending implementation of preferred scenario and capital works.
Improved billing data collection and linkage to GIS information	Pilot GIS data presentation software in development. Extensive analysis and modification of billing data undertaken as part of this IWCM process which informs future best practice.
Servicing unsewered urban areas in Parkes	Planning underway for next five years.

4.1 Scenario Description

The following table outlines the water cycle options and elements that have been bundled into solution sets (or scenarios) for evaluation against a range of cost and non-cost criteria.

Table 4.2: Parkes IWCM 2016 Scenarios

	IWCM 2005	IWCM 2015			
	RW Ring Main	RW to Golf Club + some PoS	Raw to PoS Ag Re-use plus Bores	RW Ring Main Sub No Bores	Ring Main plus Centoc Grid
	Scenario 5	**Scenario 6**	**Scenario 7**	**Scenario 8**	**Senario 9**
WATER SOURCES					
Permanent river intake and pipe to bore field	✓	✓	✓	✓	✓
Dam Safety Works - Endeavour	Extra	✓	✓	✓	✓
Connection to Forbes Bore 3 (or new bore SE)			✓		✓
Connection to CENTROC Grid - Gooloogong					✓
WATER TREATMENT					
New 28 ML/day WTP	✓				
New 16 ML/day WTP		✓	✓	✓	✓
DEMAND MANAGEMENT					
Community Education	✓	✓	✓	✓	✓
Larger Usage Pricing Adjustment	✓	✓	✓	✓	✓
Showerhead Retrofit	✓	Program Complete			
Active Leak Detection	✓	✓	✓	✓	✓
Rainwater Tanks as per BASIX	✓	✓	✓	✓	✓
Rainwater Tanks 20% Retrofit	✓	Program Complete			
Permanent Water Conservation Measures	✓	✓	✓	✓	✓
RECYCLED AND RAW WATER					
Raw Water to Northparkes, Pioneer, Spicer		✓	✓		
Raw Water to Golf Club, Racecourse, Cheney McGlynn			✓		
Recycled Water to Crop Irrigation			✓		
Recycled Water to Golf Club, Racecourse, Cheney McGlynn		✓			
Recycled Water Ring Main (excl AWTP)	✓			✓	✓
New 2 ML/day Class A AWTP	✓	✓		✓	✓
Solar 200 kW Commercial System		✓		✓	✓
SEWAGE TREATMENT					
New 3 ML/day Parkes STP	✓	✓	✓	✓	✓
Sewering of Villages	Extra	✓	✓	✓	✓

4.2 Scenario 5

28 ML Water Treatment Plant, Advanced Water Recycled Facility and Recycled Water Ring Main

This Scenario is the only option brought forward from the previous IWCM and the key point of difference from Scenario 6 is the capacity of the WTP remaining at 28ML from the projections of that earlier IWCM.

This Scenario includes:

- New 28 ML/d Water Treatment Plant to improve the quality of water supplied to Parkes' customers.
- New 15ML clearwater storage at site of the existing water treatment plant.
- A recycled water ring main for the irrigation of public open space and recreation areas around Parkes, and the potential to service a 'third pipe' scheme to new development. This will account for 100% of the average dry weather flows from the sewage treatment plant.
- Process improvement to Peak Hill sewage treatment plant to meet water quality objectives consistent with discharge to local waterways.

Because of the positive impact of demand management actions since the 2005 IWCM, the 28ML/day Water treatment Plant is no longer required. A smaller, 16ML/day plant has been accepted as the preferred solution, which is included in the following four Scenarios.

The borefield options have been more thoroughly investigated since the 2005 IWCM and these solutions are included in some of the following scenarios.

4.3 Scenario 6

16 ML Water Treatment Plant, Advanced Water Recycled Facility but no Ring Main, Raw Water to limited Public Open Space

This scenario was the first to be developed in the 2016 IWCM and as a result of an updated analysis of the potential water demand, the WTP sizing was reduced to 16ML/day.

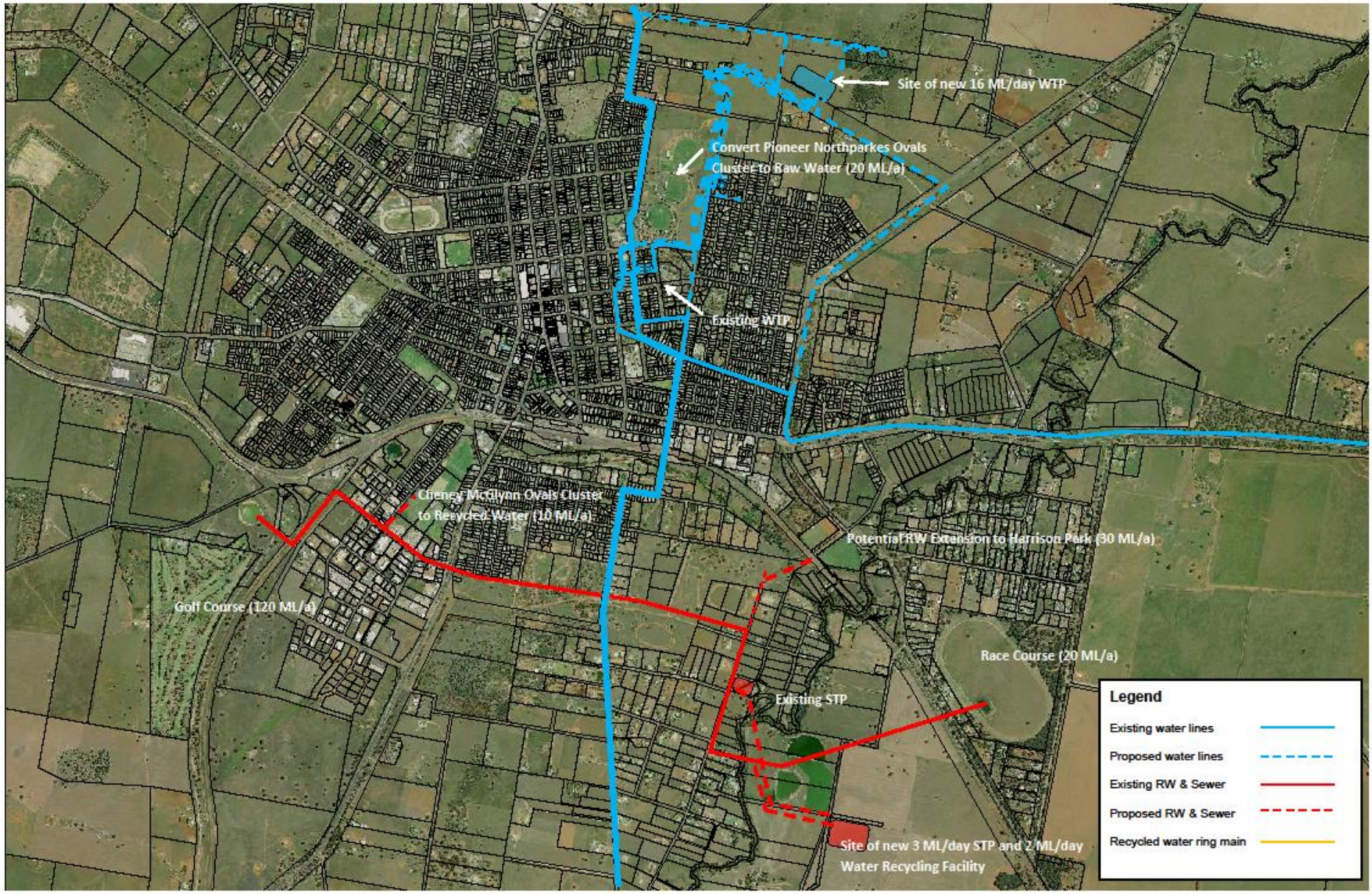
The AWRF is included in this scenario, servicing only selected end users: the Golf Club, McGlynn and Cheney Ovals. The close proximity of these end users avoids the cost of a new ring main by utilising and augmenting the existing treated effluent pipework to the Golf Club.

