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Yass Valley Council

Integrated Water Cycle Management Strategy Plan

May 2008

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Executive Summary

This report documents the development of the Yass Valley Council (YVC) Integrated Water Cycle Management (IWCM) Strategy Plan. This report has been developed in line with the NSW Department of Utilities, Energy and Sustainability (DEUS) *IWCM Guidelines* (2004). It identifies the process in which the preferred scenario for the future management of urban water services in YVC was chosen and provides guidance for its implementation.

Scenario Building Approach and Data

A range of management options were developed to address the catchment, water resource and urban issues identified by the IWCM Concept Study through the review of background studies and stakeholder consultation. In addition, a series of potential management options were investigated through a series of desktop studies, including a demand analysis and a review of alternative water sources including stormwater harvesting and effluent reuse.

This process eliminated any potential management options which would not be technically feasible for YVC given the prevailing characteristics and issues.

Once the most feasible options for YVC were identified, complimentary options were bundled together to form five scenarios. Each of these scenarios considered water, sewerage and stormwater aspects of YVC operations. Detailed capital works programs for each of the scenarios were prepared.

Triple Bottom Line Assessment of Scenarios

A set of assessment criteria were developed in order to assess the ability of each scenario to address the identified issues. The criteria developed allowed each scenario to be ranked based on environmental, social and economic aspects i.e. a triple bottom line (TBL) assessment.

The Preferred Scenario

Each scenario was presented to the Project Reference Group (PRG) and a preferred scenario was identified for implementation. The preferred scenario is summarised in the table below.

Table S-1: Preferred Scenario

IWCM Issues		Strategy	Preferred Scenario
1	Lack of water storage / Poor security of existing source	Demand management	High level demand management (pricing, education and BASIX for new development, showerhead retrofit and UFW reduction)
		Yass source augmentation	Raise dam wall by 3 metres.
		Emergency drought relief	Emergency bore, preparation of drought management plan and study on sensitivity of Yass dam yield
		Effluent management	All effluent first to river and then indirect use of 160 ML/y for park and golf course irrigation.
		Murrumbateman WTP	Augmentation to 0.9 ML/d (Shower and kitchen requirements to be supplied by RWT).

IWCM Issues		Strategy	Preferred Scenario
		Gundaroo water supply	Groundwater Source
2	Insufficient funds to provide required works	Financial management	Update DSP and Financial Plan, uncertainty in continuation of Country Town Water Supply and Sewerage (CTWSS) funding, apply full cost recovery pricing, designed to be self funding and less costly. Greater access to funds through diversified services and product delivery.
3	Need for extension / upgrade of water supply, sewerage and stormwater to serve existing and future customers.	Asset renewal	Matching renewal for investment (mains, bores, pumps, reticulation, reservoirs)
		New water mains in Yass scheme	Service extension for growth
		Bowning and Binalong	Store excess water in Binalong dam and filter in a 1.1ML/d microfiltration plant with telemetry system update.
		New water mains in Murrumbateman scheme	Service extension for growth
		Sewer extension	Reticulated sewerage system for Binalong, Bowning, Murrumbateman and Gundaroo and service extension for growth in Yass.
4	Need to maximize sustainable effluent and stormwater management	Effluent management as in 1.	
		Rainwater tanks as in 1.	
5	Development restricted by lack of water	Yass source augmentation as in 1	
		Murrumbateman WTP as in 1	
		Effluent management as in 1	
		New water mains in Yass and Murrumbateman scheme as in 3	
		Sewer extension as in 3	
6	Poor water quality in the Yass River affects the quality of the water supply.	Yass STP upgrade	Existing STP 7,500 EP. (Trickling Filter unit requires upgrading). Treatment process to be upgraded to secondary with phosphorous removal (1.22 ML/d, 6,800 EP in 2009 and 1.8 ML/d, 10,800 EP in 2032).
		Stormwater management	Update SWM plan and implement SW initiatives as in SWM plan.
		Catchment initiative	Implement Catchment initiatives and water quality monitoring and environmental management action plan
		STP for other towns	STPs for Murrumbateman, Binalong, Bowning and Gundaroo.
		On-site sewerage management (monitoring)	On-site systems audit every 5 years.
		Water Treatment in Murrumbateman as in 1	

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IWCM Issues		Strategy	Preferred Scenario
		Water Treatment in Yass	Softening plant to address hardness. Automate Powdered Activated Carbon (PAC) unit to address taste and odour.
		On-site sewerage management (incentive)	Present regime (No incentive for better on site technologies).
7	Traditional land use including land clearing, loss of riparian vegetation, deforestation, and agricultural uses has resulted in poor fertility, soil erosion, acidic soils and dryland salinity	Catchment initiative as in 6.	
8	Extensive land clearing and grazing has contributed to dryland salinity	Catchment initiative as in 6.	
9	Some rural residential developments are not sustainable	Development control	Drought management plan to identify emergency drought supply and development control planning and liaison with DNR for water licence control.
10	High operating and management costs resulting in high bills	Infrastructure upgrades as in 1, 3 and 6.	
		Asset renewal as in 3.	
11	Stormwater contributing to water quality issues in Yass River	Stormwater management as in 6.	
12	Potential groundwater over extraction	Groundwater strategy	Audit bores, groundwater quality monitoring, and prepare groundwater strategy plan through liaison with DNR.
13	Lack of water sharing process	Water Sharing Plan	Liaison with DNR to prepare water sharing plan.
14	Town water extractions contributes to hydrologic stress in Yass River	Demand management as in 1.	
		Effluent management as in 1.	
15	Occasional non compliance with drinking water guidelines	Water treatment in Yass as in 6.	
		Murrumbateman WTP as in 1.	
16	Groundwater quality for Murrumbateman town water supply is poor	Murrumbateman WTP as in 1.	
		Groundwater strategy as in 12.	
		Investigations to determine alternate source.	
17	Need for sustainable on-site systems	On-site sewerage management (monitoring) as in 6.	
		On-site sewerage management (incentive) as in 6.	
18	There are activities within the LGA that have the potential to pollute waterways.	Licensing and regulation	Liaison with DEC (through POEO licensing) and update LEP.
19	Changing land use leading to increased water demand	Stormwater management as in 6.	
		Growth planning as in 5.	
		Licensing and regulation as in 18.	
		Water Sharing Plan as in 13.	

IWCM Issues		Strategy	Preferred Scenario
20	Increase in water service and sewerage complaints and sewer main chokes	Asset renewal as in 3.	

Implementation and Monitoring

Monitoring is an essential part of the IWCM process to ensure that the management strategies which have been identified as part of this study have been successful at addressing the water cycle issues. In addition to this, it is important that any new or changes in severity of individual issues are documented and appropriate changes made to the Strategy document, capital works program and financial plan.

It is recommended that this document should be reviewed in 2012 and every fives years afterwards on an ongoing basis.

Contents

Appendices

Glossary

BASIX	A web-based design tool that ensures each new residential dwelling design meets the NSW Government's targets of up to 40% reduction in water consumption and a 25% reduction in greenhouse gas emissions, compared with the average home (DoP, 2006).
Best-practice	An industry standard recognising the most effective management methods of the time.
Capital expenditure	The initial cost of constructing infrastructure assets.
Capital works program	A schedule of planned capital expenditure, normally over a period of thirty years for water supply and sewerage businesses.
Catchment	The area of land drained by a river and its tributaries.
FINMOD	NSW Financial Modelling software package developed by the NSW Government for local water utilities.
Groundwater	Underground water filling the voids in rocks; water in the zone of saturation in the earth's crust. See also aquifer.
Local water utility (LWU)	The water supply and sewerage businesses of a local council.
Nutrients	A source of nourishment. However, for water quality, it indicates nitrogen and phosphorous.
Potable water	Water that based on current knowledge is safe to drink over a lifetime; that is, it constitutes no significant risk to health.
Rainwater tank (RWT)	Storage tank for collecting rainwater from the roofs of buildings.
Reuse	The use of treated sewage effluent or treated stormwater to replace the use of potable water. Taking water from a waste (effluent) stream or stormwater captured and purified to a level suitable for further use.
Sewage	The used water supply of a community including water-carried waste matter from homes and businesses.
Sewage treatment plant (STP)	A facility to treat sewage to produce treated effluent and biosolids.
Sewerage	Drainage system for taking sewage away from the community to a sewage treatment plant.
Stormwater	Rain that flows over hard surfaces in urban areas and is collected in drainage systems for disposal.
Surface water	Water on the surface of the land, for example in rivers, creeks, lakes and dams.
Typical residential bill (TRB)	The annual bill paid by a residential customer that is not a pensioner or the owner of a vacant block.

Wastewater	See sewage.
Water demand	The water needs of a town including homes, businesses and public organisations.
Water quality	The biological, chemical and physical properties of water.
Water supply	The available water sources, water extraction, storage, transfer and treatment systems to supply town water.
Water treatment plant (WTP)	A facility to treat raw water to a potable water quality.

List of Abbreviations

AD	Average day (demand)
ADWG	Australian Drinking Water Guidelines
BIN	Binalong
BOW	Bowning
BPM	Best-Practice Management
CMA	Catchment Management Authority
DEC	Department of Environment and Conservation, NSW
DEUS	Department of Energy, Utilities and Sustainability, NSW
DNR	Department of Natural Resources, NSW
DPI	Department of Primary Industries, NSW
DSS	Decision Support System – DWE computer modelling software for forecasting water demand
EP	Equivalent Person
DWE	Department of Water and Energy
EPA	Environment Protection Authority, NSW (now part of DEC)
FINMOD	Financial Modelling software, see also Glossary
GUN	Gundaroo
IWCM	Integrated Water Cycle Management
kL	Kilolitre
L	Litre
LGA	Local Government Area
LWU	Local Water Utility
LOS	Level of Service
mg	milligrams
mm	millimetre
ML	megalitre
MBU	Murrumbateman
PD	Peak day (demand)
POEO	*Protection of the Environment Operations Act 1997*, NSW
PRG	Project Reference Group
SBP	Strategic Business Plan
SWM Plan	Stormwater Management Plan

STP	Sewage Treatment Plant
TBL	Triple Bottom Line
TDS	Total Dissolved Solids
UFW	Unaccounted for Water
WQO	Water Quality Objectives
WEP	Water Efficiency Program
WSP	Water Savings Program
WTP	Water Treatment Plant
YVC	Yass Valley Council

1 Introduction

This report documents the development of the Yass Valley Council (YVC) Integrated Water Cycle Management (IWCM) Strategy by YVC in line with the NSW Department of Water and Energy (DWE, formerly Department of Energy, Utilities and Sustainability, DEUS) *IWCM Guidelines* (2004). This report identifies the process in which the preferred scenario for the future management of urban water services was chosen and provides guidance for its implementation.

1.1 The IWCM Process

YVC is continually planning its water, sewerage and stormwater business activities. YVC is committed to developing an Integrated Water Cycle Management (IWCM) plan for Yass Valley Local Government Area (LGA).

IWCM aims to maximise the benefit derived from available water resources through the efficient and appropriate management of urban water services (water supply, sewerage and stormwater). It also encourages the evaluation of opportunities to minimise the impact of the urban water services on the available water resources through the identification and assessment of potential management solutions (scenarios) to address a range of catchment, water resource and urban issues.

An IWCM plan considers issues such as:

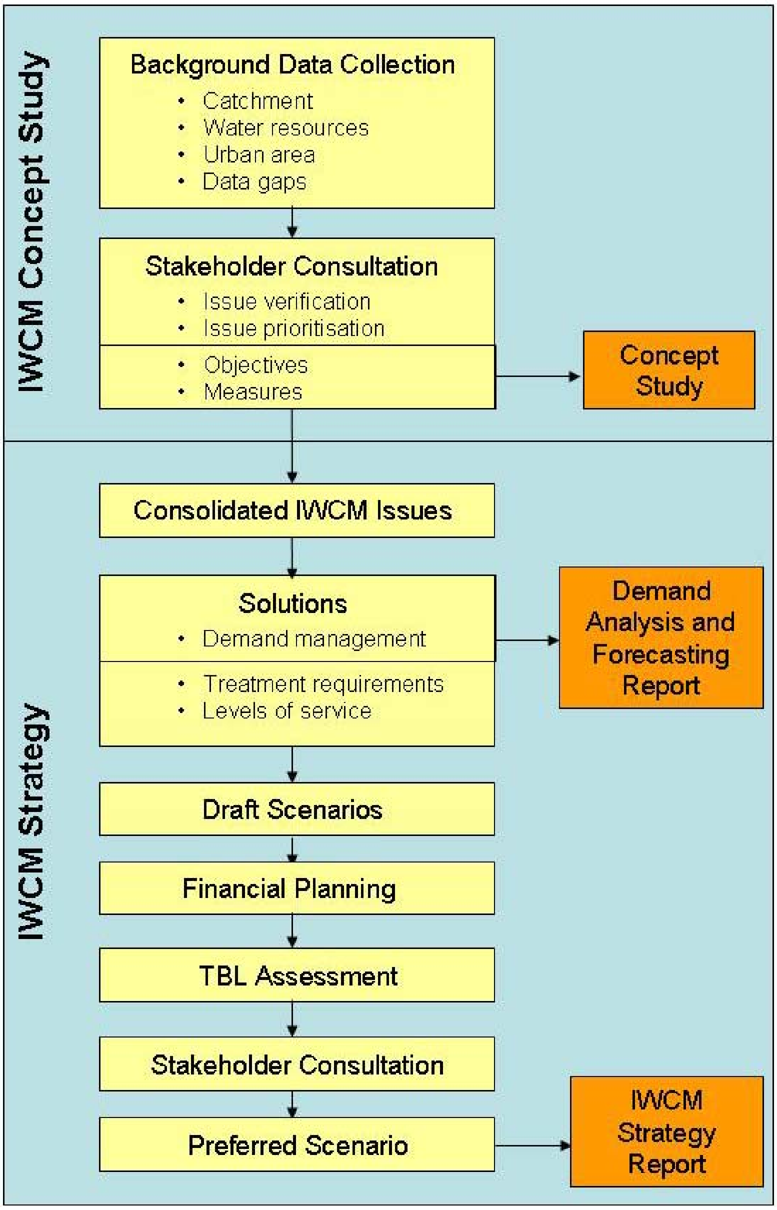
- The future urban water service needs and customer expectations;
- The availability of water including water sources such as rainwater, effluent and stormwater; and
- The impact of town water use on other water users including the environment and future generations.

In 2004, DWE published guidelines to assist LWUs in implementing IWCM, as part of their best-practice approach to LWU strategic planning. These guidelines set out a three step process for developing an IWCM plan:

- **A concept study**: an initial scoping study from which a project brief for a strategy can be developed. During this study, urban, water resource and catchment related water cycle management issues are identified by stakeholders;
- **A strategy**: to assess the ability of proposed urban water management actions to address the issues identified in the concept study. The assessment is made against economic, social and environmental criteria to formulate the most beneficial actions into a long-term business plan;
- **An implementation phase:** to put the strategy plan into place, assess the success of the plan in relation to managing the identified issues over time and revise the plan accordingly.

The IWCM process followed by YVC is illustrated in the following figure and each of these steps is discussed in further detail in the following sections.

Figure 1: IWCM Process



1.1.1 IWCM Concept Study

The YVC IWCM Concept Study was completed in March 2007. This study identified catchment, water resource and urban water cycle management issues relevant to the management and operation of YVC water supply and sewerage businesses. These issues and potential solutions were identified through a stakeholder consultation program and the review of background information.

The Concept Study is presented in Appendix A.

1.1.2 IWCM Strategy

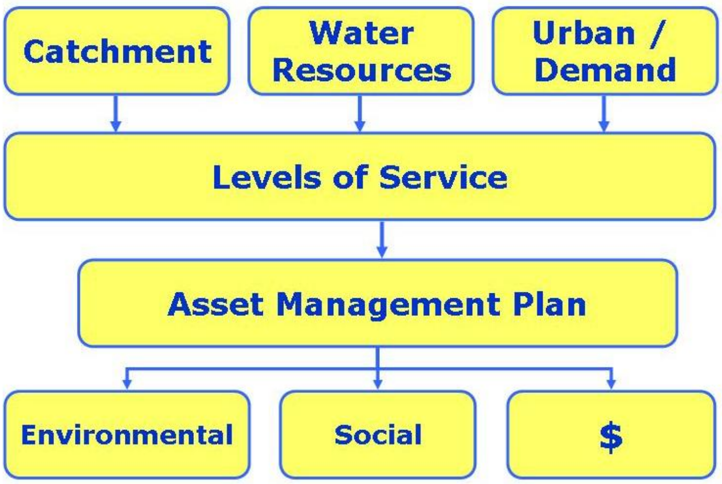
The IWCM Strategy was developed through the building and assessment of a series of management strategies (scenarios) to address the issues defined in the Concept Study.

Based on the outcomes of the Concept Study and a series of desktop analyses (See Section 2.1), a number of different management options were developed for each of the water cycle issues identified. Each of the options represents a different level of service to the environment and customers of YVC's urban water services. Similarly, each option is supported by a different asset management plan depending on the type of infrastructure required to deliver the level of service. This in turn means that each option will have different environmental, social and economic outcomes (both positive and negative).

As the number of options can be large, DWE recommends that compatible options covering water supply, sewerage and stormwater services are bundled together as a scenario.

The process of developing a scenario is set out in Figure 2.

Figure 2: Developing a Scenario.



Each of the scenarios must be assessed to identify a preferred scenario for implementation. The different scenarios are assessed on their economic, social and environmental outcomes. The preferred scenario sets out a list of strategic actions to improve the management of the identified water cycle issues over a 30 year planning horizon.

The aim of this Strategy report is to detail the development of these scenarios and to document the outcomes of the scenario assessment process as it applies to the issues facing YVC.

1.1.3 Implementation Phase

Once a preferred scenario is identified it must be implemented appropriately to ensure that the management of the water cycle issues identified in the IWCM Concept Study is improved.

Key planning tools for implementation of the IWCM preferred scenario are:

- Strategic Business Planning;
- Financial Planning;
- Best Practice Pricing;
- Development Servicing Plans;
- Demand Management; and

- Drought Management.

This Strategy report documents the process of implementation of the preferred scenario for YVC.

2 Developing the IWCM Strategy

This section sets out the approach taken to develop the YVC IWCM Strategy and includes a summary of the input data utilised (including the outcomes of the IWCM Concept Study), stakeholder consultation process, desktop analyses of some of the potential options to manage the water cycle issues and the scenario building process.

2.1 Identifying the Issues

The Concept Study is an essential part of the IWCM process providing a basis to understand the issues faced by YVC in the provision of water, sewerage and stormwater services. These catchment, water resource and urban issues were identified through the review of existing background information as well as discussions with YVC staff and regulatory authorities and stakeholder consultation.

Drawing on the outcomes of the desktop review and consultation with stakeholders, a list of verified issues to be addressed in the IWCM Strategy was developed. This process is summarised in Appendix B. The IWCM issues were confirmed in consultation with DWE and Council.

The IWCM issues are listed in Table 2-1. In developing solutions to each of the identified issues, a range of strategies were investigated. These are summarised in Table 2-1 and discussed throughout this report. The scenarios developed for YVC incorporate these strategies (refer Table 10-3).

Table 2-1: IWCM Issues and Strategies

IWCM Issues		Strategies
1	Lack of water storage / poor security of existing source.	Demand management
		Yass source augmentation
		Emergency drought relief
		Effluent management
		Murrumbateman WTP upgrade
		Gundaroo water supply
2	Insufficient funds to provide required works	Financial management
3	Need for extension / upgrade of water supply, sewerage and stormwater to serve existing and future customers.	Asset renewal
		New water mains in Yass scheme
		Increase supply to Bowning and Binalong
		New water mains in Murrumbateman scheme
		Sewer extensions

IWCM Issues		Strategies
4	Need to maximize sustainable effluent and stormwater management	Effluent management
		Demand management
5	Development restricted by lack of water	Yass source augmentation
		Murrumbateman WTP upgrade
		Effluent management
		New water mains in Yass and Murrumbateman schemes
		Sewer extensions
6	Poor water quality in the Yass River affects the quality of the water supply.	Yass STP upgrade
		Stormwater management
		Catchment initiatives
		STPs for other towns
		On-site sewerage management (monitoring)
		Water Treatment in Murrumbateman
		Water Treatment in Yass
		On-site sewerage management (incentive)
7	Traditional land use including land clearing, loss of riparian vegetation, deforestation, and agricultural uses has resulted in poor fertility, soil erosion, acidic soils and dryland salinity	Catchment initiatives
8	Extensive land clearing and grazing has contributed to dryland salinity	Catchment initiatives
9	Some rural residential developments are not sustainable	Development controls
10	High operating and management costs resulting in high bills	Infrastructure upgrades
		Asset renewal
11	Stormwater contributing to water quality issues in Yass River	Stormwater management
12	Potential groundwater over-extraction	Groundwater strategy
13	Lack of water sharing process	Water Sharing Plan
14	Town water extraction contributes to hydrologic stress in Yass River	Demand management
		Effluent management

IWCM Issues		Strategies
15	Occasional non compliance with drinking water guidelines	Water treatment in Yass
		Murrumbateman WTP upgrade
16	Groundwater quality for Murrumbateman town water supply is poor	Murrumbateman WTP upgrade
		Groundwater strategy
		Alternate source investigation
17	Need for sustainable on-site systems	On-site sewerage management (monitoring)
		On-site sewerage management (incentive)
18	There are activities within the LGA that have the potential to pollute waterways	Licensing and regulation
19	Changing land use leading to increased water demand	Stormwater management
		Growth planning
		Licensing and regulation
		Water Sharing Plan
20	Increase in water service and sewerage complaints and sewer main chokes	Asset renewal

2.2 Stakeholder Consultation Program

Stakeholder consultation was undertaken to ensure that stakeholders contributed to the definition of water cycle management issues and the identification of potential solutions. This was achieved through the formation of a Project Reference Group (PRG) which included representatives from YVC, government agencies, local organisations and the community.

The first meeting of the PRG was held in Yass Valley Council on 11 May 2006.

The objectives of the workshop were:

- To outline the role of PRG in developing the IWCM Strategy;
- To help the PRG understand the DWE IWCM concept and strategy development process;
- To present the PRG with a summary of the water cycle management issues identified in the background information review;
- For the PRG to identify additional water cycle management issues or comment on those identified; and
- For the PRG to identify possible ways of fixing these issues.