The AWRF will be powered by a 200kW solar energy system.

Raw water is to be supplied to large playing fields to the north of the urban centre as an extension of the existing raw water system.

There is no change to the borefield extraction in this Scenario.

Scenario 6 – Recycled Water to Existing Customers and selected Public Open Space



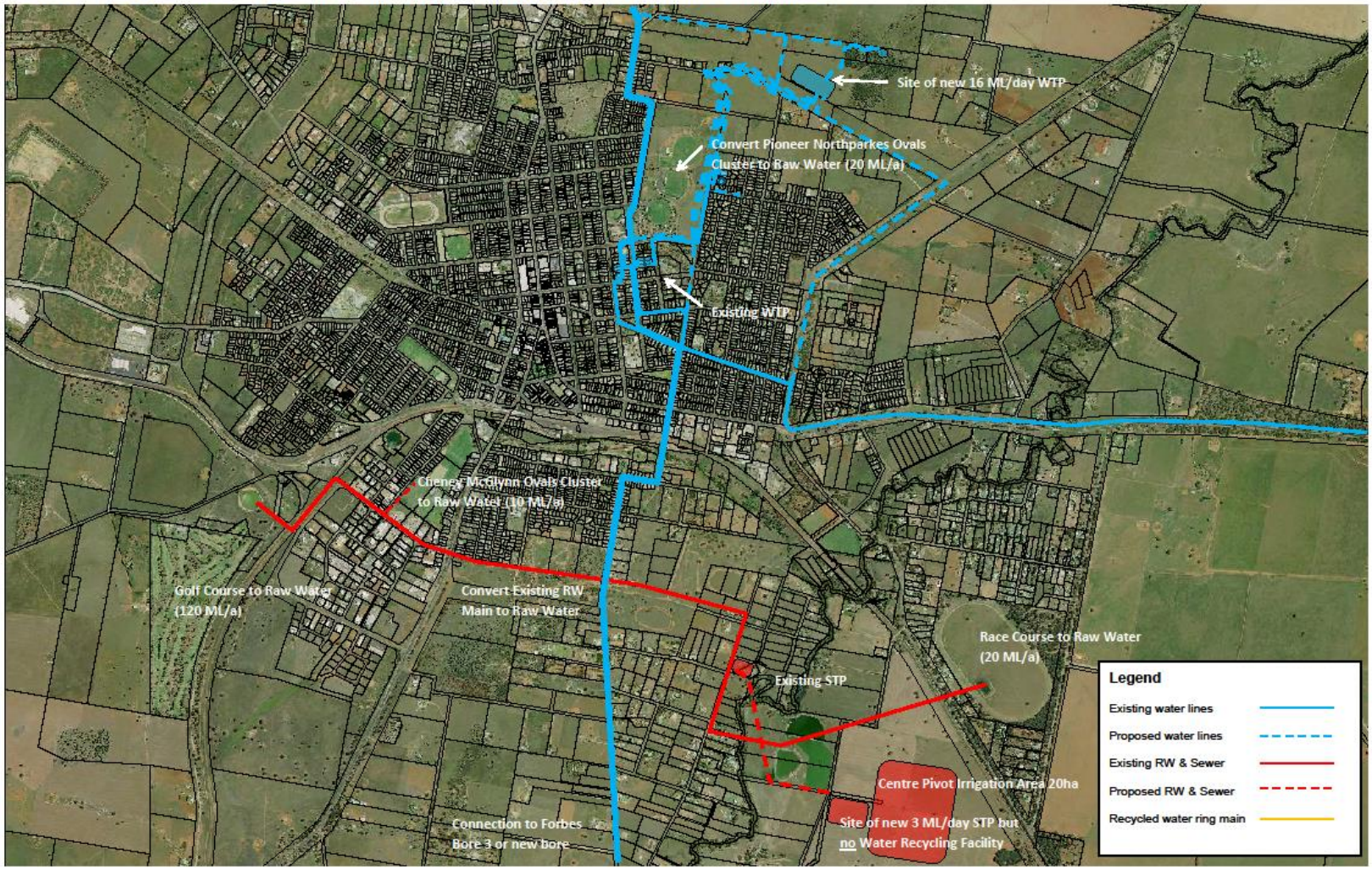
4.4 Scenario 7

Agricultural Re-use, Raw Water to Golf Club and limited POS, Forbes Bore 3

This scenario differs from the others by excluding the AWRF, instead directing raw water to the irrigation of the golf club and selected public open spaces by using and augmenting the existing treated effluent pipework. The effluent from the upgraded sewage treatment plant will no longer supply the golf course and race course, but be directed to a new agricultural demand adjacent to the treatment plant.

To augment the groundwater supply a new bore would be established in the productive zone of the Lachlan aquifer, in the vicinity of the Forbes Bore 3.

Scenario 7 – Agricultural Re-use Area, New Bore, with Raw Water to Current RW Customers



4.5 Scenario 8

AWRF and Ring Main

This scenario is similar to the original 2005 IWCM preferred scenario, with the AWRF and full-scale ring main around the town. This scenario includes the 200 kW solar power plant and the ring main delivers recycled water to all the current public open space high users and provides additional capacity to irrigate the nature strips alongside the main entry roads to Parkes.

Bore water is to be injected into the ring main to bolster supply reliability and shandy the treated effluent. This method would be beneficial for managing potential sodicity issues and does not require expansion of the existing borefield.

Initially the supply will be to Council POS only, so that the scheme can be tested and Council can establish management protocols, before being offered to other institutional customers in the future.

4.6 Scenario 9

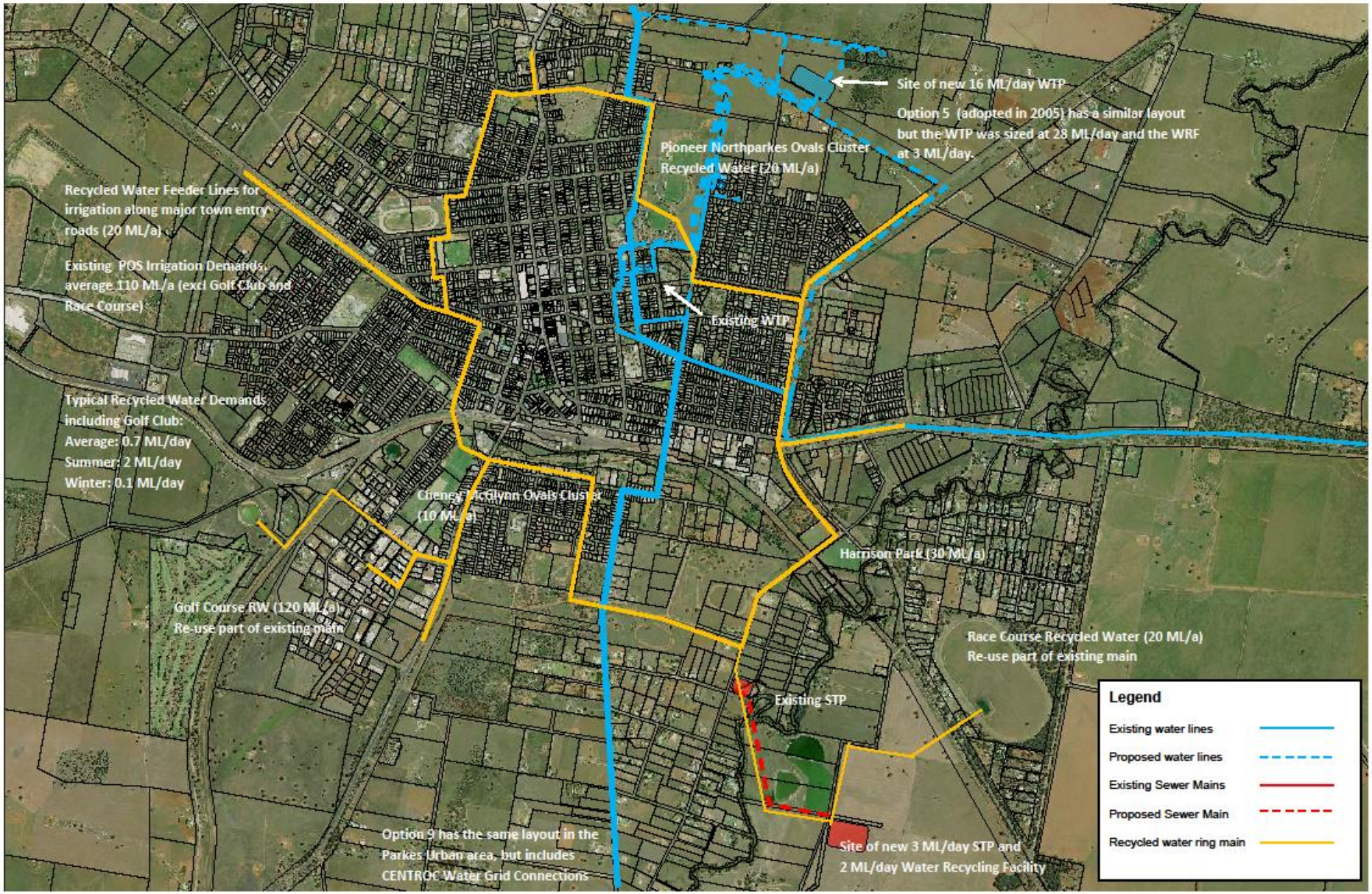
AWRF, Ring Main and full connection to the Centroc Water Grid

This builds upon Scenario 8 by adding a bore water connection to the Centroc Water Grid.

The Centroc Water Grid connection is to be a 10km pipeline from Eugowra to connect to the grid at Goologong. This measure would act as an emergency back up to the potable water supply should there be a significant failure in raw water supply or treatment. It will also give Council the option to add new, more productive bores to the Lachlan River borefield, which will allow Council to sustainably utilise its full groundwater entitlement. However, while the Water Grid pipeline will improve water security, it will not increase the overall system yield.

Importantly, the only way this option can proceed is if full project funding is made available from an external source. For this reason, the financial analysis results are similar to Scenario 8 from the Councils point of view, except for the ongoing operation and maintenance costs, which can’t yet be determined.

Scenario 8 – Recycled Water Ring Main



5 Evaluation and Ranking of Scenarios

In this section, the Scenarios that were developed for the Parkes IWCM Strategy 2016 will be evaluated against a range of environmental and social assessment criteria, developed by the project team and council in accordance with the methodology outlined in *NOW Information Sheet 6 – Evaluation of IWCM Scenarios.*

5.1 Non-Cost Assessment Criteria

The Environmental and Social criteria against which to assess the five IWCM Scenarios were developed after taking into account the following:

- The key issues identified in the Parkes IWCM 2015 Issues Paper
- The criteria used in the 2005 IWCM Strategy
- Achieving target Levels of Service
- The objectives outlined in PSC Corporate Plans, especially the Community Strategic Plan
- Assessment criteria recently used in water cycle planning in other areas
- Comments from senior council staff and the Project Reference Group.