During a facilitated discussion, the PRG identified issues and some potential management solutions. The results of this consultation process are discussed in the Concept Report (Appendix A).

During the Strategy phase, the consultation program included a Steering Committee Workshop on 6 February 2007. The workshop reviewed:

- The combined IWCM issues;
- Draft scenarios;
- Project elements; and
- TBL criteria.

A second PRG workshop was held on 13 March 2007. The objectives of the second workshop were to:

- Review the IWCM approach;
- Review issues identified in concept study and by the PRG;
- Examine draft scenarios developed; and
- Evaluate scenarios to identify preferred solutions through the TBL assessment.

The PRG Workshop 2 Briefing and Summary Papers are attached in Appendix C.

2.2.1 Modifications implemented since the PRG workshops

The source augmentation proposal initially preferred by Council was the off stream storage (OSS) as the first priority followed by dam wall raising. Since the completion of the stakeholder consultation process, YVC determined that the preferred option for source augmentation is the dam wall raising option as it provides more available water (refer Sections 4.2 and 0).

The scenarios presented in this report (and assessment of scenarios) include the dam wall raising option for source augmentation. The stakeholder consultation documentation included in Appendix C is based on the previous preferred option of OSS.

2.3 Objectives for the Strategy

A series of draft objectives to set the direction of YVC's IWCM Strategy were formulated as part of the stakeholder consultation process and documented as part of the Concept Study. These objectives set goals for the future management of the identified water cycle issues. The objectives and criteria developed to measure the achievement of the objectives and the scenario assessment process are discussed in Section 10.2.

2.4 Developing Solutions

The purpose of scenario building is to analyse the combinations of water, sewerage and stormwater options available to YVC to sustainably provide these services into the future. Consistent with the DWE methodology, in developing the IWCM Strategy, options to manage water supply, sewerage and stormwater services into the future were assessed in a two part process:

- Identification and assessment of individual management options; and
- Assessment of scenarios (bundles of complementary management options).

The general process applied to YVC is summarised below:

- The process began with the identification of the demand for water. Potable and non-potable end-uses of water were identified as part of the demand analysis (see Section 3). This analysis also examined cost-effective demand management measures that could be put in place in order to minimise urban water demands. In total, five sets of demand projections, incorporating an increasing investment in demand management, were developed;
- Having established water demands, a process of matching demand with the available water sources was undertaken (see Section 4);
- In matching demands to sources, (in addition to the maintenance of existing effluent activities) priority was given to the identification of the potential for treated effluent or stormwater/rainwater to meet the urban water demands identified. Consideration was then given to the use of these alternative water sources to meet other, lower value, demands;
- For each of these scenarios, the level of treatment required to ensure the water source would meet the requirements of the water use it had been matched with was assessed (see Section 5);
- The capacity of water and sewage treatment facilities was determined in relation to the water demand and effluent generation forecasts developed, which took into account savings as a result of demand management activities; and
- Lastly, where treated effluent and stormwater could not be utilised as a water source, options for effluent disposal were identified.

To support the process described above, a series of analyses were undertaken. The results of these analyses are set out in the following sections.

3 Demand Analysis

This study analysed the historical water demands in Yass Valley to develop forecasts of future water demands and wastewater generation. The study also included an analysis of potential demand management measures to reduce water demands and wastewater contribution. This study is attached in Appendix D.

The historical demand analysis involved:

- Compilation and review of historical production and consumption data for each of the four supplies;
- Peak Day to Average Day (PD:AD) demand ratio calculation; and an
- Unaccounted for Water (UFW) calculation, which is an estimate of system leakage and consumption that is not recorded due to faulty meters or illegal water connections.

Water and wastewater forecasting involved:

- Deriving population and demographic projections; and
- Building end-use models and forecasts for each system.

Overall, the analysis identified:

- The climate corrected potable water production within YVC's service area was found to be 848 ML/a in 2004/05 with Yass 801 ML/a and Murrumbateman 47 ML/a (Climate correction is carried out using the DWE model to eliminate the impact of unusual climate years on future demand projections. Details are provided in Appendix D);
- Average UFW in the Yass scheme was calculated from the available production and consumption records to be 26% of the total production volume for the baseline;
- Around half of the UFW is non-revenue water use such as fire fighting, mains flushing and filter backwash. It is not possible to reduce non-revenue water apart from unbilled metered use or under-registration of consumer meters. The remainder of the UFW is physical losses due to leakage. The target UFW is 20% (10% from leakage and 10% non-revenue water);
- In the absence of better data for Murrumbateman at the time of analysis an UFW of 26% was also assumed, despite 40% UFW being calculated using the available production and consumption records. The accuracy of this data could not be verified and this difference may also be the result of inaccurate or incomplete metering. Recently Council installed new flow-meter and found that there was a backflow to bores through the non return valves. Since then loss has been reduced significantly;
- Residential demand accounts for 72% of consumption in Yass and 80% in Murrumbateman;
- Population growth in Yass and Murrumbateman is expected to follow similar trends and will be the most important driver of town water demand and effluent forecasts;
- Baseline water forecasts predict that annual average production will rise by approximately 53% in Yass and 50% in Murrumbateman by 2036;

- By applying a number of individual demand management measures to the baseline forecast and examining the costs and benefits, the relative merit of each measure was determined. The best performing individual measures were progressively bundled together as a number of water savings programs (WSP). A review of YVC's best-practice pricing is expected to be the most cost-effective measure for reducing water demand over the planning horizon, combined with the impact of BASIX, and a community education program.

As part of this analysis, three WSPs were developed. Each program contains progressively more water efficiency measures based on a benefit-cost analysis of the individual measures as illustrated in Table 3-1.

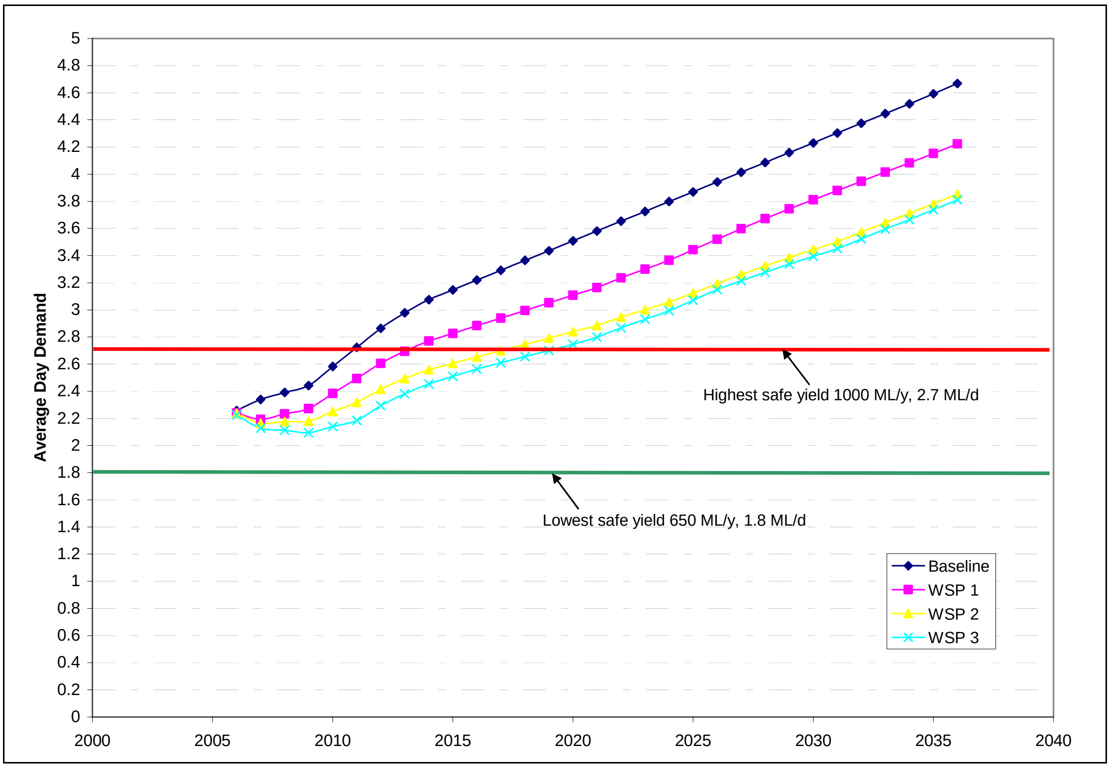
Table 3-1: Potential water saving programs for YVC.

Program	Pricing	BASIX	Education	UFW	Showerhead Retrofit	RWT Rebate	Residential Audit	Toilet Retrofit
WSP 1	✓	✓	✓					
WSP 2	✓	✓	✓	✓	✓			
WSP 3	✓	✓	✓	✓	✓	✓	✓	✓

The UFW reduction program should include measures to verify the level of unaccounted for water such as reservoir drop tests and meter calibration.

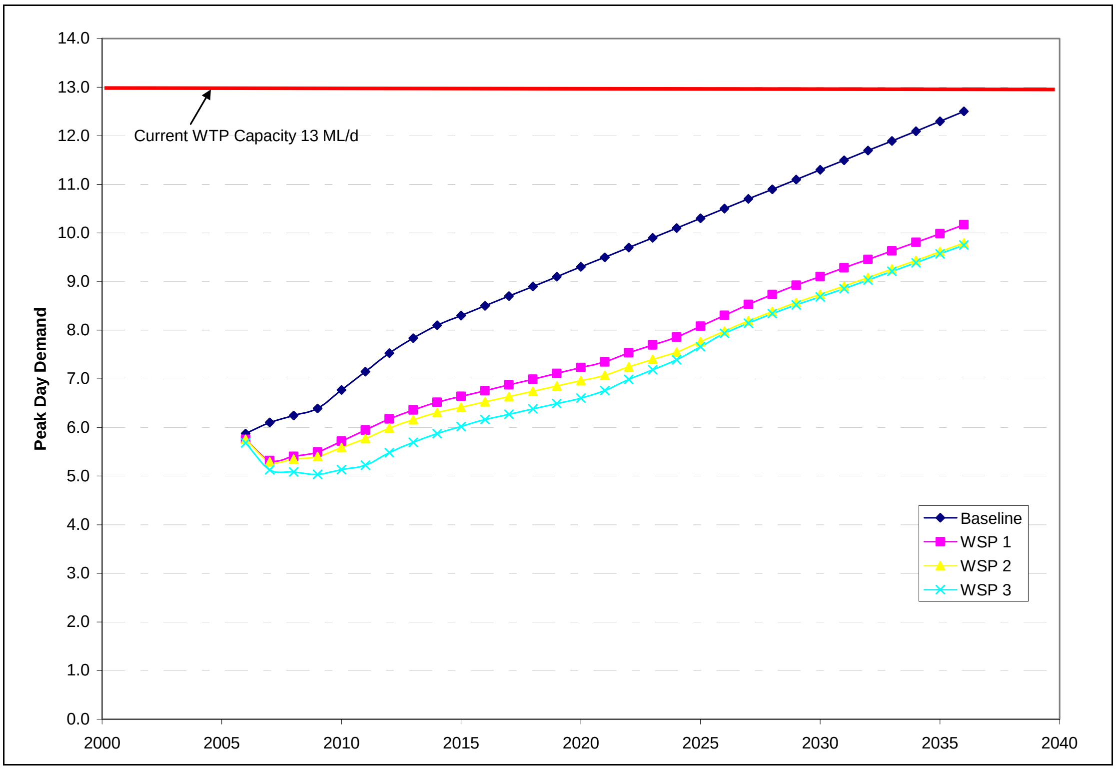
The estimated impact of each of these programs on the average day water demand, the peak day water demand and dry weather effluent flows for the Yass system are set out in the following figures. WSP 2 was considered as having the greatest benefit for the level of investment. Further information is provided in Appendix D.

Figure 3: WSP influenced average day demand forecast (ML/d) – Yass.



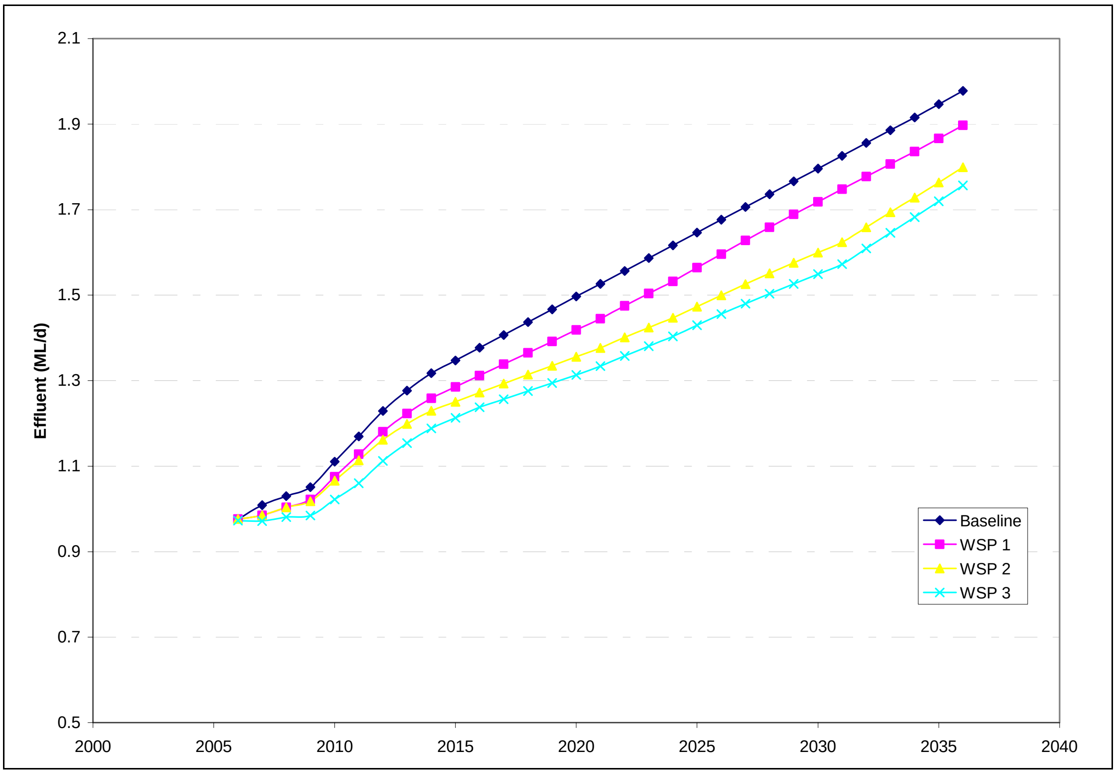
From Figure 3, it is evident that the average demand at the end of the 30 year planning horizon is below the current extraction licence limit (4.65 ML/d) but will exceed the safe yield. Therefore augmentation of the Yass water supply source is required.

Figure 4: WSP influenced peak day demand forecast (ML/d) – Yass.



Based on the demand trend, the current treatment capacity of the Yass WTP is sufficient to meet future demand beyond the IWCM planning horizon.

Figure 5: WSP influenced dry weather effluent forecast (ML/d) – Yass.



4 Water Availability Analysis

The water availability analysis aims to identify water sources currently utilised in the provision of water to each of the main towns within YVC and to also assess the ability of these resources to meet future demands. Once this is established, alternative water sources such as stormwater harvesting and effluent reuse were considered to supplement or replace non-potable demands on the town water supplies.

4.1 Existing Water Supply

YVC services the townships of Yass, Bowning and Binalong and the village of Murrumbateman. Yass Valley Water supply system draws its water from Yass Dam except for the village of Murrumbateman which sources groundwater from a bore well located in the Murrumbateman Recreation Ground near Murrumbateman Creek. This water is supplied untreated.

The Yass Dam Yield Study (Department of Commerce, 2003) concludes that the safe yield of the Yass Dam is between 650 ML/year and 1,000 ML/year. For this Study, a value of 800 ML/y is used as the average safe yield.

Due to the drought and implementation of water restrictions, the current average annual water production of the Yass water supply system is approximately 900 ML/year which could potentially exceed the secure yield of the existing headworks. Demand is expected to increase with the population growth the region is experiencing. Drought restrictions, based on daily monitoring of dam levels, have been regularly enforced in Yass Valley since 1998.

The Yass water filtration plant was first constructed in 1938, and was augmented and modernised in 1990. The plant now has a capacity of 13 ML/day and includes dissolved air flotation and rapid gravity sand filtration. The villages of Bowning and Binalong are supplied with water through a 100 mm rising main that is connected to the Yass reticulated water supply.

4.2 Source Augmentation

To improve the level of supply security for the customers of YVC, and to support the growth of the region as a whole, YVC has developed six major options to provide the LGA with a dependable and sustainable supplementary water scheme. These are discussed in the Concept Study (Appendix A) and listed below:

1. Pipeline connection to Murrumbidgee River (Good Hope);
2. Pipeline connection to ActewAGL (Hall);
3. Pipeline connection to Goldenfields (Galong);
4. Pipeline connection to Murrumbidgee River (Childowla) via Hume Highway;
5. Pipeline connection to Murrumbidgee River (Childowla) via Black Range Road; and
6. Yass Dam wall raising with a larger on-stream storage.

The existing studies did not include an investigation of the potential of rainwater tanks or other stormwater harvesting opportunities to improve the security of supply. However, due to the imminent nature of the security of supply problem, these sources cannot defer the need for a significant investment in the bulk supply.

At present, YVC is considering two options. The construction of an off-stream storage of 500 ML (approximately 1 ML/d of additional yield) and raising the dam by 3 m (which will give additional storage of 1,590 ML and approximately 4 ML/d of additional yield). Costs of the source augmentation options (including land acquisition) are given in Table 4-1.

Table 4-1: Source Augmentation Options.

Option	Capital Cost ($m)
500 ML off-stream storage	7.8
Raise Yass Dam (3m)	11.0

Source: Data supplied by YVC.

4.3 Emergency Drought Management

YVC is currently constructing 3 bores as an emergency source to supply water to south Yass. The aquifer yield does not support continuous withdrawal so the bores can not be used as a continuous source. The bores are estimated to yield an average of 1.6 ML/day during drought. According to YVC supplied data, the estimated cost is $1.78 million.

4.4 Sensitivity Analysis of Source Yield

According to the study *Yass Water Supply: Emergency Drought Relief Strategy* (Department of Commerce, 2005), the lowest yield from Yass Dam is 650 ML/a. This is based on the assumption that the historical inflow and rainfall pattern will replicate. A detailed sensitivity analysis is recommended to predict any change in the lowest yield under changed climatic conditions. A simple analysis shows that under WSP2 with a required demand of 3.9 ML/d at the end of the IWCM planning horizon, even the emergency bore can not meet the water requirements. Even without any reduction in the lowest yield (below 650 ML/a) an additional source will be required under emergency situations.

4.5 Existing Sewerage Systems

Yass is the only town within the LGA served by a reticulated sewerage system. The system consists of gravity pipes, seven sewage pumping stations and a sewage treatment plant (STP). The Yass STP treats sewage from the town of Yass and receives septic tank effluent from throughout the LGA via septic tank pump outs.

Currently 68 premises discharge liquid trade waste into the sewer system. Trade waste fees have been applied to these premises in accordance with Council's Trade Waste Policy since 2005/2006.

The Yass STP was constructed in 1935 as a trickling filter system that had a capacity of 3500 EP. In 1982 the STP was upgraded and twin 2000 EP Pasveer Channels were added. Historically, discharges flowed into the Yass River until an onsite effluent reuse system was established in 1987.

YVC is currently in the process of designing and installing a new treatment plant to replace the trickling filter system. The new system would operate using existing Pasveer channels as detention tanks. This will improve the quality of discharged effluent as well as operate at a higher capacity. A new extended aeration plant is proposed with a capacity of 6,800 EP.

Concerns about discharge to Yass River have required YVC to create an effluent reuse scheme adjacent to the treatment works. This system is responsible for the irrigation of 40 ha of agricultural land during the summer months and distributes up to 40% of the treated effluent onto these lands. Other effluent reuse schemes that are in the process of being implemented or considered include irrigation of recreation grounds, the local golf course and new urban subdivisions. Present planning includes:

- Victoria Park, currently using 10 ML / year of river water;
- O'Connor Park, currently using 10 ML / year of river water;
- Golf Course, currently using 100 ML / year of river water; and
- Walker Park, currently using 40 ML / year of town water.

All river water extractions for the above playing fields are located downstream of Yass dam except Walker Park which uses treated water.

The villages of Bowning, Binalong and Murrumbateman are not currently serviced by a collection/transport system. These villages rely on a variety of on-site-sewage treatment and management systems including septic tanks, trench absorption systems, waterless composting systems and wet composting systems.

4.6 Alternative Water Sources

4.6.1 Recycled Water

YVC currently utilises recycled water to irrigate agricultural land during summer (160 ML/year). A number of potential reuse sites have been identified as discussed above.

Figure 5 illustrates the predicted volume of effluent available for reuse from Yass STP over the next thirty years. The current volume of effluent available for reuse was estimated to be approximately 1.0 ML/d (365 ML/a or more than half the existing effluent reuse volume).

The following effluent reuse opportunities were investigated in the development of the IWCM Strategy:

- Dual reticulation for new development areas:
    - At the North of Yass town between Laidlaw Street and Yass River (approximately 200 lots); and
    - At the South East of Yass town, along the Eastern side of Grand Junction Road (approximately 500-1,000 lots).
- Dual reticulation as part of provision of sewerage to the villages of Bowning, Binalong, Murrumbateman and Gundaroo;
- Indirect potable reuse from Yass STP to Yass River at a point upstream of the water supply intake; and
- Indirect agricultural application of treated effluent (discharged to river instead of present recycling for agricultural purposes) for parks and golf courses.

- Direct agricultural application.

The effluent reuse opportunities and the estimate of capital, operational and lifecycle costs are presented in Table 4-2. These estimates do not include treatment requirements which are discussed in Section 6.

Table 4-2: Cost Estimates of Effluent Reuse Options.

System	Option	Capital ($'000)	Operating ($'000/a)	NPV ($'000 @ 7% discount)
Yass	North Yass dual reticulation	676	54	1,258
	South Yass dual reticulation	3,012	241	5,610
Bowning	Dual reticulation	968	78	1,809
Binalong	Dual reticulation	1,668	134	3,113
Murrumbateman	Dual reticulation	428	34	794
Gundaroo	Dual reticulation	562	45	1,047
Yass	Indirect potable reuse (1.8 ML/d)[1]	2,993	242	5,604
	Indirect agricultural reuse	2,146	174	4,024
	Direct agricultural application	658	53	1,230

Notes: 1: STP capacity required in 2036 under WSP 2

4.6.2 BASIX Rainwater Tank Analysis

Analysis (refer Appendix A) of the potential opportunity of stormwater harvesting via rainwater tanks in Yass town involved a simple spreadsheet model (adapted from a daily water balance model developed by DWE for the Kempsey IWCM). The analysis indicated that:

- Harvesting of the rainwater that falls on the roof for outdoor and toilet flushing uses would result in preventing 52kL/y of stormwater flowing from this house, which equates to a 66% reduction in rainfall runoff from a typical roof area; and
- Up to 45% of the total outdoor and toilet flushing water needs (which are currently supplied from the reticulation) could be supplied by a 5,000 L rainwater tank.

The contribution of a 5,000 L rainwater tank into water savings on a dwelling at Yass Town is significant. This analysis highlights the need to include rainwater tanks in new developments as a complementary way to save water (as part of the BASIX scheme).

Rainwater tanks larger than 5,000 L have less impact on water savings as they are oversized for areas of low average annual rainfall.

4.6.3 Rainwater as an Alternate Source in Murrumbateman

For Murrumbateman, the town water is not treated and can not meet total demand. Residents currently employ rainwater tanks for supplementing internal demands. Analysis of the opportunity to supply part internal water use needs in Murrumbateman residential dwellings by rainwater tanks as a sole water source was undertaken through the development of a desktop spreadsheet model using the DWE rainwater tank model as a basis (refer Appendix E).

The scenarios investigated were based on the assumption that rainwater providing all internal uses except for toilets and washing machines which can be supplied by existing town water (i.e., rainwater to satisfy 48% of total internal demand).

Three scenarios were investigated:

1. Total internal water requirement of 500 litres/house/day;
2. Total internal water requirement of 275 litres/house/day (based on actual meter readings); and
3. Total internal water requirement of 390 litres/house/day (average of scenarios 1 and 2).

The preliminary assessment shows that for an internal use of 240L/house/day (48% of the total internal water requirement of 500 L/house/day) supplied by rainwater, with the remainder provided by town water, the minimum roof size which can provide the water requirement is 300 m^2, with a tank size of 35,000L.

For a requirement of 132 L/house/day (48% of total internal demand of 275 L/house/day), the minimum roof size which can provide the water requirement is 200 m^2, with a tank size of 16,000L.

An additional scenario was modelled using an average value of the above two cases, resulting in a total internal water demand of 388 L/house/day and a part usage requirement of 186 L/house/day. Under this scenario, the minimum roof size which can provide the water requirement is 300 m^2, with a tank size of 20,000L.

The results are given in Table 4-3.

Table 4-3: Results of Murrumbateman Rainwater Tank Model

Roof Size	Annual Topup (%)	Minimum tank size (L)	Annual Topup (L)	Comment
Scenario 1: Assuming 500L/house/day total internal usage (Council request). Part internal usage = 240 L/house/day				
150	4	49500	3941	No tank can satisfy this requirement
200	3	27000	2534	No tank can satisfy this requirement
250	1	24500	1314	No tank can satisfy this requirement
300	0	34500	423	Requirement is satisfied
350	0	30000	419	Requirement is satisfied
Scenario 2: Assuming 275L/house/day internal usage (based on actual meter readings). Part internal usage = 132 L/house/day				
150	1	12000	705	No tank can satisfy this requirement

Roof Size	Annual Topup (%)	Minimum tank size (L)	Annual Topup (L)	Comment
200	0	16000	221	Requirement is satisfied
250	0	11500	239	Requirement is satisfied
300	0	10000	232	Requirement is satisfied
350	0	9000	230	Requirement is satisfied
Scenario 3: Assuming 388L/house/day internal usage (optimum case). Part internal usage = 186 litres/house/day				
150	3	17500	2377	No tank can satisfy this requirement
200	1	18000	974	No tank can satisfy this requirement
250	1	14000	1002	No tank can satisfy this requirement
300	0	20000	335	Requirement is satisfied
350	0	16000	330	Requirement is satisfied

5 Service Extension

Options to extend YVC's water and sewerage service area were considered to address the issues identified.

5.1 Sewerage

The villages of Bowning, Binalong, Sutton, Gundaroo, Wee Jasper, Bookham and Murrumbateman are not currently serviced by a sewerage collection/transport system. These villages rely on a variety of on-site-sewage treatment and management systems including septic tanks, trench absorption systems, waterless composting systems and wet composting systems.

The performance of absorption trenches in these villages is ineffective during wet weather. Poor absorptive qualities of the soil are the main cause of surcharges from absorption/evaporation trenches.

Following community consultation, YVC is considering the implementation of an affordable sewerage system for the townships of Bowning, Binalong and Murrumbateman to reduce any adverse health and environmental impacts caused by the current on-site-sewage treatment and management systems. The Gundaroo and Sutton communities do not support the development of centralised sewerage schemes. Wee Jasper and Bookham communities are considered too small to be for centralised sewerage to be cost-effective.

In Yass, growth of approximately 855 new assessments will require extension of the existing sewerage system.

Capital and operation, maintenance and administration (OMA) costs required for these service extensions are included in the SBP (YVC, 2006b).

5.2 Water

Water main extensions are planned for Yass and Murrumbateman systems to service growth of 855 and 231 assessments respectively. Capital and OMA costs required for these service extensions are included in the SBP (YVC, 2006a).

The villages of Bowning and Binalong are supplied with water through a 100 mm rising main that is connected to the Yass reticulated water supply. The pipeline from Bowning to Binalong can currently supply only 75% of peak day demand. When demand exceeds the pipeline capacity (around 60 to 65 ML/year), Binalong uses water supplied from the Illalong Off-Creek-Storage reservoir. Due to restrictions in place over the last five years, there was no need to supply water from the reservoir.

YVC commissioned a Strategy Study (DPWS, 1999) to develop options to overcome the peak day supply problem and meet future peak day requirements at Binalong. The preferred option involves storage of excess water available from low demand periods in Binalong Dam. A microfiltration plant would be installed to improve the quality of the stored water and the telemetry system would be upgraded. This would maximise the use of Binalong Dam and the existing transfer system and provide a local buffer to meet unexpected high peak demands.

In SBP (YVC, 2006a), 150mm pipeline duplication to Bowning/Binalong is proposed to solve the problem of peak demand.

The estimate of capital, operational and lifecycle costs for two alternatives are presented in Table 5-1.

Table 5-1: Cost Estimate of Bowning/Binalong transmission

Option	Capital ($'000)	Operating ($'000/a)	NPV ($'000 @ 7% discount)
150mm pipeline duplication to Bowning/Binalong	2,500	250*	5,236
Storage in dam + microfiltration plant + telemetry system update	1,733	158	3,452

* Approximate value. Already included in the SBP OMA schedule.

Source: YVC, 2006a, DPWS, 1999

6 Treatment Analysis

The water treatment analysis aims to match the type of treatment required for the water sources identified in Section 4.6 with the potential needs of the various customers to be supplied with each source. This considered not only the required quality and treatment of potable water supplies, but also of potential reuse opportunities.

6.1 Water Supply Treatment

The demand forecasting analysis (Figure 4), shows that the present capacity of Yass WTP is sufficient for the IWCM planning horizon.

Community feedback has indicated that a large number of Yass residents are dissatisfied with the water quality and the concentrations of total dissolved solids (TDS) and total hardness which frequently exceed the ADWG. As a result, YVC conducted a softening trial in 2004 to help minimise the TDS by pre-dosing with lime and soda ash.

Hardness and turbidity are also a source of concern for Yass LGA residents. Hardness is caused by naturally occurring high levels of calcium and/or magnesium. Although they do not pose a health threat they do affect the taste and aesthetics of the water.

A summary of Yass ADWG compliance is presented in the following table.

Table 6-1: Water Quality Compliance with ADWG.

Criteria	Percentage compliance		
	2002/03	2003/04	2004/05
Physical	100%	100%	100%
Chemical	100%	98%	100%
Microbiological (E.Coli)	94%	95%	96%

Source: DEUS, 2006.

YVC plans to upgrade the Yass WTP to include softening. The automation of the existing (manual) Powdered Activated Carbon (PAC) dosing system to address taste and odour was also considered in the scenario development. The microbiological compliance can be improved by additional chlorine dosing at isolated reservoir locations.

A treated supply is being considered for Gundaroo (groundwater). Options for provision of treated water to Murrumbateman (to supplement rainwater tanks) were also included in the scenarios.

The potential water treatment options are listed in Table 6-2. Capacity requirements will vary with the peak demand established for each scenario (refer Section 3).

Table 6-2: Water Treatment Options.

Location	Option	Issue Addressed	Capital Cost ($'000)	Operating Cost ($'000 p.a.)	NPV ($'000 @ 7% discount)
Yass	Water Softening	Hardness	3,000	300[1]	6,283
	Filtration plant augmentation	Quality	8,000	800[1]	16,754
	Automation of PAC dosing	Taste and odour	-	25	290
Murrumbateman [2]	1.1 ML/d Chlorination only	Potable water	1,562	157	3,281
	0.9 ML/d Chlorination only	Potable water	1,406	144	2,984
	0.8 ML/d Chlorination only (Council estimate)	Potable water	800	136	2,766
	1.1 ML/d Advanced Treatment	Potable water	2,862	326	6,455
Gundaroo	0.12 ML/d	Potable water	650	87	1,616

Note: 1: Approximate value. Already included in the SBP OMA schedule.

2: MBU WTP capacity based on various options as explained in Table 10-3 (Issue 1, Strategy: MBU WTP)

At present, Murrumbateman town water supply is of low quality and residents depend on rainwater for their internal water requirements. Full treatment is not considered to be feasible due to the high cost (refer table above). An investigation into potential alternate sources is proposed with an estimated cost of $132,000.

The alternate source investigation should include rainwater use, stormwater harvesting and effluent reuse. It should also consider purchasing water in emergencies from a nearby service provider (such as an adjacent water utility) either by a pipeline or by trucks. However, it is considered that under a severe drought situation nearby providers would also face severe water shortages.

The scope of the investigation may include the following:

- Analysis of existing scheme (demands, climate, land use, regulation, etc);
- Projections (demand, availability);
- Capacity of existing system (streamflow analysis, groundwater yield analysis);
- Water quality requirements including well head protection;
- Options identification;

- Indicative assessment of the costs, benefits and risks of each identified option; and
- Analysis of results and recommendations.

6.2 Sewage Treatment

YVC is currently planning an upgrade of Yass STP. An assessment of the impact of the existing STP against the specified environmental values for the Yass River was undertaken (refer Appendix F). This assessment was used to develop appropriate water quality goals and objectives for the planned upgrade of the STP. In addition, some consideration is also given to minimising the impact of the planned upgrade on the Yass River flow objectives.

Based on the assessment of the ambient water quality, river flow objectives and existing mixing zone, the following conclusions were made in relation to the Yass STP:

- As a result of land-use activities in the Yass River catchment, the environmental values and uses for this waterway are generally poorly protected.
- Management of treated effluent quality, particularly total phosphorus loads, is required to protect environmental values and uses.
- Although the monitoring data was unclear on whether the STP specifically was affecting aquatic ecosystems indicators, if the effluent is not discharged to waterways, the STP will not be contributing to nutrient levels in the river.
- However, the flow provided by discharges from the STP is a significant contributor to the low flow regime, which has been significantly altered as a result of irrigation extraction, farm dam diversions and Yass Dam.

As a result, the following are recommended as goals for the upgrade of the STP:

- Inclusion of treatment facilities at the STP to reduce phosphorus concentrations and to achieve treated effluent quality that meets the DEC Accepted Modern Technology criteria.
- Although there are limited opportunities for effluent reuse, YVC should continue to explore and identify reuse opportunities that may reduce the volume of effluent discharged to the Yass River, particularly during low flows.
- Sustainable and high value effluent reuse opportunities should consider the use of treated effluent as a valuable component of the low flow regime.
- This should however, also be balanced with opportunities to provide environmental flows from Yass Dam and the on-going improvement of the ability to protect the environmental values and uses of the waterway in relation to ambient water quality.
- Continue to implement a trade waste policy to ensure the influent does not impact on the appropriate functioning of the STP.
- Internal water use efficiency programs targeting residential toilets and showerheads will contribute to the reduction in effluent requiring treatment.

- Preparation and implementation of maintenance procedures that would prevent, control or minimise incidents.
- Monitoring protocols for the STP and discharge location should include faecal coliforms, algae and blue-green algae.
- The implementation of an operational monitoring program to establish the extent of the mixing zone may identify further improvements to the effluent discharge regime and potentially contribute to the environmental values of the Yass River.
- Develop chemical, physical and biological monitoring in the mixing zone to ensure the release does not further erode the protection of environmental values and uses.

These goals were considered in the scenario development in relation to the upgrade of Yass STP.

The options of dual reticulation and indirect potable reuse require a higher level of treatment.

Each of the potential sewage treatment and reuse options are listed in Table 6-3 along with estimates of their capital, operational and lifecycle costs. Capacity requirements will vary with the effluent forecasts established for each scenario (refer Section 4.6.1).

Table 6-3: Cost Estimate of Sewage Treatment Options

Location	Option	Capital ($'000)	Operating ($'000/a)	NPV* ($'000 @ 7% discount)
Yass[1]	6,800 EP (1.22 Ml/d) secondary with phosphorous removal.	9,589	412	13,740
	10,800 EP (1.94 Ml/d) secondary with phosphorous removal.	12,341	544	17,843
	2.0 ML/d secondary with phosphorous removal.	12,449	551	18,025
	1.9 ML/d secondary with phosphorous removal.	12,167	536	17,587
	1.8 ML/d secondary with phosphorous removal.	11,772	517	16,998
	1.8 ML/d advanced with filtration	12,682	540	18,115
	1.8 ML/d advanced with filtration and membranes	13,982	563	19,597
Murrumbateman	450 EP oxidation pond	497	85	1,450
Binalong	500 EP oxidation pond	501	86	1,466
Bowning	250 EP oxidation pond	479	81	1,387
Gundaroo	350 EP oxidation pond	488	83	1,419

Note: 1: Yass STP capacity is proposed as 6,800 EP upgraded to 10,800 EP (YVC, 2006b). The capacity requirements are 2.0, 1.9 and 1.8 Ml/d under base case, WSP 1 and WSP 2, Source: DSS model.

6.3 Stormwater Management

The Yass Valley LGA has a drainage network servicing urban areas consisting of kerb and guttering, pipes, surface flows, grass swales and natural drainage lines. The system discharges urban stormwater to Chinamans Creek, Golf Course Creek and the Yass River.

The removal of stormwater ensures that the risk of flooding in urban areas is reduced during periods of high rainfall events. However stakeholders have identified local deficiencies in the stormwater network including areas that have traditionally flooded and caused erosion. Stormwater from the urban areas generally receives limited treatment and can lead to the pollution of receiving waterways.

YVC prepared an Urban Stormwater Management (SWM) Plan in 2001 to meet the requirements set out by the DEC to effectively manage the impact of stormwater on aquatic ecosystems, public health and amenity. The SWM Plan covers the town of Yass only. Measures to improve stormwater quality include the development of stormwater management objectives and short and long term actions that incorporate ecological, social and economic values.

To help arrest impacts on water quality from development the YVC now implements stormwater management consultation throughout the planning, construction and the post construction phases of development. Educational measures have also been implemented including information and procedures for construction sites and Council practices, business auditing and community awareness programs.

Cost estimates in the SWM Plan were used to develop the stormwater capital works and OMA programs (Appendix I).

7 Other Initiatives

An integrated approach to water supply and sewerage services includes consideration of stormwater quantity and quality, catchment health, water sharing and the resulting interactions with the town water supply and sewerage systems. For some issues, water supply and sewerage solutions do not completely solve the identified problem and a total catchment management approach is required. The resulting solutions are not traditionally part of the water and sewerage businesses of NSW LWUs and funding for these initiatives must come from other areas (e.g. Council's General Fund, stormwater and catchment levies, the Catchment Management Authority (CMA) or other State Government departments).

As discussed in Table 2-1, the strategies investigated to solve some of the IWCM issues include the following initiatives:

- Stormwater quality control, catchment initiatives and water quality monitoring to address poor water quality in the Yass River and improve the quality of raw water through implementation of a revised stormwater management plan (refer Section 6.3);
- Incentives to improve catchment management practices to increase soil fertility, reduce soil erosion, acidity and dryland salinity;
- Development controls and water licence control to ensure rural residential developments are sustainable;
- Groundwater management strategies to reduce over-extraction and improve raw water quality for town water supplies;
- Development of a Water Sharing Plan to formalise the water sharing process and ensure all users have sufficient water; and
- Licensing and regulation to reduce pollution of waterways and improve source water quality.

These initiatives will be implemented by Council in consultation with the relevant regulatory authority.

Stormwater and catchment management capital works programs and OMA schedules are included in Appendix I. Approximate stormwater and catchment levies required to fund the related initiatives are listed in Table 7-1.

Table 7-1: Cost Estimates for Stormwater and Catchment Management Initiatives.

Initiatives	Capital ($'000)	Operating ($'000/a)	Levy ($/assessment/a)[1]
Stormwater	875	67	22
Catchment Management	5,560	19	46

1. Based on ultimate (year 2035) number of water and sewer residential assessments.

Some of the initiatives proposed to address the IWCM issues which would be funded from Council's general fund. These are listed as follows:

1. On site sewerage systems audit program: This program is proposed to be carried out every 5 years. Total estimated cost is $635,000 over 30 years.

2. Incentives for improved on-site sewerage systems: The cost of an improved domestic on-site sewerage system is estimated at about $10,000 (Source: BioMAX PTY LTD.). From the total of 2,400 on-site systems within the LGA, it is assumed that about 25% (600) are to be replaced/upgraded. It is assumed that Council would contribute 25% ($2,500) of the cost. Incentives would be provided over 10 years for existing systems only (new systems have to comply with best-practice on-site effluent management as part of the development approval conditions). The total estimated cost is $1.5 million.

3. Stormwater management actions as discussed above (refer Appendix I).

4. Environmental Management Action Plan which is considered as part of the Catchment Management initiatives (refer Appendix I).

8 Asset Management

An Asset Management Plan contains information that Council will use to manage its assets throughout their whole life cycle including asset creation, operation, maintenance, replacement and disposal. The Plan identifies current and projected capital works to satisfy future demands in terms of growth, improved level of service and replacement of existing assets.

The 2005/06 Strategic Business Plans (YVC, 2006a, 2006b) identify projected renewals investment of $150,000 p.a. for water supply (with some additional replacement cost in different years) and $100,000 p.a. for sewerage (with some additional replacement cost in different years).

To address this issue, the IWCM Strategy considers the development of a condition based asset management plan and renewals expenditure based on asset condition, remaining asset life and depreciation considering written down current cost and current replacement cost.

Information from the YVC asset register was used to determine the depreciation of each asset. Assets included dam, bore, WTP, STP, water and sewerage pump stations, reservoirs, water and sewerage mains and telemetry. No renewal cost is considered until an asset reaches 50% of its design life. The 30 year NPV of the proposed renewal expenditure is detailed in Table 8-1.

Table 8-1: Renewals Expenditure.

System	30 year Expenditure ($'000)	NPV ($'000 @ 7% discount)
Water Supply	10,510	4,540
Sewerage	2,380	990

Capital works programs for each IWCM scenario are attached in Appendix G. Appropriate operation, maintenance and administration (OMA) expenditure has also been identified to suit the required level of service delivery in each scenario.

9 Identified Data Gaps

As part of the IWCM Concept Study a data audit involving the collection of background data and the identification of data gaps was undertaken. In order to progress the IWCM Strategy, measures were identified to address these gaps that would be undertaken concurrently with the completion of Strategy and during the implementation phase.

A review of the status of these data gaps has been undertaken. A summary of this review and the original recommendations for addressing these gaps are presented in Table 9-1. Where the data gap has been resolved in the IWCM Strategy, this is discussed in Section 11.

Table 9-1: Data gap review and summary.

Data Gap	Measures to Remedy Gap	Status of data gap
Limited data on on-site sewerage management (location, condition, pump out, etc.)	Review the audit of 2000 and program on-site assessment in unsurveyed areas, particularly Gundaroo and Sutton.	The periodic on-site sewage management audit will be implemented every 5 years as part of this IWCM Strategy.
Limited groundwater quality data at Yass	DNR to devise a tracking set up.	Liaison with DNR is included in the IWCM scenarios.
Energy consumption for WTP and STP	YVC to devise a tracking set up.	The WTP and STP augmentation projects included in the IWCM scenarios should include consideration of energy consumption during the design phase. YVC will investigate overall energy consumption and methods of reducing non-renewable energy consumption by December 2008.
Water quality at dam	Develop and implement monitoring program in conjunction with YVC's Environment Section.	No IWCM activities have been allocated to specifically to establish a dam water quality monitoring program. YVC will consider investigating water quality in conjunction with the dam wall raising project in association with the CMA.
Water quality of dry and wet weather river flows, contaminant load and discharge volume.	To be determined as part of Yass STP investigation.	Completed in the STP WQ investigation (Appendix F).
Details of pollution discharge status from activities under POEO Act.	Design and implement catchment quality management.	Liaison with CMA and other agencies is included in the IWCM scenarios.

Data Gap	Measures to Remedy Gap	Status of data gap
Water Consumption database customer categories. (Current records divide customers into business, residential, farmland and non ratable, limiting end use analysis.)	Review the customer database and include a more detailed breakdown of customer categories including: industrial, motels, caravan facilities, schools, nursing homes and hospitals.	Completed for the Demand Forecast Report (Appendix D).

10 IWCM Scenarios

10.1 Draft Scenarios

Having identified and evaluated a range of opportunities to manage each of the verified issues (Table 2-1) developed as part of the Concept Study, five draft scenarios were established.

These scenarios include:

- A "base" (B) case (also known as "business as usual") which does not include any solutions beyond what YVC is already doing to improve or maintain the water supply and sewerage businesses;
- A "traditional" (T) case based on traditional solutions that solve issues in an isolated, non-integrated way; and
- Three "integrated" (IN1, IN2, IN3) solutions that incorporate combinations of various build and non-build options and an increasing level of integration of water supply, sewerage and stormwater management by including recycled water use and stormwater harvesting, among other options.

Tailoring the IWCM process in this way ensured that a high number of potential options were investigated and assessed at the preliminary stage without compromising the ability of the final outcome to provide effective management solutions.