The weightings were developed by the project team in conjunction with Council. The scores for each Scenario against individual criteria were assigned by the IWCM project team.

Table 5.1 Scenario Assessment against Environmental and Social Criteria

		RW to Golf Club + No Ring Main	RW Ring Main + 28 ML WTP (2005 IWCM)	RW to Golf Club + some PoS + 16 ML WTP	Raw to PoS + Ag Re-use + New Bores	RW Ring Main incl Solar	Ring Main + Bores + Centroc Grid
	Weighting	**BAU**	**Scenario 5**	**Scenario 6**	**Scenario 7**	**Scenario 8**	**Scenario 9**
ENVIRONMENTAL CRITERIA							
Impact on Local Waterway Health	0.3	6	8	6	10	8	8
Impact on Raw Water Sources	0.3	6	7	7	6	10	9
Minimises GHG Emissions	0.2	9	6	7	8	10	8
Minimises flood risk	0.1	7	7	7	7	7	7
Protects Biodiversity	0.1	6	7	7	7	7	7
Total Weighted Environmental	1	6.7	7.1	6.7	7.8	8.8	8.1
SOCIAL and GOVERNANCE CRITERIA							
Protects Public Health	0.2	2	8	6	10	8	8
Facilitates Economic Development	0.2	6	9	7	6	9	9
Improves water supply security	0.2	5	6	7	4	9	10
Minimises Risk / Operational Simplicity	0.2	6	6	6	10	6	4
Impact on public amenity / greenspace	0.2	5	9	8	6	10	10
Total Weighted Social	1	4.8	7.6	6.8	7.2	8.4	8.2
ENVIRONMENTAL AND SOCIAL SCORE (ESS)							
		11.5	14.7	13.5	15	17.2	16.3
	Rank	**6**	**4**	**5**	**3**	**1**	**2**

Based on the environmental and social score (ESS), Scenario 8 (Advanced Water Recycling Facility and Ring Main) is the preferred scenario, for the following reasons:

- A reduction in current raw and potable water demands of 4.1% is achieved by supplying recycled water (120 ML/annum) to identified parks and sportsfields.
- Potential to further increase raw water savings by supplying non-potable to some schools, institutions and the Transport Hub in the future.
- Reduced discharge of effluent to waterways compared to Business as Usual (BaU), with the percentage of effluent recycled rising from 17 to 30%.
- Restriction-free water supply to keep sportsfields in good condition during extreme drought events.
- Potential to extend the ability of a 16 ML/day WTP to service an extra 10 to 20 years of population growth.
- Potential to add stormwater harvesting in the future should non-potable demands rise (as described in Section 3.6).
- The solar PV power generation will offset the full AWRF and a significant proportion of the new STP's electricity demands, reducing GHG emissions and operating costs by approx. $90,000 per annum.

There is also the benefit to the borefield of reduced extraction, which is not directly captured by the criteria provided.

However, there are a few identified non-cost issues that would arise with the recycled water element of Scenario 8:

- On-site storages on POS sites may be prone to chlorine decay, creating uncertainty in chlorine dosing needs. In addition, mixing raw bore water with recycled water creates a range of water quality challenges that will need to be fully addressed in the scheme risk assessment, particularly so if school or institutional end users are brought into the scheme.
- Raw water top-up arrangement is critical to ensuring a consistent level of service and continuity of supply. This would impact on POS end-users, but even more so on potential future school or institutional end-users, especially if non-potable uses such as air-conditioning and toilet flushing are to be considered.
- Potential for cross-connection risks.

Scenario 7 ranked third after Scenarios 8 and 9, but does have a range of benefits when compared to those options, including:

- Reducing the annual demand for potable water by 35 ML/annum by substituting raw water for potable at the McGlynn/Cheney and the Pioneer/Northparkes ovals clusters.
- Potential reduction in Peak Day potable demands by 0.35 ML/day, extending the life of the proposed new WTP by approximately 5 years.
- Reducing salinity and public health risk issues being experienced at the Golf Club.
- Significant reduction in pollutant loads being released to Goobang Creek, including 100% re-use for 7 months per year. The percentage of effluent recycled will increase from 17 to almost 60%.
- Operational simplicity and very low public health risk.
- The cost of a new bore has been included in the IWCM Strategy Assessment for Option 7, which is anticipated to provide a sustainable yield of 1850 ML/annum, which is greater than the potential 700 ML/annum provided by the AWRF in Option 8.

The primary ESS concerns about Scenario 7 are that it:

- Increases the overall demand for raw water by 5.2%, which will reduce the secure yield unless a new bore is brought on-line (connection to Forbes Bore 3 or a new bore located along the proposed Gooloogong water grid link as part of this Scenario.).
- Does not provide a drought-proof source of water that can be used to maintain playing surfaces in the event of an extreme drought.

The Business as Usual case is by far the worst option based on the Social and Environmental Assessment Criteria, failing to address key water cycle issues identified during the development of this Strategy, as summarised in Table 2.1 earlier. A direct comparison of some of the key environmental outcomes is shown in Table 5.2.

Table 5.2 Scenario Assessment against Environmental and Social Criteria

	RW to Golf Club and Race Course Only	RW Ring Main 28ML WTP	RW to Golf Club + some PoS 16 ML WTP	Raw to PoS Ag Re-use plus Bores 16 ML WTP	RW Ring Main incl Subsidy No Extra Bores	RW Ring Main plus Centoc Water Grid
	BaU	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Scenario 9
Increase in Raw Water Yield (ML/annum)	0	870	36	**1850**	200	2050
Change in Raw Water Demand (% v BAU)	0	**-4.1**	-0.5	5.2	**-4.1**	**-4.1**
Reduction in Peak Day Potable Demand (ML)	0	**1.0**	0.35	0.35	**1.0**	**1.0**
Recycled Water (ML/annum)	162	200	185	**450**	200	200
Percentage of Effluent Recycled	22%	27%	25%	**62%**	27%	27%

5.2 Financial Assessment

A financial assessment of the Scenarios in accordance with the methodology outlined in NOW Information Sheet 6 has been undertaken for this strategy, and includes the following elements:

- Capital cost estimates for all infrastructure solutions
- Operating cost estimates for all solutions
- Development of NPV's for each Scenario at discount rates of 4, 7 and 10%

The environmental and social score (ESS) from the previous section will be divided by the NPV of each scenario to determine which scenario provides the highest benefits per $ spent. This ratio is the NSW Office of Water's (NOW) preferred method for demonstrating value for money, and will be used to rank the various solution sets.