The previous chapters present various potential options to solve the issues. The potential options are summarised in Table 10-1. The options showing poor cost benefit were not included in the draft scenarios.

The draft scenarios developed are listed in Table 10-3. Some alternate scenarios are presented in Section 11.1.

Table 10-1: Potential Options

Category	Options	Included in Scenarios	Note
Demand Management	No demand management	B	
	DWE best practice two part pricing	T, 1, 2, 3	
	Rainwater tanks under BASIX (for new development)	T, 1, 2, 3	
	Educational program for external water uses	T, 1, 2, 3	
	Shower head retrofit	1, 2, 3	
	Reduction in unaccounted for water	1, 2, 3	
	Rainwater tank retrofit (for existing development)	No	Poor cost benefit
	Residential audit	No	Poor cost benefit

Category	Options	Included in Scenarios	Note
	Dual flush toilet retrofit	No	Poor cost benefit
Source augmentation	Off river storage 500 ML capacity increase	1a	Alternative option
	Dam raise by 3 m (1,590 ML capacity increase)	B, T, 1, 2	
Emergency drought management	Drought management plan to identify emergency drought supply	T, 1, 2, 3	
	Emergency bore: Capacity 1.6 ML/d	All	
Dual reticulation	Yass: STP to new development area	2	
	BOW: STP to new development area	No	Poor cost benefit
	BIN: STP to new development area	No	Poor cost benefit
	MBU: STP to new development area	No	Poor cost benefit
	GUN: STP to new development area	No	Poor cost benefit
Indirect potable use	Yass STP to river at a point upstream of water intake	3	
Effluent management	Agricultural application of 160 ML/y, STP to fields	B	
	All to river, then 160 ML/y to park/ golf courses	T, 1, 2, 3	
WTP	MBU: 0.8 ML/d (chlorination only)	B	
	MBU: 1.1 ML/d (chlorination only)	No	Assumes total requirement supplied by town water
	MBU: 1.1 ML/d (with advanced treatment for NO_2 removal)	No	Meets drinking water standards
	MBU: 0.9 ML/d (chlorination only)	T, 1, 2, 3	
	GNU groundwater: 0.12 ML/d	All	
New mains extension (water)	Yass scheme	All	
	MBU scheme	All	
New mains	Yass	All	

Category	Options	Included in Scenarios	Note
extension (sewer)	BIN	All	
	BOW	All	
	MBU	All	
	GNU	All	
Transmission	Yass to Binalong and Bowning - as per DPWS strategy study, option 3B: store excess filtered water from Yass in Binalong dam and filter in a 1.1ML/d microfiltration plant with telemetry system update.	T, 1, 2, 3	
	Duplicate 150mm pipe from Yass to Binalong as per SBP	B	
Asset renewal	Renewals as in SBP	B	Cost allocation is not sufficient
	Matching renewal for investment (Mains, bores, pumps, reticulation, reservoirs)	T, 1, 2, 3	
STP	Yass: 6,800 EP (secondary with P removal)	No	Insufficient capacity
	Yass: 10,800 EP (secondary with P removal)	B	Cost allocation is not sufficient
	Yass: 2.0 ML/d (secondary with P removal)	No	Alternative cost allocation for base case
	Yass: 1.9 ML/d (secondary with P removal)	T	
	Yass: 1.8 ML/d (secondary with P removal)	1	
	Yass: 1.8 ML/d (advanced, filtration)	2	
	Yass: 1.8 ML/d (advanced, filtration + membrane)	3	
	MBU: 450 EP (oxidation pond)	All	
	BIN: 500 EP (oxidation pond)	All	
	BOW: 250 EP (oxidation pond)	All	
	GUN: 350 EP (oxidation pond)	All	
Stormwater Management	SBP and Management Plan	B	
	Update stormwater management plan	T, 1, 2, 3	
	Full implementation of stormwater management plan	T, 1, 2, 3	

Category	Options	Included in Scenarios	Note
Stormwater harvesting	Stormwater harvesting for all new development	NO	Unfavourable rainfall regime
	For MBU as an alternate source	All	
Catchment initiatives	Initiatives from Management Plan	B, T	
	Initiatives from Management Plan, State of Environment Report, CMA Action Plan, Environmental Action plan	1, 2, 3	
OMA costs	SBP OMA cost	B	
	SBP OMA cost (modified)	T, 1, 2, 3	Cost allocation is not sufficient
	Preparation of drought management plan	T, 1, 2, 3	
	Water quality monitoring	1, 2, 3	
	Audit of bores and groundwater quality at Murrumbateman groundwater source	T, 1, 2, 3	
	On-site systems audit	T, 1, 2, 3	
	Incentives for better on site technologies	2, 3	
	Development Control Planning	T, 1, 2, 3	
	Liaison with CMA	T, 1, 2, 3	
	Liaison with DNR	T, 1, 2, 3	
	Liaison with DECC	T, 1, 2, 3	
	Study on sensitivity of Yass dam yield	T, 1, 2, 4	
	Yass: upgrade (automate) management of PAC units	T, 1, 2, 3	
	MBU alternate source investigation	T, 1, 2, 3	

The basis of the draft scenarios is listed in Table 10-2.

Table 10-2: Main components of Draft Scenarios.

Scenario	Demand Management	Source Augmentation	Effluent Management
Base Case	None	Dam wall raising (3m)	Direct agricultural applications
Traditional	Low level	Dam wall raising (3m)	Indirect park and golf course irrigation
Integrated 1	High level	Dam wall raising (3m)	Indirect park and golf course irrigation

Scenario	Demand Management	Source Augmentation	Effluent Management
Integrated 2	High level	Dam wall raising (3m)	Dual reticulation for new development in Yass
Integrated 3	High level	None	Indirect potable reuse from Yass STP

Each of these five draft scenarios combines complementary management options to provide YVC with solutions to their water cycle management issues. The draft scenarios developed are listed in Table 10-3.

Table 10-3: YVC Draft Scenarios

IWCM Issues		Strategy	Base case (B) (04/05)	Traditional (T)	Integrated 1 (IN 1)	Integrated 2 (IN 2)	Integrated 3 (IN 3)
1	Lack of water storage / Poor security of existing source	Demand management	No demand management Present average demand (in 2006): Yass 2.25 ML/d, MBU 0.13 ML/d Projected average demand (in 2036); Yass 4.7 ML/d, MBU 0.4 ML/d GUN has no reticulated supply at present.	Demand management including pricing, education and BASIX for new development Projected demand 4.2 ML/d (Yass in 2036)	High level demand management (T + showerhead retrofit and UFW reduction) Projected demand 3.9 ML/d (Yass in 2036)	same as IN 1	same as IN 1
		Yass source augmentation	Average safe yield 2.2 ML/d (800ML/y) Augmentation required 2.5 ML/d (for Yass scheme) Off river storage gives extra storage of 500 ML (~1 ML/d) Dam raise by 3 m gives extra storage of 1,590 ML (~4 ML/d) Council prefers dam wall raise (3m) option	Augmentation required 2 ML/d Dam wall raise (3m)	Augmentation required 1.7 ML/d Dam wall raise (3m)	Dual reticulation demand 0.7 ML/d Augmentation required 1.0 ML/d Dam wall raise (3m)	No augmentation required Additional demand supplied by indirect potable reuse in Yass scheme (available 1.8 ML/d, DSS)
		Emergency drought relief	Lowest yield 1.8 ML/d (650 ML/y) Emergency bore 1.6 ML/d Total 3.4 ML/d (without any augmentation)	B + Preparation of drought management plan + Study on sensitivity of Yass dam yield	Same as T	Same as T	Same as T
		Effluent management	Current effluent reuse 40% in summer (160 ML/y) in direct agricultural applications	All effluent first to river and then indirect use of 160 ML/y for park and golf course irrigation (Town water demand reduction of 40 ML/y)	Same as T	Dual reticulation for new development areas (Only Yass, ET 1800) Insignificant benefit for other towns	Indirect potable reuse (Available 1.8 ML/d from Yass WS area, Source: DSS)
		MBU WTP	Murrumbateman (MBU) present supply capacity 3.5 l/s (0.3 ML/d) Augmentation to 0.8 ML/d planned (by 2007/08) Shower and kitchen requirement to be supplied by RWT Requirement is 0.9 ML/d for external, laundry and toilet use (refer to DSS for end use) (only chlorination for bore water) (But required is 1.1 ML/d if no RWT, and will require advanced treatment for nitrate removal)	Augmentation to 0.9 ML/d (Shower and kitchen requirements to be supplied by RWT)	Same as T	Same as T	Same as T
		GUN water supply	Groundwater Source for Gundaroo (GUN) as identified in SBP (by 2013/14) Projected Pop 350, avg demand 350L/c/d, capacity required 0.12 ML/d	Same as B	Same as B	Same as B	Same as B
2	Insufficient funds to provide required works	Financial management	Update DSP & Financial Plan (cost included in SBP OMA) Uncertainty in continuation of Country Town Water Supply and Sewerage (CTWSS) funding	B + Apply full cost recovery pricing	T + Designed to be self funding and less costly. Greater access to funds through diversified services and product delivery (No cost included)	same as IN 1	same as IN 1
3	Need for extension / upgrade of water supply, sewerage and stormwater to serve existing and future customers.	Asset renewal	Asset renewal as stated in SBP	Matching renewal for investment (mains, bores, pumps, reticulation, reservoirs)	Same as T	Same as T	Same as T
		New water mains in Yass scheme	Service extension as stated in SBP	Same as B	Same as B	B + Dual reticulation piping (for effluent management as in 1)	B + transfer of treated effluent to upstream of water intake (for effluent management as in 1)

IWCM Issues		Strategy	Base case (B) (04/05)	Traditional (T)	Integrated 1 (IN 1)	Integrated 2 (IN 2)	Integrated 3 (IN 3)
		Increase supply to Bowning and Binalong	Only 75% of full peak day demand can be supplied by 100mm main connected to Yass reticulated water supply. Duplicate 150mm pipe from Yass to Binalong as per SBP.	Yass to Binalong & Bowning - as per DPWS strategy study, 3B option: store excess water in Binalong dam and filter in a 1.1ML/d microfiltration plant + telemetry system update.	Same as T	Same as T	Same as T
		New water mains in MBU scheme	MBU extension as stated in SBP	Same as B	Same as B	Same as B	Same as B
		Sewer extensions	Yass, BIN, BOW, MBU and GUN as stated in SBP	Same as B	Same as B	Same as B	Same as B
4	Need to maximize sustainable effluent and stormwater management	Effluent management	*Effluent management as in 1*				
		Demand management	*Rainwater tanks as in 1*				
5	Development restricted by lack of water	Yass source augmentation	*As in 1*				
		MBU WTP	*As in 1*				
		Effluent management	*As in 1*				
		New water mains in Yass and MBU scheme	*As in 3*				
		Sewer extensions	*As in 3*				
6	Poor water quality in the Yass River affects the quality of the water supply.	Yass STP upgrade	Existing STP 7500 EP (3500 EP Trickling Filtration unit requires upgrading, Pasveer Channel is 4,000 EP). SBP proposed to change treatment process (secondary with P removal) 6,800 EP (1.22 ML/d) in 2009 and 10,800 EP (1.94 ML/d) in 2032 But required is 2.0 ML/d in 2036	Capacity required 1.9 ML/d in 2036	Capacity required 1.8 ML/d in 2036	IN 1 + Advanced STP process (filtration) for dual reticulation requirements Capacity 1.8 ML/d	1 + Advanced STP processes (filtration + membrane) to satisfy indirect potable reuse requirements Capacity 1.8 ML/d
		Stormwater management	SWM activities as identified in SBP	Update SWM plan + Implement SW initiatives as SWM plan (partial funding through SW levy)	Same as T	Same as T	Same as T
		Catchment initiative	No integrated catchment initiative	Same as B	Implement Catchment initiatives (partial funding through catchment levy to be paid to CMA) + Water quality monitoring (cost by CMA) + implement environmental management action plan	Same as IN 1	Same as IN 1
		STPs for other towns	STP for MBU, Binalong (BIN), Bowning (BOW) and Gunderoo (GUN) as identified in SBP	Same as B	Same as B	Same as B	Same as B
		On-site sewerage management (monitoring)	Last monitoring was conducted in 2000	On-site systems audit every 5 years (cost to be included in General Fund)	Same as T	Same as T	Same as T
		Water Treatment in MBU	*As in 1*				
		Water Treatment in Yass	Water softening as identified in SBP will address hardness problem only	B + Upgrade (automate) of Powdered Activated Carbon (PAC) unit to address taste and odour	Same as T	Same as T	Same as T

IWCM Issues		Strategy	Base case (B) (04/05)	Traditional (T)	Integrated 1 (IN 1)	Integrated 2 (IN 2)	Integrated 3 (IN 3)
		On-site sewerage management (incentive)	Present regime (No incentive for better on site technologies)	Same as B	Same as B	Incentives (@$2500) for better on site technologies. Assumed 25% upgrade of total over 10 years (cost to be included in General Fund)	Same as IN 2
7	Traditional land use including land clearing, loss of riparian vegetation, deforestation, and agricultural uses has resulted in poor fertility, soil erosion, acidic soils and dryland salinity	Catchment initiative	*As in 6*				
8	Extensive land clearing and grazing has contributed to dryland salinity	Catchment initiative	*As in 6*				
9	Some rural residential developments are not sustainable	Development control	Do nothing	Drought management plan to identify emergency drought supply + Development Control Planning (no cost included in draft scenario) + Liaison with DNR for water licence control (no cost included in draft scenario)	Same as T	Same as T	Same as T
10	High operating and management costs resulting in high bills	Infrastructure upgrades	*As in 1, 3 and 6*				
		Asset renewal	*As in 3*				
11	Stormwater contributing to water quality issues in Yass River	Stormwater management	*As in 6*				
12	Potential groundwater over extraction	Groundwater strategy	Do nothing	Audit bores and GW quality monitoring (DNR to fund) + Liaison with DNR to prepare GW strategy plan (no cost included in draft scenario)	Same as T	Same as T	Same as T
13	Lack of water sharing process	Water Sharing Plan	As usual (No water sharing plan)	Liaison with DNR to prepare water sharing plan (no cost included in draft scenario)	Same as T	Same as T	Same as T
14	Town water extractions contributes to hydrologic stress in Yass River	Demand management	*As in 1*				
		Effluent management	*As in 1*				
15	Occasional non compliance with drinking water guidelines	Water treatment in Yass	*As in 6*				
		MBU WTP	*As in 1*				
16	Groundwater quality for MBU town water supply is poor	MBU WTP	*As in 1*				
		Groundwater strategy	*As in 12*				
		Alternate source investigation	Do Nothing	Investigations to determine alternate source	Same as T	Same as T	Same as T
17	Need for sustainable on-site systems	On-site sewerage management (monitoring)	*As in 6*				

IWCM Issues		Strategy	Base case (B) (04/05)	Traditional (T)	Integrated 1 (IN 1)	Integrated 2 (IN 2)	Integrated 3 (IN 3)
		On-site sewerage management (incentive)	*As in 6*				
18	There are activities within the LGA that have the potential to pollute waterways	Licensing and regulation	As usual	Liaison with DEC (through POEO licensing). Update LEP (included in SWM plan).	Same as T	Same as T	Same as T
19	Changing land use leading to increased water demand	Stormwater management	*As in 6*				
		Growth planning	*As in 5*				
		Licensing and regulation	*As in 18*				
		Water Sharing Plan	*As in 13*				
20	Increase in water service and sewerage complaints and sewer main chokes	Asset renewal	*As in 3*				

10.2 Financial Analysis

A capital works program, OMA schedule (Appendix G) and financial model (Appendix H) was set up for each IWCM scenario in order to compare levels of expenditure and typical residential bills (TRB) to be paid by water and sewerage customers under each IWCM scenario. This enabled the IWCM scenarios to be compared in terms of TRB, a key social criteria identified by the PRG.

In order to conduct the financial analysis, preliminary design and cost estimates were determined for each project/capital works item. These design and cost estimates are provided at a planning level and costs may vary by up to 50%. This achieves the purpose of draft scenario evaluation since similar assumptions, procedures and origins are used for all of the cost estimates.

Cost estimates are based on NSW Reference Rates, information from similar projects and quotations from suppliers. The costs are adjusted for CPI and construction industry trends as applicable. In most cases, the cost includes engineering, training, manuals, site establishment, project management, land acquisition and contingency.

10.3 Stakeholder Review

As they will be critical to the successful implementation of the IWCM Strategy, stakeholders were invited to participate in the process of reviewing and selecting a scenario for implementation. As discussed in Section 2.2, a second PRG workshop was held to:

- Review the solutions proposed to the identified issues;
- Discuss the developed draft scenarios;
- Evaluate the draft scenarios considering the social, economic and environmental costs and benefits of each scenario; and
- To identify a preferred scenario or preferred scenario components.

Prior to the workshop, participants were issued with a project briefing paper (refer Appendix C).

10.4 Triple Bottom Line Assessment

Consistent with the DWE IWCM framework, the scenarios developed were ranked based on their performance against a series of economic, social and environmental measures (a Triple Bottom Line assessment). The methodology and outcomes of this assessment for YVC is detailed in Appendix J and summarised in the following sections.

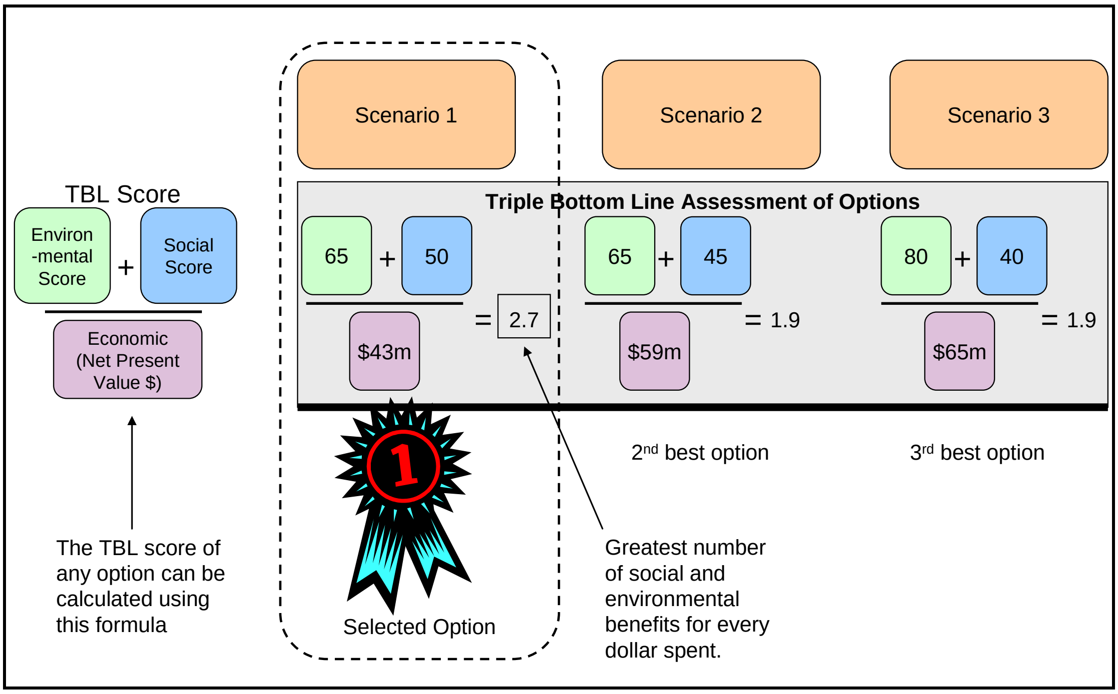
Triple Bottom Line (TBL) assessment is an approach of assessing individual or bundled management options against a set of social, environment and economic measures. It is possible to develop many environmental and social measures upon which to measure the appropriateness of the management options. However, for practical purposes, it is necessary to identify key criteria which best represent local values.

The inputs of the PRG, government agencies and YVC staff, as part of the community consultation process were utilised to determine a set of triple bottom line assessment measures for YVC (refer Appendix A, Appendix C, H and Section 2.2).

Each of the three scenarios were ranked using the TBL measures, to assess the relative desirability of the outcomes from implementing the different scenarios.

An example of the TBL assessment approach applied to the YVC draft IWCM Scenarios is set out in Figure 6.

Figure 6: TBL Assessment Approach.



Based on the measures set, each option was assigned an environmental score and a social score and weightings for each measure were assigned by the PRG members. In order to rank the relative TBL performance of each option, the environmental and social scores for each option were summed and then divided by the net present value of the option. Ranking each option in this manner provides a measure of how many positive social and environmental outcomes every dollar invested would buy. Hence, this process provides an opportunity to assess the relative desirability of the outcomes of implementing different scenarios.

A ranking of the draft scenarios was presented to the PRG in the second workshop (refer Appendix C).

10.5 Identifying a Preferred Scenario for Implementation

Once the draft scenarios were ranked, the preferred scenario for YVC's water, sewerage and stormwater businesses was determined through consultation with the PRG. The PRG discussed the project elements within each scenario, the methodology used to build the scenarios and the TBL assessment of scenarios, including assigning weightings to each assessment measure.

On the basis of social, environmental and economic performance of each scenario considered, the scenario "Integrated 3" received the highest score in the TBL ranking. However, the PRG found that the implementation of this scenario will require a relatively long lead time due to the investigations, risk assessment and consultation required for the indirect potable reuse component. The LGA is having severe water restrictions and without an alternative source will run out of water in the near future. Also, Council has placed a moratorium on new development because of a lack of water and this condition is hindering development in the Yass Valley. Due to the immediate need for an augmented source of water, the PRG considered that the scenario “Integrated 1” (which scored the second highest in the TBL ranking), is required as a short term solution.

The PRG agreed to review the IWCM strategy in five years time to assess the appropriateness of the measures implemented and revisit the requirement to implement the indirect potable reuse components of the Integrated 3 scenario.

11 Preferred Scenario

Based on the results of the consultation program and the scenario ranking, Integrated 1 was identified as the preferred scenario for implementation. This section summarises the preferred scenario and the method for its implementation.

Table 11-1: Finalised Preferred Scenario

IWCM Issues		Strategy	Preferred Scenario
1	Lack of water storage / Poor security of existing source	Demand management	High level demand management (pricing, education and BASIX for new development, showerhead retrofit and UFW reduction)
		Yass source augmentation	Yass Dam Raise (3m)
		Emergency drought relief	Emergency bore, preparation of drought management plan and study on sensitivity of Yass dam yield
		Effluent management	All effluent first to river and then indirect use of 160 ML/y for park and golf course irrigation.
		Murrumbateman WTP	Augmentation to 0.9 ML/d (Shower and kitchen requirements to be supplied by RWT).
		Gundaroo water supply	Groundwater Source
2	Insufficient funds to provide required works	Financial management	Update DSP and Financial Plan, uncertainty in continuation of Country Town Water Supply and Sewerage (CTWSS) funding, apply full cost recovery pricing, designed to be self funding and less costly. Greater access to funds through diversified services and product delivery.
3	Need for extension / upgrade of water supply, sewerage and stormwater to serve existing and future customers.	Asset renewal	Matching renewal for investment (mains, bores, pumps, reticulation, reservoirs)
		New water mains in Yass scheme	Service extension for growth
		Increase supply to Bowning and Binalong	Store excess water in Binalong dam and filter in a 1.1ML/d microfiltration plant with telemetry system update.
		New water mains in Murrumbateman scheme	Service extension for growth
		Sewer extensions	Reticulated sewerage system for BIN, BOW, Murrumbateman and GUN and service extension for growth in Yass.
4	Need to maximize sustainable effluent and stormwater management	Effluent management as in 1.	
		Rainwater tanks as in 1.	

IWCM Issues		Strategy	Preferred Scenario
5	Development restricted by lack of water	Yass source augmentation as in 1	
		MBU WTP as in 1	
		Effluent management as in 1	
		New water mains in Yass and MBU scheme as in 3	
		Sewer extension as in 3	
6	Poor water quality in the Yass River affects the quality of the water supply.	Yass STP upgrade	Existing STP 7,500 EP. (Trickling Filter unit requires upgrading). Treatment process to be upgraded to secondary with phosphorous removal (1.22 ML/d, 6,800 EP in 2009 and 1.8 ML/d, 10,800 EP in 2032).
		Stormwater management	Update SWM plan and implement SW initiatives as in SWM plan.
		Catchment initiative	Implement Catchment initiatives and water quality monitoring and environmental management action plan
		STPs for other towns	STPs for Murrumbateman, Binalong, Bowning and Gunderoo.
		On-site sewerage management (monitoring)	On-site systems audit every 5 years.
		Water Treatment in Murrumbateman as in 1	
		Water Treatment in Yass	Softening plant to address hardness. Automate Powdered Activated Carbon (PAC) unit to address taste and odour.
		On-site sewerage management (incentive)	Present regime (No incentive for better on site technologies).
7	Traditional land use including land clearing, loss of riparian vegetation, deforestation, and agricultural uses has resulted in poor fertility, soil erosion, acidic soils and dryland salinity	Catchment initiative as in 6.	
8	Extensive land clearing and grazing has contributed to dryland salinity	Catchment initiative as in 6.	
9	Some rural residential developments are not sustainable	Development control	Drought management plan to identify emergency drought supply and development control planning and liaison with DNR for water licence control.
10	High operating and management costs resulting in high bills	Infrastructure upgrades as in 1, 3 and 6.	
		Asset renewal as in 3.	
11	Stormwater contributing to water quality issues in Yass River	Stormwater management as in 6.	
12	Potential groundwater over extraction	Groundwater strategy	Audit bores, groundwater quality monitoring, and prepare groundwater strategy plan through liaison with DNR.

IWCM Issues		Strategy	Preferred Scenario
13	Lack of water sharing process	Water Sharing Plan	Liaison with DNR to prepare water sharing plan.
14	Town water extractions contributes to hydrologic stress in Yass River	Demand management as in 1.	
		Effluent management as in 1.	
15	Occasional non compliance with drinking water guidelines	Water treatment in Yass as in 6.	
		MBU WTP as in 1.	
16	Groundwater quality for MBU town water supply is poor	MBU WTP as in 1.	
		Groundwater strategy as in 12.	
		Investigations to determine alternate source	
17	Need for sustainable on-site systems	On-site sewerage management (monitoring) as in 6.	
		On-site sewerage management (incentive) as in 6.	
18	There are activities within the LGA that have the potential to pollute waterways	Licensing and regulation	Liaison with DEC (through POEO licensing) and update LEP.
19	Changing land use leading to increased water demand	Stormwater management as in 6.	
		Growth planning as in 5.	
		Licensing and regulation as in 18.	
		Water Sharing Plan as in 13.	
20	Increase in water service and sewerage complaints and sewer main chokes	Asset renewal as in 3.	

The key financial parameters associated with the preferred scenario are as follows:

- Total capital cost (water): $63.6 million
- Total capital cost (sewerage): $40.9 million
- 30 year OMA cost (water): $60.0 million
- 30 year OMA cost (sewerage): $46.2 million
- Typical residential bill (water): $940
- Typical residential bill (sewerage): $670

11.1 Alternate Preferred Scenarios

One of the critical components in the preferred scenario is the timely completion of the source augmentation. Following extensive investigations (refer Section 4) YVC is currently considering two options:

- the construction of an off-stream storage (OSS) of 500 ML (approximately 1 ML/d of additional yield); and
- raising the dam by 3 m (which will give additional storage of 1,590 ML and approximately 4 ML/d of additional yield).

Costs of the source augmentation options are given in Table 4-1. Of these two options, Council prefers the dam wall raising option because it gives more available water. All scenarios presented in this Strategy Plan are based on the dam wall raising option (refer Section 2.2.1).

However, in the event of a long delay in implementing the dam wall raising option, water shortages may occur and Council might be forced to consider the OSS option as an interim measure. An alternate analysis was carried out to investigate the impact of this situation as shown in the following table.

Table 11-2: Alternate Analysis for Source Augmentation Option

Scenarios	Requirements (refer to Table 10-3)	Source Augmentation
Base Case (Ba)	Average safe yield from Yass Dam 2.2 ML/d Projected demand 4.7 ML/d Augmentation required 2.5 ML/d	OSS can supply 1 ML/d Dam wall raise is also required to meet the demand
Traditional (Ta)	Projected demand 4.2 ML/d Augmentation required 2.0 ML/d	OSS can supply 1 ML/d Dam wall raise is also required to meet the demand
Integrated 1 (IN 1a)	Projected demand 3.9 ML/d Augmentation required 1.7 ML/d	OSS can supply 1 ML/d Dam wall raise is also required to meet the demand
Integrated 2 (IN 2a)	Projected demand 3.9 ML/d Augmentation required 1.7 ML/d	Dual reticulation can supply 0.7 ML/d OSS can supply 1 ML/d
Integrated 3 (IN 3a)	Projected demand 3.9 ML/d Augmentation required 1.7 ML/d	Indirect potable reuse can supply 1.8 ML/d

It is apparent that under this alternate analysis, the investment costs for scenarios Ba, Ta, and IN 1a would be higher than corresponding scenarios B, T and IN 1 due to the need for both source augmentation options. The cost of scenario IN 2a would be less than scenario IN 2 as only the OSS option is required, which is cheaper than the dam wall raise option. Scenario IN 3a is the same as scenario IN 3.

As explained in Section 10.5, the selection of the preferred scenario was not based solely on the TBL score or the investment cost, but also on social and implementation constraints perceived by the PRG. Under this alternate analysis, the preferred scenario would remain at the same level of integration (i.e. scenario IN 1a).

A capital works program, OMA schedule and financial model was set up for scenario IN 1a in order to understand the level of expenditure and typical residential bills (TRB) to be paid by water and sewerage customers (refer Appendix K). The combined water and sewerage TRB is $1,790 per assessment under scenario IN 1a (compared to $1,610 under scenario IN 1).

Another critical component in the preferred scenario is the average and lowest safe yield assumed as 800 ML/y and 650 ML/d, respectively (refer Section 4.1). These values are based on historical stream flow conditions. However, recent experience suggests climate change may not guarantee that the historic stream flow would replicate in future. A sensitivity analysis for the dam yield is recommended to determine the required augmentation option (Section 4.4).

To gain a preliminary understanding of the effect of reduced stream flow, an alternate analysis was carried out assuming the dam yield would be only 500 ML/y. Source augmentation is assumed to be the dam wall raise option. In the event of reduced stream flow, the dam raising option would not provide the same increase in capacity (i.e. less than 4 ML/d increase in capacity for a 3 m rise). However it is impossible to predict the increase in capacity under reduced stream flows without a sensitivity analysis and re-run of the water balance model. Therefore a pro-rata reduction in yield was assumed as shown in the following table.

Table 11-3: Pro-rata estimation of reduced extra capacity

	Existing dam yield	Additional capacity achieved by 3m dam wall raise
Average yield	800 ML/y	4 ML/d
Assumed yield under reduced stream flow	500 ML/y	2.5 ML/d

The alternate analysis was carried out to investigate the impact on augmentation requirements as shown in the following table. Since this situation corresponds to extreme drought conditions, it is assumed that the extra 1.6 ML/d of water would be available from emergency bores.

Table 11-4: Alternate Analysis for Reduced Yield

Scenarios	Requirements (refer to Table 10-3)	Source Augmentation
Base Case (B b)	Lowest safe yield from Yass Dam 500 ML/y (1.4 ML/d) Projected demand 4.7 ML/d Augmentation required 3.3 ML/d	Dam wall raise can supply 2.5 ML/d Emergency bore can supply remaining 0.8 ML/d. OSS is not required
Traditional (T b)	Projected demand 4.2 ML/d Augmentation required 2.8 ML/d	Dam wall raise can supply 2.5 ML/d Emergency bore can supply remaining 0.3 ML/d. OSS is not required
Integrated 1 (IN 1b)	Projected demand 3.9 ML/d Augmentation required 2.5 ML/d	Dam wall raise can supply 2.5 ML/d Emergency bore is not required. OSS is not required
Integrated 2 (IN 2b)	Projected demand 3.9 ML/d Augmentation required 2.5 ML/d	Dual reticulation can supply 0.7 ML/d Dam wall raise can supply 2.5 ML/d Emergency bore is not required. OSS is not required
Integrated 3 (IN 3b)	Projected demand 3.9 ML/d Augmentation required 2.5 ML/d	Indirect potable system can supply 1.8 ML/d Shortfall of 0.73 ML/d can be met through emergency bore

It is apparent that under this alternate analysis, the investment costs for all scenarios would be the same as scenarios B, T, IN 1, IN 2 and IN 3. Therefore the dam wall raise option is likely to meet the demand under severe drought conditions. Modelling is required to confirm this assumption.

11.2 Implementation

This IWCM Strategy has set the future direction for YVC by addressing a number of priority issues identified by YVC staff, government agencies and the local community.

The implementation of the preferred scenario is reliant on YVC's commitment to the capital works program developed as part of this Strategy, as well as its ability to maintain financial stability over the next thirty years. Hence, the capital works program and financial model of the preferred scenario, attached in Appendix H, have set the direction for YVC's Strategic Business Plan (SBP). YVC will need to continuously develop, implement and review the components of this Strategy to ensure it is successful.

A summary of the financial implications of the preferred scenario is given in the following table.

Table 11-5: Capital and Recurrent (OMA) Expenditure and Typical Residential Bills (TRB).

Component	30 year Capital Works Program ($'000)	30 year OMA Expenditure ($'000)	TRB ($/assessment)
Water Supply	63,600	60,000	940
Sewerage	40,900	46,200	670
Total	104,500	106,200	1,610

The following figures provide a summary of the capital expenditure (works divided into ILOS – improved levels of service, growth and renewals) and recurrent (OMA) expenditure for water supply and sewerage.

Figure 11-1: Water Supply Capital and Recurrent (OMA) Expenditure – Preferred Scenario.

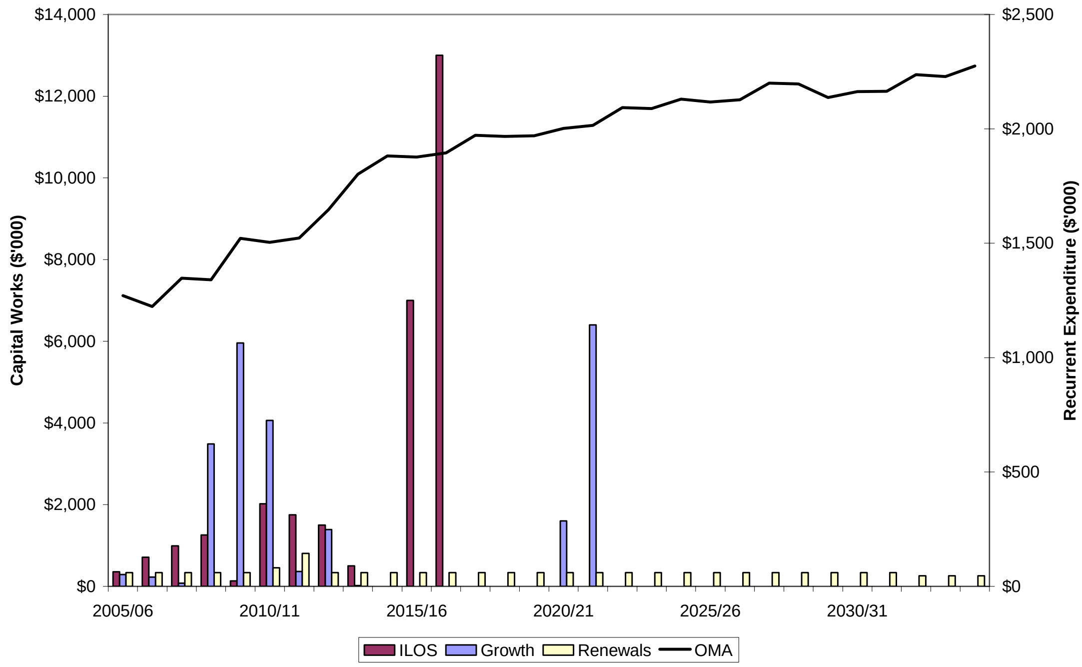
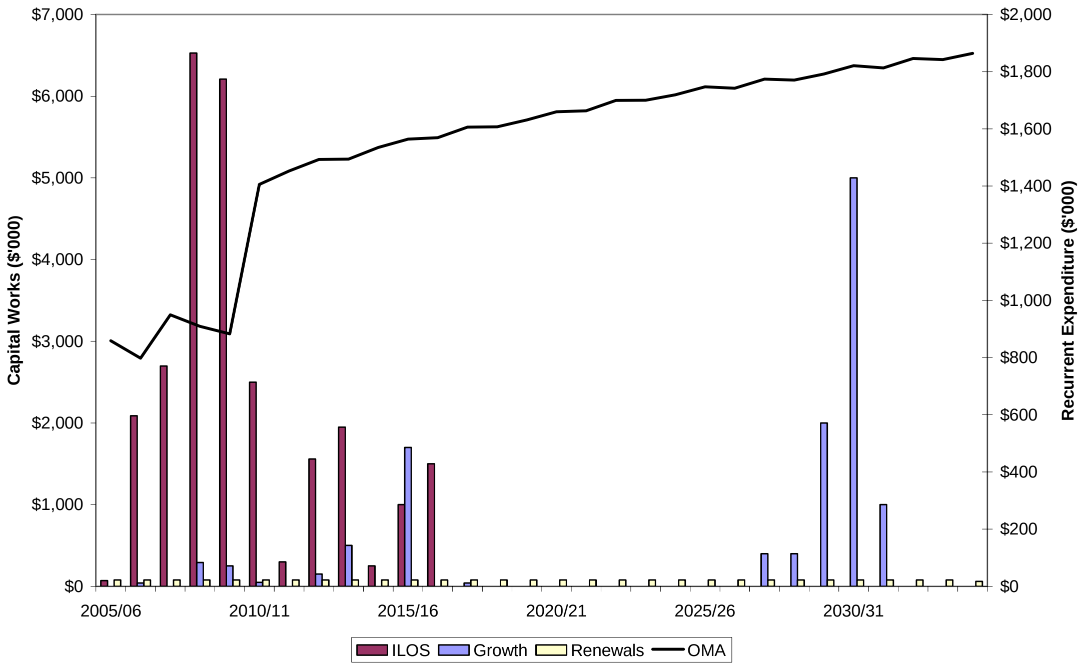


Figure 11-2: Sewerage Capital and Recurrent (OMA) Expenditure – Preferred Scenario.



Where possible, the capital works program and recurrent expenditure is funded through existing cash levels which is determined by the amount of income generated from bills (TRB). Where planned expenditure exceeds the available cash levels, loans will be required.

The current TRBs need to increase to meet the current operation and maintenance costs of YVC's water supply business. A financial plan is required to determine the most appropriate medium term price paths and funding scenarios.

11.3 Best-Practice Management

IWCM is just one of the eight Best-Practice criteria set by DWE which aims to promote the long-term sustainability of LWU's and their water, sewerage and stormwater businesses. The progress of YVC in meeting each of these criteria and their relationship with this IWCM Strategy is set out in Table 11-6.

Some of these reports will require updating now that the IWCM Strategy has been completed to incorporate relevant changes.

Table 11-6: YVC's Best Practice Management Progress.

DWE Best Practice Management Criteria	Relationship to this IWCM Strategy	Action
Strategic Business Plan	The preferred scenario and capital works programs developed in the IWCM Strategy will be used to set the direction of YVC and form the basis of YVC's strategic business plan.	To be updated.
Financial Plan	The preferred scenario and capital works programs developed in the IWCM Strategy were used to as inputs into YVC's FINMOD analysis and financial plan.	Attached in Appendix G and H. To be updated as part of Strategic Business Planning.

Best-Practice Pricing	Included as a demand management measure in demand analysis. Requires updating to reflect the IWCM Strategy capital works program and financial plan.	To be updated.
Demand Management Plan	Results from the demand analysis as mentioned in Section 3 will be used in developing YVC's demand management plan.	To be prepared.
Drought Management Plan	Demand analysis and results of IWCM Concept Study will be used in the development of YVC's drought management plan.	To be prepared.
Development Servicing Plan	The capital works programs and financial plan developed in the IWCM Strategy will be used as inputs into YVC's development servicing plans.	To be updated.
IWCM	This IWCM Strategy document completes the second phase of the IWCM process. Results from the Concept Study were used in the development of this document.	Refer to YVC's IWCM Concept Study (Appendix A) and this document.
Reporting	YVC must provide reporting information annually to DWE, in order to assess YVC's progress at achieving a sustainable business.	Ongoing.

11.4 Monitoring and Review

Monitoring is an essential part of the IWCM process to ensure that the management strategies which have been identified as part of this study have been successful at addressing the water cycle issues. In addition to this, it is important that any new or changes in severity of individual issues are documented and appropriate changes made to the Strategy document, capital works program and financial plan. In addition, YVC will review the need to implement components of Integrated 3 (including indirect potable reuse) to determine if additional, more integrated measures are required to solve the identified IWCM issues.

It is recommended that this document should be reviewed in 2012 and every five years afterwards on an ongoing basis.

However, annual reviews should take place in the form of DWE Reporting which should provide an indication of the success of YVC's IWCM Strategy and the other Best-Practice planning documents in achieving sustainability and progress in meeting YVC's business goals and social and environmental responsibilities.

12 Qualification

1. In preparing the report and estimate of costs JWP has exercised the degree of skill and care and diligence normally exercised by members of the engineering profession and has acted in accordance with accepted practices of engineering design principles.
2. JWP has used all reasonable endeavours to inform itself of the parameters and requirements of the project and has taken all reasonable steps to ensure that the report and costs estimate is as accurate and comprehensive as possible given the information upon which it is based.
3. It is not intended that this report and costs estimate represent a final assessment of the feasibility of the project.
4. JWP reserves the right to review and amend all calculations, cost estimates and/or opinions included or referred to in the report if:
   (a) additional sources of information not presently available (for whatever reason) are provided or become known to JWP; or
   (b) JWP considers it prudent to revise the estimate in light of any information which becomes known to it after the date of submission.
5. The report and cost estimate are preliminary only and restricted in that certain information is obtained from external sources and has not been independently verified.
6. JWP does not give any warranty nor accept any liability in relation to the completeness or accuracy of the report and cost estimate.
7. If any warranty would be implied whether by law, custom or otherwise, that warranty is to the full extent permitted by law excluded.
8. All limitations of liability shall apply for the benefit of the employees, agents and representatives of JWP to the same extent that they apply for the benefit of JWP.
9. This report and cost estimate is for the use of the party to whom it is addressed and for no other persons. No responsibility is accepted to any third party for the whole or part of the contents of this report and cost estimate.
10. If any claim or demand is made by any person against JWP on the basis of detriment sustained or alleged to have been sustained as a result of reliance upon the report and cost estimate or information therein, JWP will rely upon this provision as a defence to any such claim or demand.

13 References

NSW Department of Commerce (2003) *Yass Water Supply: Yass Dam Yield Study*.

NSW Department of Commerce (2005) *Yass Water Supply: Emergency Drought Relief Strategy*.

Department of Energy, Utilities and Sustainability (DEUS) 2004, *Integrated Water Cycle Management Guidelines for NSW Local Water Utilities*.

Department of Energy, Utilities and Sustainability (DEUS) 2004b, *Best-Practice Management Guidelines for NSW Local Water Utilities.*

Department of Energy, Utilities and Sustainability (DEUS) 2006, *Water Supply and Sewerage NSW Benchmarking Report for 2004/05*.

Department of Public Works and Services (1998) *Bowning and Binalong Water Supply Augmentation*.

JWP (2007) *Yass Valley Council Integrated Water Cycle Management Concept Study.*

Storm Consulting Pty Ltd (2001) *Yass Stormwater Management Plan*.

YVC (2006a) *Strategic Business Plan for Water Supply 2005/06*.

YVC (2006b) *Strategic Business Plan for Sewerage Services 2005/06*.

Appendix A

Concept Study

Success through Partnership

JWP

Yass Valley Council

Integrated Water Cycle Management Concept Study

March 2007

Yass Valley Council

Integrated Water Cycle Management

Concept Study

March 2007

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Executive Summary

As a business unit of Yass Valley Council (YVC), the Yass Valley Local Water Utility (LWU) provides water supply and sewerage services within the local government area (LGA). The LWU continually plans for the on-going provision of these services and implements best-practice management practices. YVC is furthering its best-practice management commitment by preparing an Integrated Water Cycle Management (IWCM) Strategy according to the NSW Department of Energy, Utilities and Sustainability (DEUS) guidelines. IWCM is characterised as the process of bringing together water supply, sewerage and stormwater management to achieve a more efficient use of water resources.