The capital and operating costs summarised in this section have been drawn from a wide range of supporting studies. This IWCM Strategy has benefitted from the parallel development of concept plans and tender documentation for the proposed Water and Sewerage treatment plants, the Lachlan River intakes and several other infrastructure elements common to all solutions. This detailed planning has optimised solutions and refined the cost estimates for all the key elements.

Similarly, detailed estimates of the capital and operating costs of all recycled water options have been prepared, recognising that this is a key differentiator between many of the options.

The NPV's for each Scenario have been calculated using a new financial modelling tool developed by the Australian Water Recycling Centre of Excellence[30], designed specifically for the Australian water industry. These are presented as an Appendix to the Strategy.

Financial analysis assumptions

The following assumptions are key to the financial analysis and are consistent throughout the relevant scenarios.

- Council Infrastructure department acts as the utility, not PSC as a whole.
- All water charged for and billed based on assumed prices as outlined:
    - Recycled water charged at $1.50
    - Bore water charged at $1.25
- Chlorine costs $52.50/ML disinfected water
- Pumping of bore water costs $0.25/kL
- Long range marginal cost of bulk potable supply $0.82/kL

Note that the three Scenarios that include the Advanced Water Recycling Facility and Ring Main have assumed that the Commonwealth will contribute $8.75M under the National Stronger Regions Fund, as announced on 12 May 2015.

The golf club and racecourse do not currently pay for effluent supply under current arrangements and have both stated that they could not afford to pay for water. In addition, potable water used for irrigating POS is not currently billed. Hence the economic benefit of a new recycling scheme will be limited if based on comparison with existing financial arrangements.

Scenario 7 Potentially creates a new cost to Council through having to subsidise the supply of raw water to the golf club.

[30] This financial modelling tool was funded by the Australian Water Recycling Centre of Excellence and developed by Marsden Jacob Associates, with support by the Victorian Government's Business Innovation Fund and GHD.

The capital and operating costs of all the individual solution elements, and for each of the Scenarios, is shown in the table on the following page. The total capital cost of each Scenario excludes projects already underway and common to all, such as the Lake Endeavour dam safety works.

Table 5.3: Summary of Capital and Operating Costs

	IWCM 2005	IWCM 2015				Capex	Delta Opex
	RW Ring Main	RW to Golf Club + some PoS	Raw to PoS Ag Re-use plus Bores	RW Ring Main Sub No Bores	Ring Main plus Centoc Grid		
	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Scenario 9	$M	$K/annum
WATER SOURCES							
Permanent river intake and Bore 8	✓	✓	✓	✓	✓	2.75	0
Dam Safety Works - Endeavour	Extra	✓	✓	✓	✓	11.7	0
Connection to Forbes Bore 3 (or new bore SE)			✓		✓	3.5	40
Connection to CENTROC Grid - Gooloogong					✓	43	200
WATER TREATMENT							
New 28 ML/day WTP	✓					45	3020
New 16 ML/day WTP		✓	✓	✓	✓	44.9	2420
DEMAND MANAGEMENT							
Community Education	✓	✓	✓	✓	✓	0	
Larger Usage Pricing Adjustment	✓	✓	✓	✓	✓	0	
Evaporative Cooler Efficiency Program	✓	✓	✓	✓	✓		
Active Leak Detection	✓	✓	✓	✓	✓	0.45	-10
Rainwater Tanks as per BASIX	✓	✓	✓	✓	✓	0	
Rainwater Tanks 20% Retrofit	✓	Program Complete					
Permanent Water Conservation Measures	✓	✓	✓	✓	✓	0	
RECYCLED AND RAW WATER							
Raw Water to Northparkes, Pioneer, Spicer		✓	✓			0.2	-5
Raw Water to Golf Club, Racecourse, Cheney McGlynn			✓			0.5	20
Recycled Water to Crop Irrigation			✓			0.3	-40
Recycled Water to Golf Club, Rececourse, Cheney McGlynn		✓				0.3	
Recycled Water Ring Main (excl AWTP)	✓			✓	✓	12.5	
New 2 ML/day Class A AWTP	✓	✓		✓	✓	5.2	233
Solar 300 kW Commercial System		✓		✓	✓	0.5	-25.6
SEWAGE TREATMENT							
New 3 ML/day Parkes STP	✓	✓	✓	✓	✓	21.8	250
Sewering of Villages	Extra	✓	✓	✓	✓		
	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Scenario 9		
Future PSC Capital Works ($M 2015)	83.0	76.1	74.4	79.4	125.9		
OPEX ($K/annum)	3244.4	2802	2645	2877	2977		

The following page outlines the Net Present Values (NPV) and other key financial information for each of the Scenarios, and the ranking of the Scenarios based on financial criteria only. The NPV's exclude elements common to all scenarios, including the water and sewerage treatment plants.

Table 5.4: Scenario Assessment against Financial Criteria

	IWCM 2005	IWCM 2015			
	RW Ring Main	RW to Golf Club + some PoS	Raw to PoS Ag Re-use plus Bores	RW Ring Main Sub No Bores	Ring Main plus Centoc Grid
	Scenario 5	**Scenario 6**	**Scenario 7**	**Scenario 8**	**Scenario 9**
Future PSC Capital Works ($M 2015)	83.0	76.1	74.4	79.4	125.9
OPEX ($K/annum)	3244.4	2802	2645	2877.4	2977.4
NPV at 7% & 30 Years ($M)	-17.19	-7.28	-10.96	-6.45	-7.68
Net levelised cost ($/kL)	4.26	2.75	6.58	1.60	1.90
Scenario Ranking based on Financial Criteria	**5**	**2**	**4**	**1**	**3**

The financial assessment clearly favours Scenario 8 on account of its significant benefits and avoided costs. $8.75M of Commonwealth funding has been incorporated into the calculations, including $500,000 towards a 200 kW solar PV system that also helps to reduce the operating costs of the Ring Main options.

5.3 Combined TBL Assessment and Ranking

To determine which of the Scenarios is preferred, the environmental and social score (ESS) is divided by the NPV of each scenario to determine which scenario provides the highest benefits per $ spent. This ratio is the NSW Office of Water's (NOW) preferred method for demonstrating value for money.