This Concept Study, part one of the IWCM process, has four main goals:

1. To collate and review the available data on the water system and identify data gaps;
2. To document the current condition of the water cycle in the study area in order to establish and prioritise the system issues that will need to be managed as part of IWCM Strategy (part two of the IWCM process);
3. To set out a framework for defining the future water system management in the study area by setting objectives for the IWCM Strategy; and
4. To set a scope of works for developing the IWCM Strategy based on preliminary management options to address the issues identified.

Stakeholder input was a key element in undertaking the Concept Study. A Project Reference Group (PRG), including representatives from Council, state regulatory bodies, Murrumbidgee Catchment Management Authority and the community, was set up. The PRG's role included examining some of the available information, identifying as many water cycle management issues (some not necessarily evident through data analysis) as possible, and setting objectives for the IWCM Strategy to work towards.

The available data upon which the Concept Study was based was generally very comprehensive. Major data gaps included limited data on on-site sewerage management (location, condition, pump out, etc.), limited groundwater quantity and quality data and a lack of water quality information in relation to dry and wet weather river flows and pollution load from agriculture and industry.

The issues arising from the data audit (which was based on the available background data) included some problems with managing and monitoring the system, environmental stresses within the catchment and missed opportunities for sustainable water management. A summary of the issues identified by the audit is set out in **Table 1**.

Table 1: Summary of Issues Identified in the Data Audit.

Audit Component	Issues
Catchment	• Water scarcity is a critical issue. Surface water utilisation in the catchment is above the sustainable yield. • The Upper Yass River sub-catchment was found under the high hydrological and environmental stress level. Other sub-catchments are also under high stress. The main reasons for stress are extraction and salinity. • Extensive land clearing from pioneering times and grazing in the Yass district caused dryland salinity. • Most local ground water has high salt concentrations making it unsuitable as drinking water source. • Many of the soils in the Yass Valley are very acidic. • There are activities within the LGA (e.g. quarrying, various industries) that have the potential to contribute to chemical releases into waterways and the environment. • Traditional land use including land clearing, loss of riparian vegetation, deforestation, and agricultural uses results in poor fertility, soil erosion and dryland salinity. • Climate change may adversely alter the rainfall and temperature patterns in an area where evaporation already exceeds rainfall on an annual basis. • Changing land uses: rural to rural residential, grazing and cropping to viticulture/horticulture. • Alternate source for water supply is required. One potential option is interstate water transfer. • Lack of a water sharing process for the Yass River which is over-allocated. This is potentially threatening security of town water supply.
Water resources	• Water stress as identified in the catchment. • Town discharges (Yass treated sewage effluent) implicated in environmental stress (quality and flow regime disruption). • Town extractions (Yass water supply) implicated in the hydrologic stress. • Surface water quality is poor and being impacted by land uses on acidic, poor fertility and high erosion hazard soils. • Major water quality issues identified are occasional turbidity, salinity, nutrients (total phosphorus) and total suspended solids. Ambient water quality does not protect the identified environmental values for the Yass River. • Difficulty in determining the impact of point source industrial pollution on water quality. • Non-sustainable levels of groundwater licence allocation have occurred within rural residential developments areas of Murrumbateman and Sutton. • Poor groundwater quality: hardness and TDS limiting the potential use of this resource without treatment.

Audit Component	Issues
Urban area	• High growth potential of Yass due to proximity to Canberra, facilitation of Sydney-Canberra corridor, and opportunity for industrial and tourism growth. • Poor security of existing supply in terms of historical performance (demands exceeding secure yield) and diversity of sources. • Restrictions impacting on standard of living. • Development capped by lack of water. • Potential need for service extension: sewerage and stormwater services for existing towns. • Distribution of peak demands to Bowning and Binalong. • Poor comparative compliance with drinking water guidelines for total dissolved salts and hardness. • Raw surface water quality for town water supply poor in relation to salinity and TSS. • Groundwater quality for Murrumbateman town water supply is poor in relation to hardness and TDS. • Need for sustainable effluent management. • Need for improved selection and monitoring of on-site systems. • Limited stormwater collection, treatment and reuse. • Stormwater contributing to erosion and sedimentation in Yass. • High operating and management costs giving rise to bills for both water supply and sewerage services above the state median. • Recent rise in water service and sewerage complaints probably associated with an aging infrastructure and rise in sewer main chokes probably due to penetration of tree roots.

Following consideration of the issues identified in the audit, the PRG identified six priority issues and set measurable objectives to guide the development of an effective IWCM Strategy. These prioritised issues and objectives are summarised in **Table 2**.

Table 2: PRG Priority Issues, Objectives and Measures.

No	Issues	Objective	Measure
1.	Lack of water storage.	Improved security of water supply both now and into the future.	• Reduced frequency of high level restrictions.
2.	Lack of funding of water supply and sewerage services by the state and federal governments.	Sustainable funding to provide affordable services.	• Available grants realised. • Developers contributing their share. • Change in typical residential water and sewer bills. • Suitable infrastructure provided.

No	Issues	Objective	Measure
3.	Providing urban water services for existing town and predicted growth, particularly water supply.	*Objectives and measures to address this issue are included in other objectives and measures.*	
4.	Ensuring the best use of treated sewer effluent and stormwater resources.	Improved matching of water demand with available water sources.	• Improvement in meeting Interim Environmental Objectives (IEO) for water quality and quantity. • Change in cost of operating. • Increase in volume of water recycled. • Offset in potable water usage.
5.	Water for industry and town growth	*Objectives and measures to address this issue are included in other objectives and measures.*	
6.	Poor water quality in the Yass River	Improved catchment management practices.	• Improvement in meeting Interim Environmental Objectives (IEO) for water quality and quantity.

Some methods of addressing the priority issues raised have been identified and preliminary assessment of some of these options has been undertaken to test their level of effectiveness in Yass LGA. **Table 3** lists the options assessed and describes the results. A comprehensive assessment of options to address the issues raised in this Concept Study will be undertaken in the IWCM Strategy phase.

Table 3: Potential Options and Preliminary Assessment

Issue	Potential Options	Preliminary Assessment
Lack of water storage.	• Storage options as set out in **Table 11.** • Rainwater tanks. • Treated effluent and stormwater.	Rainwater tanks A simple spreadsheet model (**Appendix A**) was used to assess the effectiveness of rainwater tanks in the Yass area. The model demonstrated that: • Up to 45% of the outdoor and toilet flushing water needs of an individual home could be supplied by a 5,000 L rainwater tank in Yass; • Rainwater harvesting resulted in a 52 kL per year reduction of stormwater flow from this property, which equates to a 66% reduction in runoff; • A 2,000 L tank would supply 35% of the outside and toilet water demands and capture 40 kL per year of stormwater; while a 10,000 L tank would supply 53% of those water demands and capture 62 kL per year of stormwater. Rainwater tanks on new development should be included in bulk supply water modelling options.
Lack of funding of water supply and sewerage services by the state and federal governments.	• Grants • Full cost reflective Developer charges.	No preliminary assessment required to scope strategy phase works.
Providing urban water services for existing town and predicted growth, particularly water supply. Water for industry and town growth.	• Options as described above. • Demand management. • Effluent reuse. • Stormwater reuse.	Demand management Four programs with various management measures were modelled using the DEUS Decision Support System (DSS) model (See **Appendix B** for details). The preliminary cost benefit assessment identified the most effective measures as: • An adjustment of price structure to send a clear price signal; • The regulatory impact of BASIX on new development; • An active program of unaccounted for water (UFW) investigation including leak detection and pressure reduction; and • An education program focussing on outdoor water use.

Issue	Potential Options	Preliminary Assessment
Ensuring the best use of treated sewer effluent and stormwater resources.	• Effluent reuse. • Stormwater reuse.	Preliminary investigation of effluent options highlighted: • Net evaporation exceeds rainfall in Yass. So effluent irrigation activities would be effective; • Depending on the level of treatment achieved, there is still a potential for nutrients to enter the river system from effluent irrigation; • Possibility of dual reticulated supply to the new urban release area located in proximity to Yass STP with effluent/stormwater replacement of potable water; • Open space watering (particularly Yass Golf Course and playing fields), street cleaning, works depot, agricultural, industrial; and • Aquifer storage and recovery of effluent to reduce impact of extractive stress on groundwater aquifer. • Return flows and indirect potable reuse to alleviate hydrologic stress in Yass River.
Poor water quality in the Yass River.	• Stormwater quality management. • Improved effluent management. • Improved septic management. • Land use management.	No additional preliminary assessment required to scope strategy phase works.

Contents

Appendices

Glossary

Acid sulphate (sulfate) soils	Includes *acid sulphate soils* and *potential acid sulphate soils*. Acid sulphate soils contain highly acidic layers resulting from the aeration of materials that are rich in iron sulphides. This oxidation produces hydrogen ions in excess of the capacity of the sediment to neutralise the acidity resulting in soils of pH of 4 or less when measured in dry season conditions. Potential acid sulphate soils contain iron sulphides or sulphidic material which have not been exposed to air and have not oxidised. However, they pose a considerable environmental risk when disturbed.
Aquifer	An underground layer of soil, rock or gravel able to hold and transmit water. Bores, spear-points, springs and wells are used to obtain water from aquifers.
BASIX	A web-based design tool that ensures each new residential dwelling design meets the NSW Government's targets of up to 40% reduction in water consumption and a 25% reduction in greenhouse gas emissions, compared with the average home (DoP, 2006).
Best-practice	An industry standard recognising the most effective management methods of the time.
Capital expenditure	The initial cost of constructing infrastructure assets.
Capital works program	A schedule of planned capital expenditure, normally over a period of thirty years for water supply and sewerage businesses.
Catchment	The area of land drained by a river and its tributaries.
Conductivity	A measure of the ability of water to conduct an electric current between electrodes placed in the water. The value obtained relates to the nature and amount of salts present.
Dissolved oxygen	The concentration of oxygen which is dissolved in environmental waters and compared with oxygen ‘saturation’ at a particular temperature.

Faecal coliform	A type of bacteria found in the faecal material of humans and other mammals that is an indicator of faecal pollution. Faecal coliforms themselves generally do not make people ill.
FINMOD	NSW Financial Modelling software package developed by the NSW Government for local water utilities.
Floodplain	Flat land beside a river that is inundated when the river overflows its banks during a flood.
Groundwater	Underground water filling the voids in rocks; water in the zone of saturation in the earth's crust. See also aquifer.
Hydrology	The study of the distribution and movement of water.
Local water utility (LWU)	The water supply and sewerage businesses of a local council.
Nutrients	A source of nourishment. However, for water quality, it indicates nitrogen and phosphorous.
Potable water	Water that based on current knowledge is safe to drink over a lifetime; that is, it constitutes no significant risk to health.
Rainwater tank	Storage tank for collecting rainwater from the roofs of buildings.
Recharge	Water that infiltrates through the soil surface to the water table.
Reuse	The use of treated sewage effluent or treated stormwater to replace the use of potable water. Taking water from a waste (effluent) stream or stormwater captured and purified to a level suitable for further use.
Sewage	The used water supply of a community including water-carried waste matter from homes and businesses.
Sewage treatment plant (STP)	A facility to treat sewage to produce treated effluent and biosolids.
Sewerage	Drainage system for taking sewage away from the community to a sewage treatment plant.
Stormwater	Rain that flows over hard surfaces in urban areas and is collected in drainage systems for disposal.
Surface water	Water on the surface of the land, for example in rivers, creeks, lakes and dams.

Suspended solids (SS)	The smaller, lighter material such as clay, silt and fine sand carried in suspension in water.
Typical residential bill	The annual bill paid by a residential customer that is not a pensioner or the owner of a vacant block.
Wastewater	See sewage.
Water demand	The water needs of a town including homes, businesses and public organisations.
Water quality	The biological, chemical and physical properties of water.
Water supply	The available water sources, water extraction, storage, transfer and treatment systems to supply town water.
Water treatment plant (WTP)	A facility to treat raw water to a potable water quality.
Wathnet	WATHNET is software developed by University of Newcastle for simulating water supply headworks systems. It uses network linear programming to intelligently allocate water from multiple sources to competing demands making allowance for capacity and operational constraints.

List of Abbreviations

ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
ADWG	Australian Drinking Water Guidelines
AHD	Australian Height Datum
ANZECC	Australia and New Zealand Environment and Conservation Council
ASS	Acid Sulphate Soils
BOD	Biological Oxygen Demand
BPM	Best-Practice Management
$CaCO_3$	Calcium Carbonate
cfu	Colony Forming Unit
cm	Centimeter
CMA	Catchment Management Authority
DEC	Department of Environment and Conservation, NSW
DEUS	Department of Energy, Utilities and Sustainability, NSW
DNR	Department of Natural Resources, NSW
DO	Dissolved Oxygen
DPI	Department of Primary Industries, NSW
DSP	Development Service Plan
DSS	Decision Support System – DEUS computer modelling software for forecasting water demand
E. Coli.	Escherichia coliform (bacteria)
EC	Electric Conductivity
EP	Equivalent Person
EPA	Environment Protection Authority, NSW (now part of DEC)
eu	Enterococci Unit

FINMOD	Financial Modelling software See also Glossary
FSL	Full Supply Level
GWCC	Goldenfields Water County Council
Ha	Hectors
IEO	Interim Environmental Objectives
IWCM	Integrated Water Cycle Management
kg	Kilogram
kL	Kilolitre
L	Litre
LGA	Local Government Area
LWU	Local Water Utility
mg	Milligrams
ML	Megalitre
NPWS	National Parks and Wildlife Service, NSW (Now part of DEC)
NTU	Nephelometric Turbidity Units
POEO	*Protection of the Environment Operations Act 1997*, NSW
PRG	Project Reference Group
SBP	Strategic Business Plan
SILO	Special Information for Land Owners
SMP	Stormwater Management Plan
SoE	State of the Environment Report
STP	Sewage Treatment Plant
TBL	Triple Bottom Line
TDS	Total Dissolved Solids
TN	Total Nitrogen
TP	Total Phosphorus

TSS	Total Suspended Solids
UFW	Unaccounted for Water
UWS	Urban Water Supply Scheme
Wathnet	Water supply headworks simulation software See also Glossary
WQO	Water Quality Objectives
WTP	Water Treatment Plant
YVC	Yass Valley Council
µs	Micro simens

1 Introduction

As a business unit of Yass Valley Council (YVC), the Yass Valley Local Water Utility (LWU) provides water supply and sewerage services within the local government area (LGA). The LWU continually plans for the on-going provision of these services and implements best practice management procedures.

In 2004, the NSW Department of Energy, Utilities and Sustainability (DEUS) introduced a new best-practice management criterion for LWUs: Integrated Water Cycle Management (IWCM). IWCM involves the integration of urban water services – water supply, sewerage and stormwater – so that water is used optimally. The DEUS IWCM criterion requires LWUs to develop and implement a long-term IWCM strategy for the provision of urban water services.

In 2005, YVC committed to implementing this new best-practice requirement into the business planning activities it undertakes to provide urban water services. This document sets out the results of an initial scoping study (known as a Concept Study) for the development of YVC's IWCM Strategy.

1.1 Yass Valley Local Government Area

Yass LGA is a developing region located in the south west of New South Wales. Yass township, the administrative centre of the LGA is located about 60 km north of Canberra an 294 km southwest of Sydney. It is on the Yass River, an unregulated tributary of the Murrumbidgee River and situated amongst rolling hills in rich grazing country. Approximately 12 km northwest of Yass Township is the town of Bowning and a further 25 km is the town of Binalong. Both of these towns are included in the Yass Urban Water Supply Scheme (UWS). Murrumbateman village has a separate water supply scheme. Other major villages within the LGA, which are not served by Yass LWU include Bookham, Burrinjuck, Wee Jasper, Sutton and Gundaroo.

1.2 Previous Relevant Studies

YSC continuously updates its plans to accommodate changed resources and future needs in the urban water services. Some of the recent water cycle related planning studies are:

- Water Cycle and Strategic Planning for Murrumbateman Township, undated
- Yass Stormwater Management Plan, 2001
- Yass Village Sewerage Scheme Option Refinement Report, 2002
- Yass Dam Yield Study, 2003
- Yass Snap shot on Sustainability, 2004
- Yass Water Supply Emergency Drought Relief Strategy, 2005
- Strategic Business Plan for Water Supply,2005/06
- Strategic Business Plan for Sewerage Services,2005/06

To integrate all urban water services under one umbrella based on the DEUS IWCM best practice management guideline, YVC commissioned this IWCM study.

1.3 What is Integrated Water Cycle Management?

Increasingly water utilities need to consider all aspects of the water cycle and catchment in relation to their business activities – the provision of safe, reliable, environmentally sound and affordable urban water services. In recognition of the impact of increasing demands on river and groundwater resources, attention has turned towards looking at ways to maximise the benefits of water use in the urban sector.

Broadly, IWCM is the process of balancing water needs with the sustainable use of available water resources. In an urban context, IWCM is characterised as the process of bringing together water supply, sewerage and stormwater management to achieve a more efficient use of water resources in the urban sector.

However, urban water use is also about the provision of essential services (water supply, sewerage and stormwater management) to customers, both now and into the future. Therefore, IWCM is the process of identifying appropriate water cycle management options that meet the demand for services while sustainably managing the available water resource.

The DEUS IWCM Guidelines (DEUS, 2004a) define the principles of IWCM as:

- Consideration of all water sources (including rain water and wastewater) in water planning;
- The sustainable and equitable use and reuse of all water sources;
- Consideration of all water users;
- Integration of water use and natural water processes; and
- A whole of catchment integration of natural resource use and management.

1.4 The IWCM Process

The DEUS IWCM documentation sets out a three part process for developing an IWCM strategy:

- Part 1: Preliminary components (often referred to as a Concept Study) – designed to scope the work required to develop a strategy; and
- Part 2: A Strategy – to set out the actions the LWU will undertake to implement an integrated approach to the management and operation of their businesses; and
- Part 3: Strategy implementation and review.

The IWCM process is also one of adaptive management and planning. In each phase (including the on-going process of strategy review), the following questions should be used to guide strategy development:

1. What are the issues?
2. How do we fix the issues? and
3. How do we know the issues are fixed?

The development of a Concept Study can be summarised in the following steps:

1. Assess the current situation. This involves:
   - Defining the boundaries of the water system;
   - Collecting the available data on the water system; and
   - Reviewing the available data to understand current system performance.
2. Identify problems in the water system. This involves:
   - Auditing the available data to identify current and potential future water cycle management issues; and
   - Prioritising the identified issues.
3. Identify goals for improving the system. This involves setting water cycle management objectives based on the issues identified.
4. Identify preliminary options to manage the system issues. This involves:
   - Identifying areas where existing management options can be improved;
   - Examining options for integration; and
   - Undertaking preliminary feasibility analysis of selected options.

1.5 Objectives of YVC's Concept Study

The objectives of the YVC's Concept Study are:

- To identify the key water cycle issues related to the provision of urban water services in the Yass Valley local government area;
- To identify potential actions for managing the identified water cycle issues;
- To define a tailored process for developing an IWCM Strategy for YVC;
- To provide stakeholders with the opportunity to participate in this strategic planning process; and
- To continue to implement best-practice management practices in the planning and operation of YVC's water and sewer businesses.

2 Where Are We Now?

The purpose of this section is to assess the current situation within which urban water services are provided. This involves:

- Defining the boundaries of the water system;
- Collecting the available data on the water system; and
- Reviewing the available data to understand current system performance.

Three different perspectives were considered in reaching an understanding of the current situation: the catchment context, the water resource context and the urban context.

2.1 Boundaries of the Water System

There are a number of aspects to take into consideration when defining the boundaries of the water system (the study area) for YVC:

- Service boundaries;
- Administrative boundaries; and
- Physical boundaries.

2.1.1 Service Boundaries

YVC provides reticulated water supply services to the towns of Yass, Bowning and Binalong and to the Village of Murrumbateman. Other villages and rural residences within the LGA rely on non-reticulated water sources such as rainwater tanks and groundwater. There are no plans to provide reticulated water to these premises in the near future.

Yass has a reticulated sewerage system. Other towns, villages and rural areas within the LGA are currently served with on-site sewage treatment systems under land-holder management and YVC regulation.

IWCM Issue: Potential requirement for extension of services.

Stormwater drainage infrastructure for Yass township comprises a mixture of kerb and gutter, piped stormwater, surface flows and some grassed swales. The Yass stormwater system discharges urban stormwater to Chinamans Creek, Golf Course Creek and the Yass River.

The village of Murrumbateman has a relatively small stormwater drainage system that is comprised of underground concrete pipes, table drains and natural drainage lines which eventually drain into Murrumbateman Creek. Stormwater drainage systems are yet to be developed in other parts of the LGA where the stormwater runoff predominately travels via natural drainage lines to local waterways.

2.1.2 Administrative Boundaries

Reticulated water supply and sewerage systems are owned and operated by the YVC LWU. YVC assists land-holders to manage their on-site sewage treatment systems through the Health and Building branch.

The provision of water supply and sewerage services is regulated by a number of NSW government departments, primarily:

- DEUS with local representation in Albury until May 2006, now based in Wollongong;
- NSW Department of Natural Resources (DNR) with local representation in Yass; and
- NSW Health and NSW Department of Environment and Conservation (DEC) with local representation in Queanbeyan.

Stormwater services are managed by YVC through its Health and Building branch. As stormwater discharges may constitute pollution, the DEC is the primary regulator of stormwater in the study area.

The Murray-Darling Basin Commission (MDBC) is another administrative body relevant to the management of the YVC urban water cycle. However, most of the obligations of NSW in the MDBC processes are managed by Catchment Management Authorities (CMAs). Most of YVC LGA falls within the Murrumbidgee CMA area with a small portion in the northern corner in the Lachlan CMA area.

ActewAGL, Canberra's major water utility, also forms part of the administrative boundaries of this study as YVC is considering purchasing bulk water from the ActewAGL Googong system. The implementation of this option also potentially involves the NSW and ACT government agencies with responsibility for water supply. Preliminary IWCM options are discussed further in Section 5.1.

IWCM Issue: Interstate water transfer.

YVC also falls in the Capital Region Development Board (CRDB) area. The Board is a regional development organisation that facilitates sustainable economic, employment and investment development in the South East Region of NSW and the ACT. Although the CRDB is not a statutory authority, it may influence the development of the ActewAGL water supply option.

2.1.3 Physical Boundaries

The study area is located in the Upper Murrumbidgee catchment area with a small portion of the northern area (about 2% of the LGA) located in the Upper Lachlan catchment area.

Water for Yass, Bowning and Binalong urban centres is taken from the Yass River catchment, which is a part of the Murrumbidgee catchment.

The study area excludes the 1,025 ML Burrinjuck Dam which is located 60km downstream Yass town. As YVC is responsible for only 5% of Yass River current level of extraction (see **Section 2.3.1**), it is assumed YVC has little or no influence over the dam storage volume given the considerable number of water extraction points between the dam and the town water supply intake. Similarly, it is assumed YVC has no significant contribution to the nutrient loads discharged into Burrinjuck Dam given the number of discharge points between the dam and the effluent release point and the poor water quality already present in Yass River upstream of Yass sewage treatment plant.

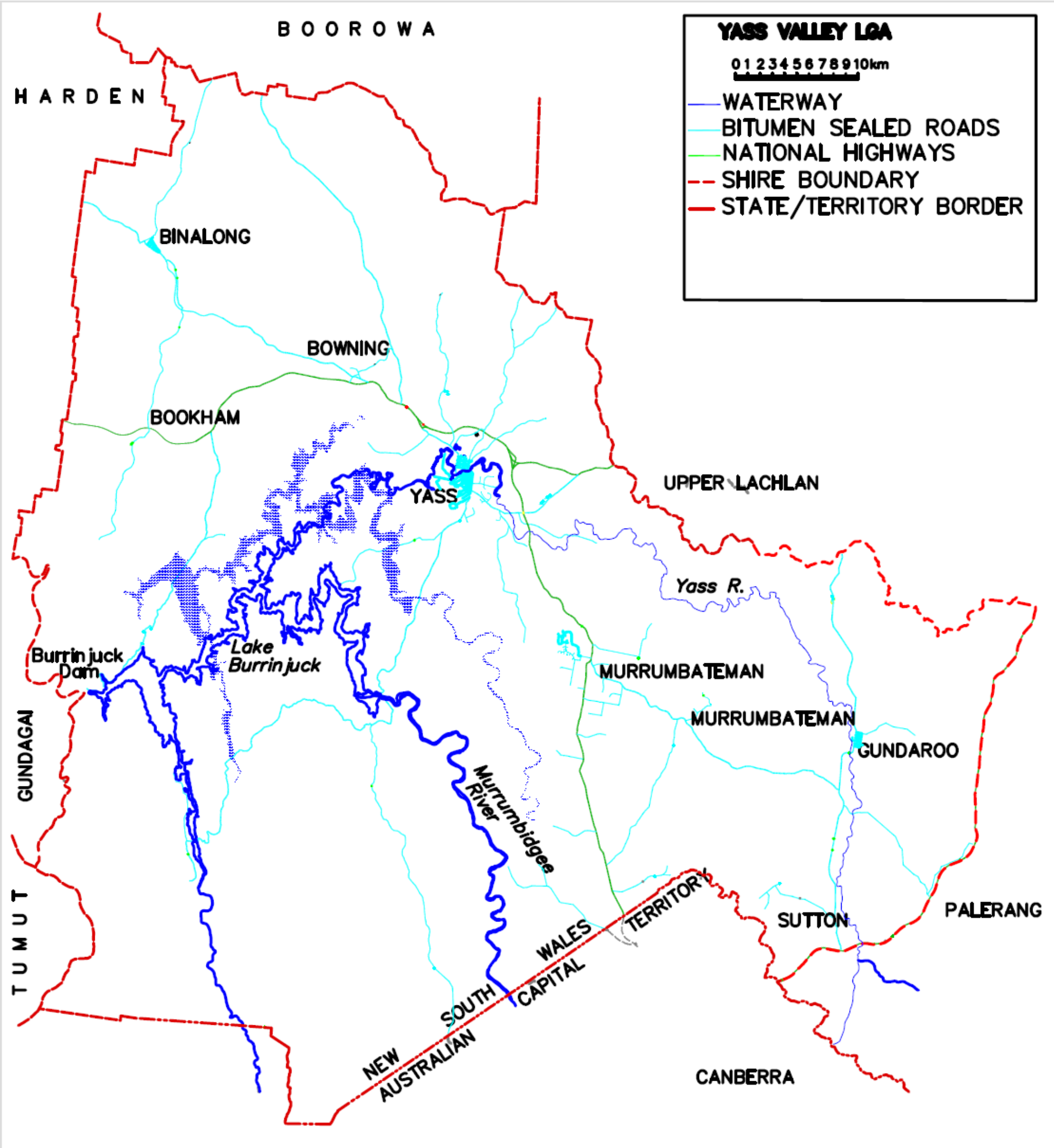
YVC is considering an emergency bore for Yass water supply system. The borehole would take water from the Murrumbidgee groundwater catchment.

YVC is considering the option to draw water from the Googong water system which receives waters from the Queanbeyan and the Molonglo-Burra-Googong River sub-catchment of the Murrumbidgee River catchment.

Water for the Murrumbateman Village is taken from a groundwater borehole located near Murrumbateman Creek and from rainwater tanks. Groundwater resources in the LGA are located within the Murrumbidgee catchment, with a small portion in the northern part of the LGA lying in the Lachlan catchment.

Figure 1 shows the YVC LGA boundary and **Figure 2** shows the sub-catchments of the Upper Murrumbidgee catchment from which YVC water supplies are currently (or would be potentially) drawn.

Figure 1: Yass Valley Council Local Government Area Boundary.



Source: Base map provided by Yass Valley Council (2006), Modified.

Figure 2: Upper Murrumbidgee Catchment.

Source: Murrumbidgee Catchment Stressed Rivers Assessment (1999) (Modified).

Data Sources: Consulting Engagement for IWCM (YVC, 2005a); rought Strategy (YVC, 2005c); Yass Valley Boundary (Department of Lands, 2003); Stressed Rivers Assessment, (DLWC, 1999).

2.2 Catchment Information

Available information on the catchments related to the YVC water cycle was categorised as:

- Location information: describing the main features of the study area and the region;
- Population information: describing the historical population trends of the study area and the available forecasts of expected population;
- Climate information: describing the rainfall, runoff and evaporation characteristics of the area;
- Soil and geological information: describing the characteristics of the land resources that shape land use in the study area;

- Land use: describing the current major land uses of the study area and expected changes in this use into the future; and
- Flooding: describing patterns of catchment inundation and the impacts on urban areas.

Detailed information for each category is presented in the following sections.

2.2.1 Location

Location data is important to the IWCM process as location influences climate, the availability of water resources and the types of land uses and urban development within a study area.

YVC is located in the Southern Tablelands, Capital region of NSW. The LGA has an area of 3,649 km^2 and is bound by the Boorowa LGA to the north, the Tumut and Palerang LGAs and the Australian Capital Territory (ACT) to the South, the Upper Lachlan LGA to the east, and Harden and Gundagai LGAs to the west.

Yass town is the administrative centre of the Yass LGA and it is located 294 km southwest of Sydney and 60 km north of Canberra. Other urban centres in the LGA are Murrumbateman, Bowning, Binalong, Wee Jasper and Bookham. The State government initiated LGA boundary adjustments in March 2004 saw the villages of Gundaroo and Sutton join the Yass Valley LGA.

IWCM Issue:
High growth potential as Yass is a hub in the Sydney Canberra corridor and located close to ACT.

Yass town is located on the Sydney Canberra corridor. As a result it has a development potential to become a stop over and tourism spot. Further, proximity to Canberra allows residents to commute daily to Canberra for employment.

Data Sources: Management Plan (YVC, 2005b), SoE (YVC, 2004b), DLG Boundaries commission (2004a), EMAP (YVC, 2006d).

2.2.2 Population and Growth

Population information is important to the IWCM process as it is the nature and location of population growth that will determine future urban water infrastructure and operational requirements.

As set out in **Table 4**, the population of the YVC LGA was recorded as 9,708 at the 2001 national census adjusted for the corresponding previous area. When Gundaroo, Sutton and Wallaroo areas are included the LGA's population in 2001 is 11,631.

Table 4: Population of Yass Valley LGA.

	1991 Census	1996 Census	2001 Census
Population	8,780	9,128	9,708
Growth		0.79 % pa	1.27 % pa

Source: ABS (2006a).

The growth shown in **Table 4** is slightly higher than the growth of surrounding LGAs. The ABS Southern Tablelands statistical division (comprising Corowa, Crookwell, Goulburn, Gunning, Harden, Mulwaree, Tallaganda, Yarrowlumla, Yass and Young) and the ABS ACT statistical division had an average annual growth rate of 0.8% and 0.9% between 1999 and 2003 respectively. This compares with 1.1-1.2% annual growth for YVC LGA during the same period (ABS, 2006a and ABS, 2006b).

In 2001, 34% of the LGA population resided in rural areas while Yass and Murrumbateman townships held about 58% of the total population for the same year. The latter two towns have reported population growth in recent years with many residents commuting daily to Canberra for employment.

In December 2004 Council took the unprecedented step of limiting development to 20 new water connections per year for the next 5 years until the current water crisis is resolved (YVC, 2005a). Despite this limit, residential development continues to grow, particularly in the form of alternation (modification / sub division) of the existing housing.

Areas to accommodate future growth will be identified by urban, non-urban and industrial lands studies to be undertaken as part of Council's Community Based Strategic Plan "Yass Valley Vision" currently underway (YVC, 2006e). At this stage, this has identified two preliminary growth areas:

- At the North of Yass town between Laidlaw Street and Yass River (approximately 200 lots); and
- At the South East of Yass town, along the Eastern side of Grand Junction Road (approximately 500-1,000 lots).

Yass villages are predominantly residential with some commercial and other non-residential developments such as shops, hotels and schools and their growth is significantly dependent upon the development and quality of water supply and other services provided in the future.

No growth in industrial and commercial activities within the YVC LGA has been reported in the recent past. Recent development approvals are shown in **Table 5**.

Table 5: Development Approvals in Yass LGA.

Type		July 04 – June 05 (12 months)	July 05 – Jan 06 (7 months)
Residential	New dwellings	3	2
	Alterations and additions	75	127
Non Residential		0	0

Source: ABS (2006a).

Data Sources: DSP (YVC 2004a); Drought Strategy (2005c); DIPNR (2003); ABS (2006a); Murrumbateman Strategy (DPWS, undated).

2.2.3 Climate

Climate data is important to the IWCM process as it is a key determinant in the nature and availability of surface and ground water resources.

Climate data of 1889-2005 was accessed from BOM. The Yass region experiences distinct seasons due to its elevation above sea level (550 m AHD) and distance from the ocean.

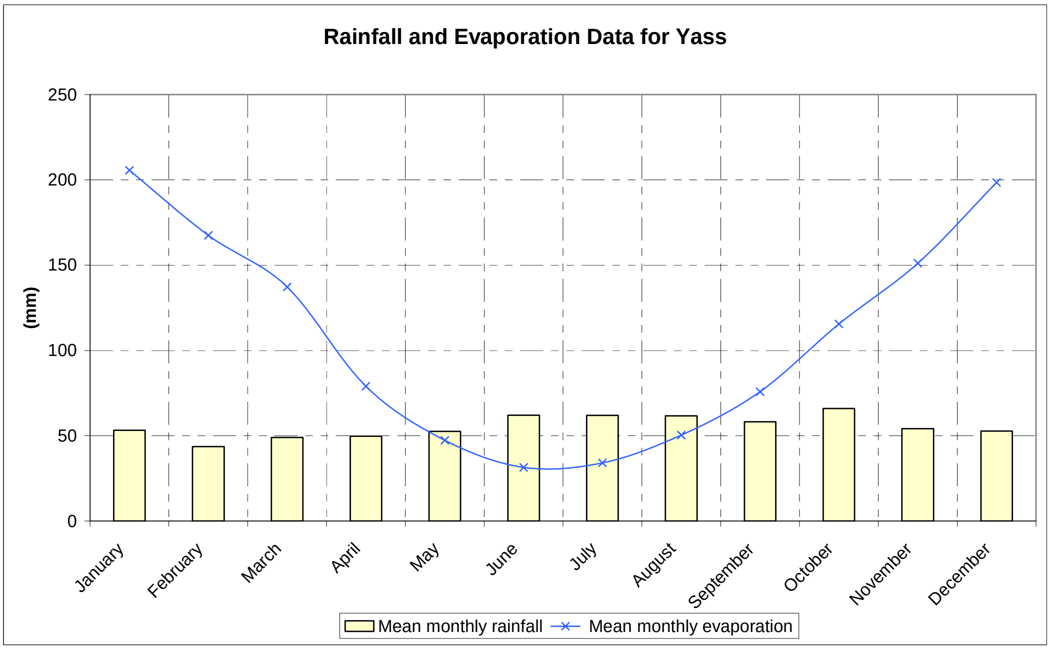
Rainfall in the LGA is naturally erratic, with considerable variation between years. Droughts and flooding rains are typical of the climate type, characterized by a winter-spring rainy season. The rainfall within the LGA averages 651 mm/year while median annual rainfall is 609mm.

Mean monthly rainfall is higher than evaporation between May and August while the remaining months of the year (September to April) have higher evaporation than rainfall. There is a strong seasonal pattern of evaporation in Yass. Mean yearly evaporation is 629 mm/year higher than mean yearly rainfall (**Figure 3**). Temperatures in the LGA range from an average maximum temperature of 29.3ºC in January to 12ºC in July.
Minimum temperatures range from 13.9ºC in February to 1ºC in July.
The mean number of days with temperatures of 35ºC or higher is 10.

Figure 4 shows the mean monthly rainfall and mean monthly evaporation for the Googong area. This area has been studied as YVC is considering purchasing bulk water from the ActewAGL Googong system. As illustrated in **Figure 4**, rainfall tends to exceed evaporation most of the year with exception of the period between August and November. In the Googong area, the mean yearly rainfall is 527mm/year higher than mean yearly evaporation.

Figure 3 and **Figure 4** however, use mean monthly data which is likely to be skewed by the impact of very high rainfall events and may over-estimate the period of time in which rainfall exceeds evaporation.

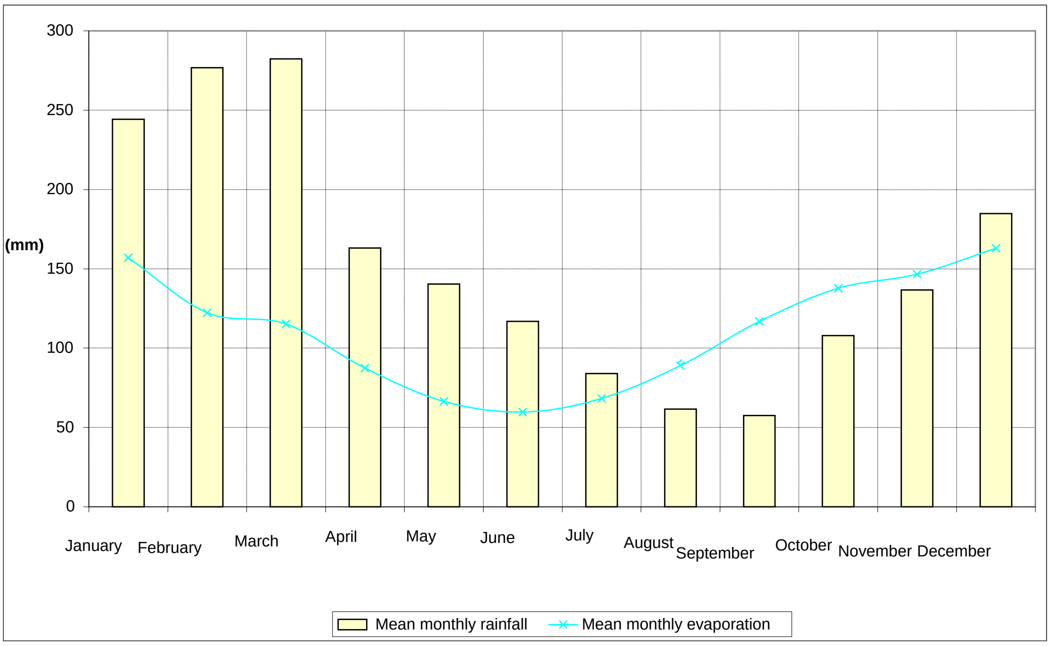
Figure 3: Mean Monthly Rainfall and Mean Monthly Evaporation at Yass (34 48'S 148 54'E).



Source: BOM/SILO (2006).

IWCM Issue: Total evaporation exceeds total rain in Yass.

Figure 4: Mean Monthly Rainfall and Mean Monthly Evaporation at Googong (34 24'S 149 15'E).



Source: BOM/SILO (2006).

Data Sources: BOM (2006); Drought Strategy (YVC, 2005).

2.2.4 Topography, Geology and Soils

Geology and soil information is important to the IWCM as it can be a significant determinant of the water quality of the study area and will also impact on the type of land use. Geology and soil information was taken from the *2002 DLWC Soil Landscapes of the Canberra 1:100,000* Sheet.

The Yass River catchment is characterised by mainly undulating landforms made up of wide valleys and low round ridges, with gentle to moderated slopes. Elevations within the catchment vary from 500 m AHD along the Yass River, to 691 m AHD within Mantons Ridge (located to the east of Yass).

The Yass urban area similarly exhibits gentle to moderate slopes, grading to gentle/low lying relief to the northeast near the Bango Creek/Yass River junction. The majority of urban development occurs in the hills surrounding the central business district. Steep bedrock ridges border the Yass River where it bends upstream and downstream of the Chinamans and Golf Course creek confluences. The Yass River dam, located to the north east of Yass, is also bordered by steep ridges on the northern side. The watercourses entering the Yass River (Chinamans, Golf Course and Bango Creeks) are characterised by gentle slopes.

Extensive alluvial deposits are found in Yass Valley, especially along the Yass River at Gundaroo (Kellet 1981; Jacobson et al. 1976 cited by DLWC 2000). The Yass Valley contains an area of floodplain and terrace development bounded on either side by the Cullarin Upland. Sections on the Yass River obtain a maximum floodplain width of two kilometres (SCS 1981; Gunn et al. 1969 cited by DLWC 2000).

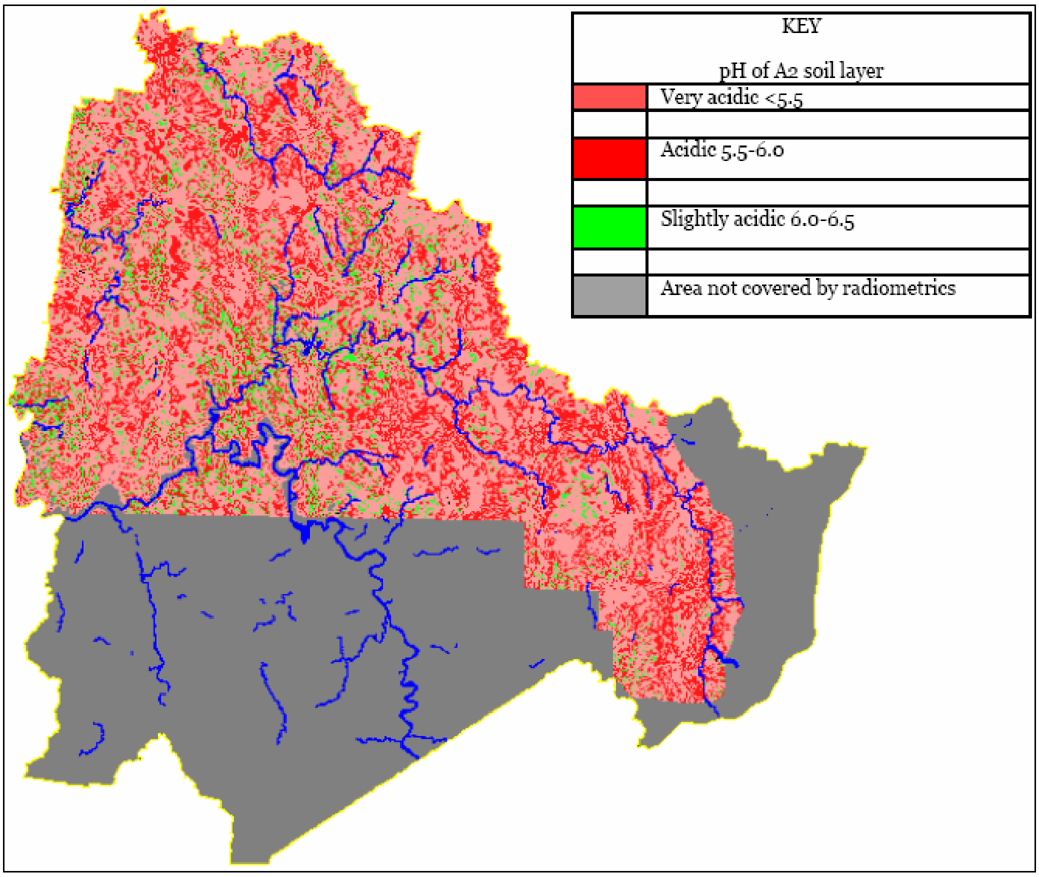
There are a diverse range of soils in the Yass Valley, resulting from the extent of relict depositional features (such as colluvial fans and alluvial terraces) and the diversity of lithologies, predominantly the sub-vertically bedded sediments (Nicoll & Scown, 1993 cited by YVC 2006d).

The three main groups of soils in the Yass Valley are podzolics (mostly red podzolics on the better drained side slopes, with minor yellow podzolics on the lower slopes and more waterlogged country), lithosols (on the steeper ridge and slope terrain), and soloth-solodic soils on footslopes and drainage lines. There are minor areas of alluvial soils along active floodplains in the Yass Valley. Many of the soils in the Yass Valley are very acidic, with a pH of less than 5.5 (**Figure 5**). These soils are generally low in fertility and present a high erosion hazard when vegetative cover is removed (YVC 2006d). Information regarding moisture content on these soils was unavailable.

IWCM Issue: Potential water quality impact of acidic soils of low fertility and high erosion hazard, if vegetation is removed.

A less well-known form of acid sulphate soils (ASS) has been reported sporadically under irrigation areas in the Yass Valley associated with dryland salinity and water logging (EPA 2000; CSIRO 1999). These soils develop in saline-scalded discharge areas where the underlying rocks or sediments contain sulphide minerals. They are often linked with land clearing and consequent rising watertable. Salinity and waterlogging in the scalded discharge areas can lead to the mineralisation of sulphur and iron, transforming once-productive agricultural soils into highly degraded ASS (Fitzpatrick 1999 cited by EPA 2000).