An alternative method is to give the Environmental, Social and Financial Scores equivalent weightings and determine which of the Scenarios has the highest overall TBL score.

Table 5.5: Combined TBL Assessment and Scenario Ranking

		RW to Golf Club + No Ring Main	RW Ring Main + 28 ML WTP (2005 IWCM)	RW to Golf Club + some PoS + 16 ML WTP	Raw to PoS + Ag Re-use + New Bores	RW Ring Main incl Solar	Ring Main + Bores + Centroc Grid
	Weighting	**BAU**	**Scenario 5**	**Scenario 6**	**Scenario 7**	**Scenario 8**	**Scenario 9**
ENVIRONMENTAL CRITERIA							
Impact on Local Waterway Health	0.3	6	8	6	10	8	8
Impact on Raw Water Sources	0.3	6	7	7	6	10	9
Minimises GHG Emissions	0.2	9	6	7	8	10	8
Minimises flood risk	0.1	7	7	7	7	7	7
Protects Biodiversity	0.1	6	7	7	7	7	7
Total Weighted Environmental	1	6.7	7.1	6.7	7.8	8.8	8.1
SOCIAL and GOVERNANCE CRITERIA							
Protects Public Health	0.2	2	8	6	10	8	8
Facilitates Economic Development	0.2	6	9	7	6	9	9
Improves water supply security	0.2	5	6	7	4	9	10
Minimises Risk / Operational Simplicity	0.2	6	6	6	10	6	4
Impact on public amenity / greenspace	0.2	5	9	8	6	10	10
Total Weighted Social	1	4.8	7.6	6.8	7.2	8.4	8.2
ENVIRONMENTAL AND SOCIAL SCORE (ESS)							
		11.5	14.7	13.5	15	17.2	16.3
	Rank	**6**	**4**	**5**	**3**	**1**	**2**
COST CRITERIA							
Capex NPV ($M)			14.56	6.92	7.47	8.73	10.00
Opex NPV ($M)		N/A	10.09	4.06	4.38	6.36	5.46
Benefits NPV ($M)			- 7.46	- 3.69	- 0.89	- 8.64	- 7.78
Total NPV (-$M) at 7% & 30 Yr		N/A	17.19	7.29	10.96	6.45	7.68
COMBINED TBL ASSESSMENT							
ESS/$M		-	0.9	1.9	1.4	2.7	2.1
TBL Ranking		**6**	**5**	**3**	**4**	**1**	**2**

The non-cost assessment favours Scenario 8, which includes the construction of an Advanced Water Recycling Facility (AWRF) and a ring main to distribute recycled water around the Parkes Urban area for irrigation of public open space.

It should be noted that Scenario 7 and 9 includes $2.6M towards linking the Eugowra Road Raw Water Pump Station with expanded borefield extraction as part of the Centroc Water Grid. This part of the scenario will only proceed if Centroc is fully funded by the State or Commonwealth government.

Scenario 8 is the preferred option for future proofing the water supply of Parkes and providing a more sustainable alternate supply to bore extraction. The borefield has been under stress in past drought periods, and this scenario serves to alleviate that, while also reducing sewer discharges and enabling parks and open space irrigation throughout drought periods.

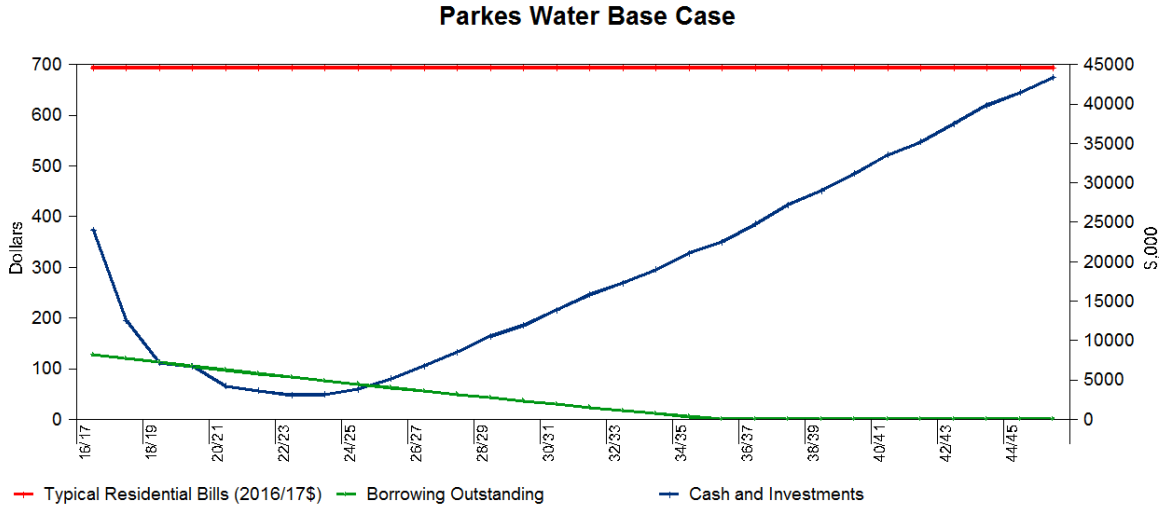
5.4 Impact on Typical Residential Bill

An updated financial model was completed in March 2017 to inform the impacts on typical residential bills of the adopted IWCM scenario (Scenario 8). The modelling was based on the 30-year capital works program investments of $74 million and $38 million in water supply and sewerage assets respectively. These comprise new works and asset renewals and reflect the works in Scenario 8 and 9 including the recycled water main.

The 2016/17 TRB for water is $693 and sewerage $440 per customer.

As shown in Figure 5.1, the modelling found that neither the water nor sewerage TRB required increasing beyond normal CPI increments to implement the asset management plan. In fact, there may be reserves available in the future to reduce the TRB over time.

Figure 5.1 Outcomes from the financial modelling of the preferred IWCM scenario



6 Implementation

6.1 Implementation Funding

PSC recognises the iterative nature of preparing this IWCM, planning and designing the new water and sewerage treatment assets, scoping the recycled water ring main and delivering on the best practice management elements of SBP, Financial Plan, Asset Management Plans.

As a result Council resolved to and undertook an interim review of the 2013 long term Financial Plan in 2015 to enable the progress of design and construction of the treatment plants and river intake. Adjustments to the capital expenditure budget were made to the water and sewer funds but usage charges maintained at 2011 levels as the ratio of over 75% had been achieved. The forecast revenues and grant funding are considered sufficient to complete the planned projects.

Further financial modelling is being undertaken in 2017 to revise the 30 year financial planning forecast and confirm the Typical Residential Bill impact of the scenario.

Council is currently completing a Strategic Asset Management Plan, from which asset management plans specific to water and sewer will be developed. These will detail the renewals and operational aspects needed to supply the new capital works currently underway.

6.2 Implementation Timing

The main benefits to achieving target levels of service over the long term from each of the scenarios are detailed in :

- Ensuring security of supply during peak day demands in a future affected by climate change
- Achieving consistent water quality performance
- Reducing sewer flows to Goobang Creek

For Scenario 8, achieving these levels of service will occur at the completion of the water and sewage treatment plants and be continuously maintained through the non-capital demand management actions. The timing of implementation is presented in Table 6.1.

Table 6.1 Scenario 8 Implementation Status

Scenario 8 - RW Ring Main, no bores	Milestones			
	Procurement	Construction	Commissioning	Practical Completion
WATER SOURCES				
Permanent river intake and pipe to bore field	Jul-15		Jun-17	
Dam Safety Works - Endeavour				Dec-15
WATER TREATMENT				
New 16 ML/day WTP	Dec-15	Apr-16	Jun-17	
Larger Usage Pricing Adjustment				Aug-16
Active Leak Detection				Ongoing
Permanent Water Conservation Measures				Ongoing
RECYCLED AND RAW WATER				
Recycled Water Ring Main (excl AWTP)	Dec-17		Dec-18	
New 2 ML/day Class A AWTP	Dec-16	May-17	Aug-17	Dec-17
Solar 300 kW Commercial System	Mar-16			Dec-17
SEWAGE TREATMENT				
New 3 ML/day Parkes STP	Dec-15	Apr-16	Jun-17	
Sewering of Villages				Jul-20

7 Recommendations

The preferred option is Scenario 8. It scores highest with the environmental and social criteria and, with the funding available from the Federal government, scores well in economic criteria, with a stable TRB to fund operational expenses.

The key elements of the preferred Scenario are:

- New 16 ML/day Water Treatment Plant for the Parkes – Peak Hill Supply Scheme.
- New 3 ML/day Sewage Treatment Plant for Parkes.
- New 2 ML/day Advanced Water Recycling Facility to supply parks and open space throughout Parkes Urban Centre via a ring main. This facility is to be powered by 300kW solar array.
- Permanent Lachlan River Intake.
- Connection to Centroc Water Grid (if externally funded) via a pipeline between Eugowra and Goologong.
- Delivering the System Loss Management Plan.
- Minor changes to the Permanent Water Conservation Measures.

Scenario 8 requires a capital investment of $84M and operating costs of $2.8M per year.

The implementation of the preferred scenario is currently underway and supported by Councils financial plan and asset management plan, which are provided as Appendices. Because of the iterative way the IWCM Strategy was developed to inform the development of capital projects, each of the elements works in concert to achieve the optimum outcome, with revisions when new information arises.

This strategy will continue to evolve as projects proceed, grant funding opportunities arise and environmental and political conditions change. Parkes Council is committed to achieving best practice water cycle management in collaboration with DPI Water. Ongoing reporting in accordance with Integrated Planning and Reporting will occur as required.

8 References

Previous Strategy and Supporting Documents

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Economic Appraisal of the Parkes Water Security Project, AEC for Parkes Shire Council, June, 2014

Parkes WTP - Water Quality Analysis & Jar Testing Report, Banergee and Associates, Dec 2014

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Parkes STP Concept Design Report, PWD, Feb 2014

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Parkes STP Sewerage Scheme Operation Strategy Discussion Paper, Banergee, January 2015

Parkes STP – Design Basis Memorandum, HunterH2O, June 2015

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9 Feedback and Coverage of Check List

The preparation of the Parkes IWCM 2015 Strategy Paper has involved presentations and workshops with key Government Agencies, Council staff and the Community Project Reference Group (which included some members of the original PRG for the IWCM 2005). The feedback from these meetings has informed the formulation of options and scenarios presented in this Strategy.

Formal comments on the Strategy paper were provided by DPI Water in December 2015. Council responses to the feedback shown in Table 9.1 were discussed in a meeting at DPI Water offices on 21 July 2016. Finalisation of both the Issues and Strategy papers wwas discussed with DPI Water on 11 April 2017.

A summary of the coverage of the IWCM Checklist provided in the Issues and Strategy papers is presented in Table 9.2.

Table 9.1 Summary of Comments on the Draft Strategy Paper

Where?	Full Comment	PSC actions
Strategy	The mine only has high security water access license and not LWU access license. The high security access license has a lower priority than LWU access license, hence in an extreme event will get lower allocations. The total flow to mine in Table 3.2.3 provides a constant flow for all restriction levels. Confirm if this is legally achievable.	PSC to outline the process for managing mine supply under drought conditions, referencing agreement with mine and license. Agreement being formalised. Allocation for mine is able to be met through secure yield.
Strategy	The increase in raw water secure yield figure quoted for scenario 9 in Table 5.2 is questionable given the comment on page 19 'there is no surplus yield available at present in the CTW network' including the reported cost in Table 3.7.2.	Sustianable groundwater yield will increase, but not total groundwater yeild. should not increase. Emergency water can be available to the system, but yield should not be considered to be higher.
Strategy	The strategy report does not evaluate/comment on supply options such as pipeline from Wyangala dam and supplying treated water from Forbes (subject to WTP having surplus capacity) from a joint headwork system.	Is Wyangala dam connection at all realistic? Forbes bore 3 line be duplicated - 5 ML/d. 10 ML/d to/from Eugowra. Refer back to Hydroscience report. Public works detail. CENTROC water grid briefing paper.

Strategy	The reported (page 21) long-term sustainable yield of 1,200ML from the existing borefield appears to be based on system configuration constraints and not water resource constraints. Therefore securing and/or installing new bores to the south-west of existing borefield appear to be common to all scenarios.	New bores to east are common to all scenarios. Forbes has constructed bore 3, taking SW expansion option away. Siting of new bores to be determined through future groundwater study.
Strategy	The basis of how the costs in section 3.7.8 have been derived needs to be documented. Similar comment applies to other costs reported throughout the report.	AWRF costs explained. Need to check others.
Strategy	Does the cost and present value analysis of effluent/recycled water reuse options include revenue from the sale/use of this water?	To be confirmed. Council does not currently pay for irrigation water. Neither does golf course and racecourse. Edit text to incorporate term 'levelised cost'.
Strategy	Salinity has been identified as an issue with effluent reuse at golf course. Is it due to accumulation (sustainability) in soil affecting growth or is it an immediate effect of scorch of foliage on contact? The effluent reuse options proposed does not seem to address this issue.	This is a soil sodicity issue (not contact burn) and would be a justification for injecting raw water into the recycled water system.
Strategy	It appears that the benefits of the ring main proposal is overstated (see page 48), thus affecting the relative environmental and social scores in Table 5.1.	List out the benefits considered from the AWRF grant funding application.
Strategy	As shown in the attachment there is a more cost effective effluent/reclaimed water reuse scenario that achieves the expected outcomes of a ring main proposal. This proposal could also be initially used as a raw water POS system. To overcome the salinity issues with effluent reuse, the clarifier in the existing water plant may be converted into an effluent/raw water reservoir and could be used for mixing both the waters. This scenario should be	Need to resolve tension/conflict between DPI Water and EPA views and have an internal discussion at Council. To satisfy EPA we recycle BAU, and consider discharges to creek as environmental flows?

	costed and assessed.	
issues	Section 6L.1- Peak Wet Weather Flow (PWWF) - The discussion presented on PWWF is inconsistent as follows:	STP and SPS design are set and will not change. Julian to ensure description of flows into STP better reflects past studies and incorporate any new data that can be made available. Awaiting response from Sentinel. Persistence is apparently low so inflows the main problem ahead of infiltration. Peak instantaneous flow rate probably reaches 10 ADWF, but total volume in the day would not.
	· ADS flow gauging indicates 10 x ADWF based on a small number of moderate rainfall events, the logical inference being that PWWF would likely be even higher for larger rainfall events.	
	· PWWF events of 6 to 7 x ADWF are then stated as being very rare> However, it is acknowledged elsewhere in the Issues Paper that flow measurement at the STP inlet works is problematic and cannot be relied upon. A PWWF of 6 to 7 x ADWF is therefore difficult to justify.	
	· 7 x ADWF has been adopted for PWWF within the Issues Paper and Strategy.	
	Given the age of a substantial portion of the sewer system, it may not be unreasonable for PWWF of 10 x ADWF or higher to actually occur as portrayed by ADS flow monitoring and an expectation of only 6 to 7 x ADWF may be overly optimistic.	

	NOTE: That a higher PWWF of 10 x ADWF would impact on current sewerage augmentation planning in one of two ways:	
	· Should the capacity of the new transfer SPS capacity at the existing STP site remain at a design maximum of 7 x ADWF then the available storage at the SPS should be confirmed, OR;	
	· Should the capacity of the new transfer SPS capacity at the existing STP site be upsized to 10 (or more) x ADWF then:	
	a) hydraulics of flow through the new STP would need to cater for increased flows and may require some upsizing in terms of pipe sizes, weir lengths, etc. for conveyance of higher flows.	
	b) bioreactor (aeration tank) units could readily cater for plant inflows above 7 x ADWF via either the incorporation of a flood cycle (decanter parked at TWL) or alternatively provision of a storm bypass pipeline.	
Issues	Section 6L.1 - Design STP Capacity - A design plant capacity of 3 ML/d is stated as being required to cater for projected loads through to the year 2046 with 0.4% growth rate. This is not supported by Table 6.12 which gives 3.15 ML/d being required.	3.07 ML/d is the official size.
Issues	NOTE: That this may not impact on current STP augmentation planning if it is acceptable for the new plant to be constructed with an expected design horizon of 20 years sufficient for load through to year 2036 in lieu of 30 years through to year 2046.	Julian to confirm and update (if required) all details of figures underpinning STP sizing (design EP, sewage yield, septage, etc.)

Issues	Section 7K – STP Design Load - STP requirements are stated as being to cater for 12,500 EP, but this is not consistent with the loading projections presented in Table 6.12 which indicate either 15,000 EP sufficient for year 2036 loads or 15,800 EP sufficient for year 2046 loads.	Julian to also check capacity expansion allowance.
Strategy	The strategy report does not address any urban water services issues relating to the towns/villages other than Parkes.	Julian to establish planning for satellite towns and figure out how to incoporate into IWCM.
Strategy	The strategy report does not have a TAMP and TRB for each scenario.	Julian to follow up with Daya regarding TAMP. TRB should be available.
Strategy	Section 4 Scenario descriptions required.	
Strategy	Section 5.2 needs completing	
Strategy	Section 6 Recommendations needs completing	
Strategy	Section 7 needs input from FINMOD	RB
Strategy	Section 8 Implementation Plan needs to be developed completed	

Table 9.2 IWCM checklist coverage

Checklist No	Checklist Topic	IWCM Section
1 to 8	**Issues Paper**	**Issues Paper**
	According to Checklist	All Sections
9	**Feasibility Review of Previous Options**	**IWCM Strategy**
A	Previous Options and Pricing	3.1 and 3.2
G to I	Water Supply Security	3.3
J to M	Water Quality, Treatment and Distribution	3.4
N to R	Sewage Treatment and Recycled Water	3.5 and 3.7
S to W	Stormwater and WSUD	3.6
10	**Evaluation and Assessment of Feasible Options**	**IWCM Strategy**
A to H	Water Supply Options and Demand Management	3.2 and 3.3
I to N	Sewage Treatment	3.5

J to M	Water Quality, Treatment and Distribution	3.4
P to Q	Stormwater Harvesting	3.6.2
T to V	WSUD and Liveable Cities	3.6.1
11	**Development of IWCM Scenarios**	**IWCM Strategy**
A to M	Description and Cost of Bundled Scenarios	4
12	**Evaluation and Ranking of Scenarios**	**IWCM Strategy**
A and B	TBL Assessment in Accordance with Info Sheet 6	5.1 and 5.2
13	**Draft Strategy**	**IWCM Strategy**
A	Executive Summary including Key Issues	Exec Summary
B	Descriptions	3.1 to 5.2
C	Recommended Scenario	6
13 to 16	**Consultation and Adoption**	**Council Adopted**
17	**Financial Planning Updates**	**Underway**
18	**Implementation Plan**	**IWCM Strategy**
	Actions included in Asset Management Plan	New AMP in preparation