Figure 5: pH of A2 Soil Layer.



Source: YVC (2006d).

Data Sources: EMAP (YVC, 2006d); DLWC (2000); DLWC (2002); EPA (2000); CSIRO (1999).

2.2.5 Land Use

Land use data is important in the IWCM process as it influences the demands on the available water resources. Further, land use also impacts on the water quality of the available resources.

Land use in the Yass River catchment has changed considerably over recent years as a result of farm dam development and the change from traditional grazing enterprises to more intensive land uses such as rural residential developments. A summary of the Yass LGA land use is provided in **Table 6**.

Table 6: Land Use in the Yass LGA.

Land Use	Area (km^2)	Percentage of LGA Area (%)
Rural production	3,404	93.3%
Rural living	113	3.1%
Town & Village	9	0.3%
Open space	3	0.1%
Special uses	3	0.1%
National park	95	2.6%
Protected area	22	0.6%
TOTAL	**3,649**	**100%**

Source:.EMAP, (YVC,2006d).

In general, the catchment area upstream of the Burrinjuck Dam has a mixture of rural-residential developments and farming, with viticulture being a major industry in the area of Murrumbateman. The upper reaches of the Yass River catchment area located east of the Federal Highway (in the Palerang LGA) is dominated by rural-residential developments.

The table above shows that the majority of land in the LGA area is used for rural production like agricultural activities. There is an increasing demand for land for uses such as viticulture, horticulture and rural residential living. The southern portion of the Yass Valley area is currently under increasing pressure for subdivision and more intensive use of rural lands. The growing demand for rural residential lifestyles greatly influences land use patterns and places increased pressures on the natural environment. Rural residential lot size range from 2,500 m^2 to more than 10,000 m^2 within the Yass LGA area.

IWCM Issue: Potential for land use change.

About 72% of the natural vegetation in the riparian zone and the catchment has been cleared representing an extensive decline in land quality. As a result, sheet and gully erosion and dryland salinity is extensive. Much of the remnant vegetation is found on land unsuited to agricultural uses. Sedges occur along drainage lines.

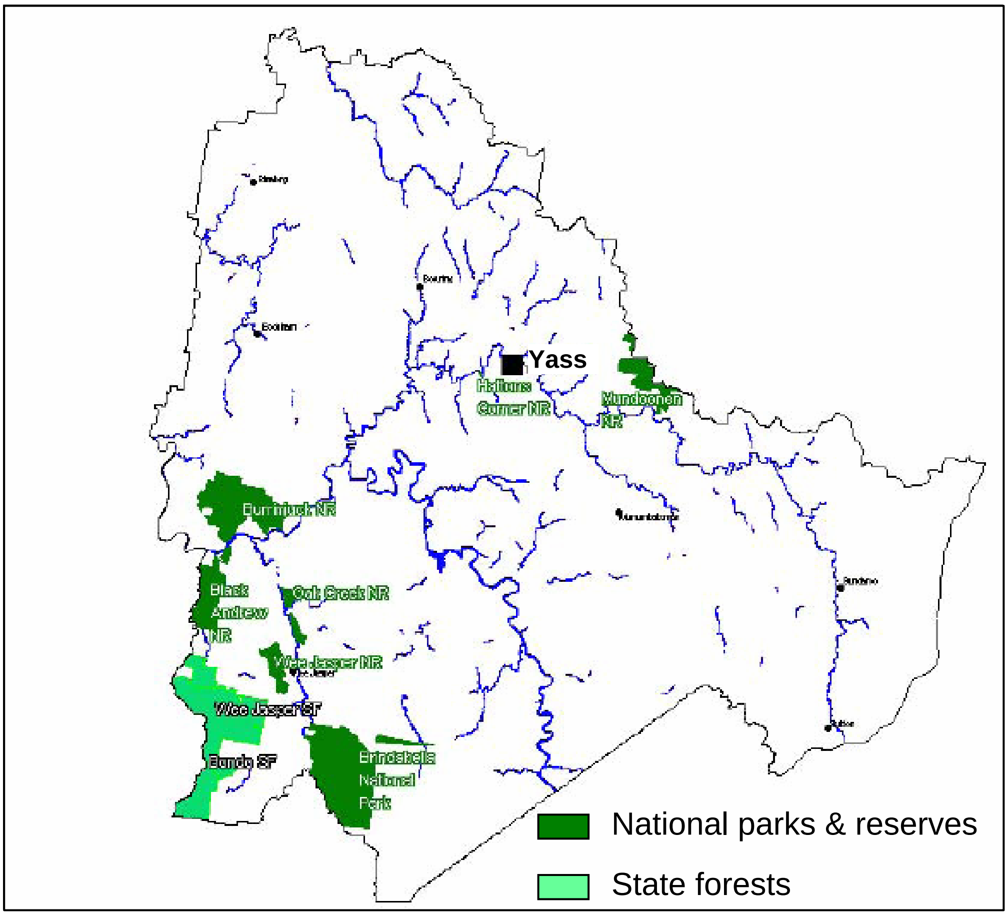
IWCM Issue: Erosion and dryland salinity issues from catchment clearing.

High electric conductivity (EC) values on the Yass River are due to dryland and urban salinity on the catchment area. Dryland and urban salinity accounts for about 4% of the catchment area (MCMB, 2003) and are attributable to a rising water table or subsurface flow that brings dissolved salts within 1-2 metres of the soil surface and to soil erosion exposing naturally saline sub-soils.

The LGA contains several hundred hectares of land managed for conservation purposes (**Figure 6**). There is one national park, seven nature reserves and one state conservation area managed by the NSW National Parks and Wildlife Service (NPWS), a part of Department of Environment and Conservation (DEC). There are also two State Forests managed by the NSW Department of Primary Industries (DPI) and one State Park (Burrinjuck Waters State Park) managed by the NSW Department of Lands, which also perform conservation and preservation purposes. All are located in the southwest of the LGA.

There was no information about water supply catchment protection measures and their effectiveness although the YVC EMP (2006d) reports two projects currently in progress in the Yass River catchment area: the Yass Urban Landcare Streambank Rehabilitation Program and the Yass Catchment Targeted Salinity and Water Quality Program. The progress of these projects towards the protection of the Yass River water quality is unknown.

Figure 6: National Parks and Other Conservation Areas in the YVC LGA.



Source: YVC EMAP (2006d).

Activities within the LGA, licensed under the *Protection of the Environment Operations (POEO) Act, 1997*, with the potential to impact on waterways are set out in **Table 7**.

Table 7: Activities in YVC LGA Licensed Under the POEO Act, 1997.

Licence No.	Licensed Activity (operator or location)	Parameters monitored	Max. Allowable Daily Discharge Volume (kL/d)	Last non-compliance
3896	A G Irvine Pty Limited (Yass) – Spray Irrigation	-	450	License surrendered Feb/03
2685	Glenlee Quarries Pty Ltd (Murrumbateman) – Quarrying	pH $CaCO_3$ Sulphate Total Iron Total Zinc "pump out" volume	-	Sep 03 - Sep 04 Samples not taken or analysed
4219	T.J. & R.F. Fordham Pty Ltd (Bookham) – Quarrying and Bitumen Pre-mix	Wet weather discharge	-	-
4082	Boral Resources (Country) Pty. Limited (Murrumbateman) - Quarrying	Airblast overpressure levels. Gound vibration levels.	No water parameters to be monitored. Licence states applicant must comply with Section 120 POEO Act (ie. not to pollute the waters).	-
901	Boral Resources (Country) Pty. Limited (Yass) – Concrete Batching	-		-
1062	Concrete Pty Ltd (Yass) – Concrete Batching	-		-
4323	G C Schmidt Pty Ltd (Murrumbateman) - Quarrying	-		-
2343	Tharwa Sands Pty Limited (Yass) - Dredging	Discharge to waters TSS	476 kL/day TSS limit = 30mg/L 100 percentile Concentration Limit	Dec 03 – Dec 04 Only sampled on 2 occasions out of required 12. Dec 03 Clean-up action

Licence No.	Licensed Activity (operator or location)	Parameters monitored	Max. Allowable Daily Discharge Volume (kL/d)	Last non-compliance
11363	Transgrid (Yass) - Generated and/or stored waste (mineral oils; oil/water and hydrocarbon/water mixtures or emulsions; Waste substances and articles containing or contaminated with polychlorinated biphenyls)	Noise Wind and Temperature	-	-
1611	Perenc; Valent – Pig Production	Rainfall BOD COD Total Kjedahl Nitrogen Total Phosphorus Orthophosphate Potassium Total Suspended Solids Electrical Conductivity Chloride Sodium Calcium Magnesium Sulpur Sodium Absorption Ratio Alkalinity Ammonia	-	Apr 01 – Mar 02 No daily monitoring reports provided
1805	Yass Valley Council (Yass) – Water Treatment Plant	100 percentile Concentration Limits: pH 6.5-8.5 Faecal coliforms 200 cfu/100mL TSS 50 Volume/mass limit = 140 kL/day		Jun 04 – May 05 Exceedance of Faecal Coliform limit at discharge monitoring point

<table>
<tr><th>Licence No.</th><th>Licensed Activity (operator or location)</th><th>Parameters monitored</th><th colspan="3">Max. Allowable Daily Discharge Volume (kL/d)</th><th>Last non-compliance</th></tr>
<tr><td rowspan="7">1730</td><td rowspan="7">Yass Valley Council (Yass) – Sewage Treatment</td><td colspan="4">Enclosed Waters (all units in kg)
BOD 7890
Nitrogen (total) 11835
Oil and Grease 5260
Phosphorus (total) 4734
Total suspended solids 11835</td><td rowspan="7">Apr 04 – Jun 04
Effluent discharged >1300kL.

Apr 04 – Jun 04
Discharge to waters when flow in receiving waters is below 50 megalitres per day and dilution ratio is less than 1:50.</td></tr>
<tr><td colspan="4">At the Discharge Point No 1</td></tr>
<tr><td>Percentile</td><td>10</td><td>50</td><td>100</td></tr>
<tr><td>pH</td><td></td><td></td><td>6.5-8.5</td></tr>
<tr><td>TSS (ml/L)</td><td>20</td><td>25</td><td>30</td></tr>
<tr><td>BOD (ml/L)</td><td>20</td><td>25</td><td>20</td></tr>
<tr><td colspan="4">Volume/mass limit = 1,300 kL/day</td></tr>
<tr><td>5895</td><td>Yass Valley Council (Murrumbateman) – waste facilities (ie. Landfill)</td><td>$CaCO_3$
Ammonia
BOD
Conductivity
Nitrate
pH</td><td colspan="3">-</td><td>Sep 03 – Sep 04
No samples taken at MP3 and MP5</td></tr>
</table>

Source: DEC (2006a).

Table 7 shows some non-compliance with the licences during certain periods. Some of the licensed activities do not have monitoring parameters that show the quality of water discharged to the waterways. Thus, it is not possible to determine if these activities are affecting the water quality in the study area.

Data Sources: EMP (YVC, 2006d), DEC (2006a), SoE (YVC, 2004b), DIPNR (2004), DLWC (2001).

IWCM Issue: It is not possible to determine if activities licensed under the POEO Act are affecting the water quality.

Data Gap: Limited data on activities under POEO act.

2.2.6 Flooding

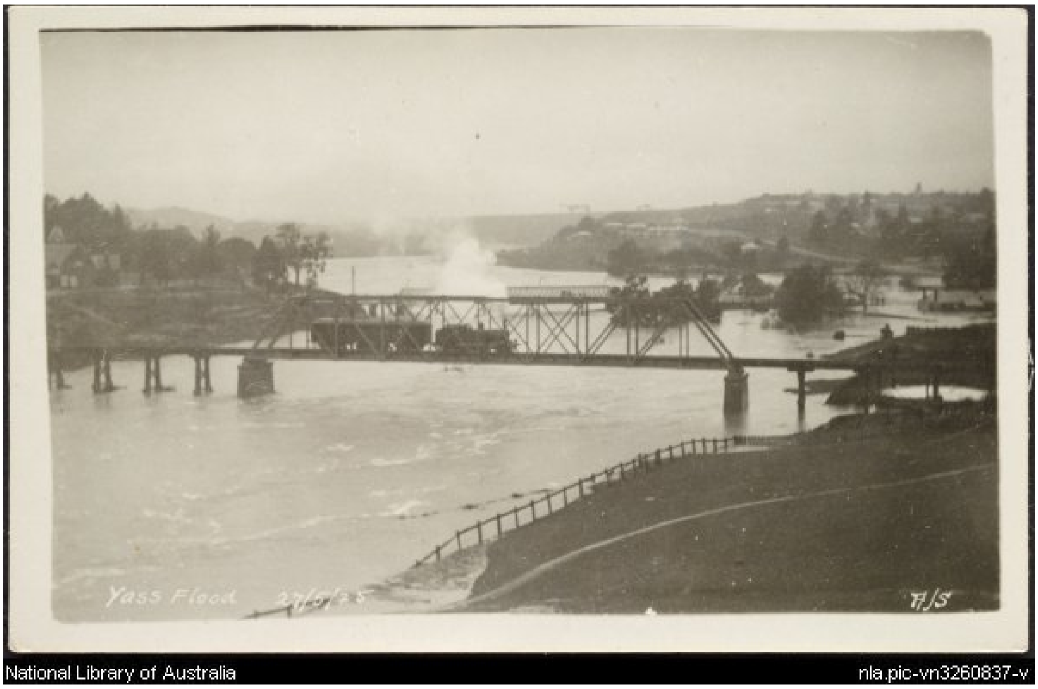
Information on flooding is important to the IWCM process as inundation areas may constrain the provision of some urban water services (such as the location of STPs above flood level and the potential for infiltration into sewers).

Local newspapers reported that major floods have been registered in 1850, 1894, 1900, 1925, 1959 and 1974 (**Figure 7**). Many streams in the Yass urban area have been highly modified in order to reduce flooding as well as erosion.

Information regarding the location and extension of flood liable areas was not available. It is also unclear if Yass STP is located above the flood level.

However, aerial photographs and maps of the Yass STP area suggest that it might be located outside the flood liable area.

Figure 7: Yass River Flooding During May 1925.



Source: NLA (2006)

Data Sources: NLA (2006), SMH (2006), EMAP (YVC, 2006d), YVC (2005b).

2.3 Water Resource Information

Knowing the characteristics of the available water resource is important to the IWCM process as it is essential for determining how the demands on the resource can best be met.

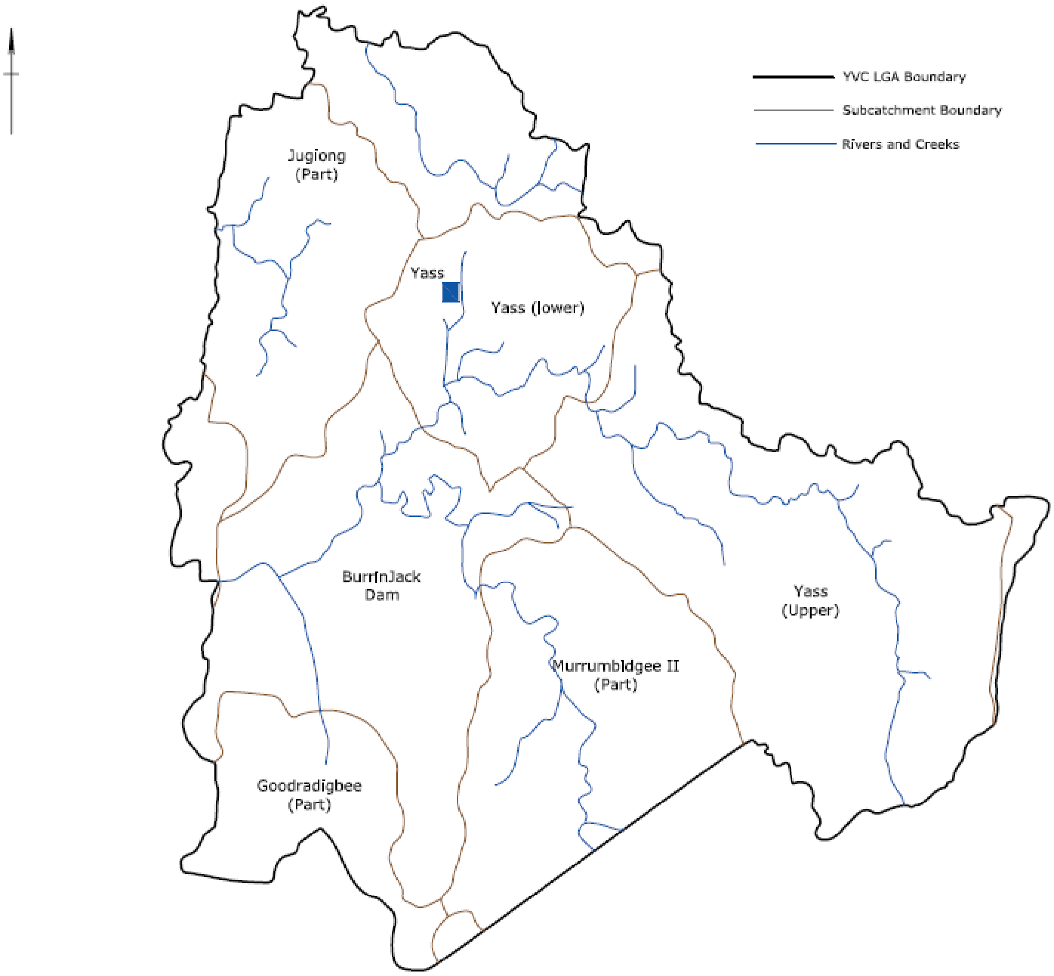
The quantity of water available will play a role in determining the storage requirements for communities and may drive the search for alternative sources and more efficient water use. The quality of water available plays a role in determining the type of treatment the water will require in order to be used in a particular way, and may impact on the cost of providing the water. Understanding these characteristics is important in ensuring that the resource is used in the most efficient and sustainable way. Surface waters are the primary water resource utilised by the majority of the urban population in the LGA although groundwater sources are also utilised. Details of each resource are set out in the following sections. There is presently very little use of treated sewage effluent or stormwater to meet urban needs.

2.3.1 Surface Waters

The Yass River catchment located in the upper Murrumbidgee River catchment covers 1,230 km^2, flowing north-west from the ACT border until it enters the backwaters of the Burrinjuck Dam. The Yass River subcatchment area covers the Yass Valley and the Palerang Council LGA (**Figure 8**).

The median annual flow for the Yass River is 58,620 ML/a. This is the annual flow rate that has been exceeded half of the time for all river gauging station records. There are extended periods of no flow in the river. Highest recorded daily flow rate recorded is 46,156 ML/day during the May 1925 flooding. The variability in the annual flow rate is considerable. The lowest recorded annual flow is 2,500 ML/yr in 1919 and highest recorded flow is 360,000 ML/yr in 1952.

Figure 8: Yass River Catchments.



Source: EMAP (YVC, 2006d) (modified).

Figure 9 shows that the current level of surface water utilisation is 21,000 ML/a which is 189% of the estimated sustainable yield (11,130 ML/a).

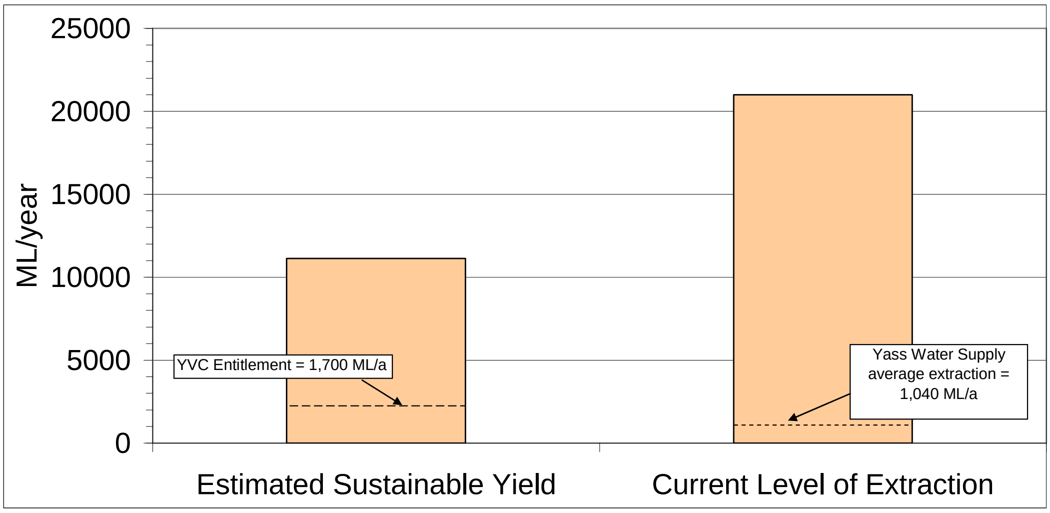
YVC is entitled to extract 1,700 ML/a of surface water (water from lakes, rivers and dams) under DNR licences (YVC, 2006f). This entitlement accounts for 15% of the estimated sustainable yield. Yass town water supply average extraction of 1,040 ML/a (between 1990 and 2005) only accounts for 9% of the total sustainable yield and is responsible for 5% of the current level of extraction (refer **Figure 9**).

Based on the above it is possible to conclude that the majority of surface water extraction on the Yass River Catchment is for cropping, grazing and irrigation activities.

Although there are two water sharing plans for the Murrumbidgee River, these plans do not cover the study area and these plans are areas downstream to Yass River. There is no specific water sharing plan for the Yass River.

IWCM Issue: There is no specific water sharing plan for the Yass River.

Figure 9: Yass Surface Water Sustainable Yield versus Current Extraction.



Source: DIPNR (2004), YVC (2006b) (modified).

IWCM Issue: Current surface water utilisation is 189% over the estimated sustainable yield.

The *1999 Stressed Rivers Assessment Report* (DLWC, 1999) for the Murrumbidgee catchments compiled was reviewed for this Study. The results of this assessment for the Yass River are summarised in **Table 8.**

The Upper Yass River catchment was found to be under high hydrological and environmental stress due to rural residential development, rural dams and salinity. The lower Yass catchment area, where the Yass town water supply and the sewage treatment works are located, was categorised as low hydrological but high environmental stress. According to the Report, the high environmental stress in the Yass lower catchment area is due to town sewage (from the Yass sewerage treatment plants), the presence of weirs and salinity.

The Burra-Googong, Jugiong and Murrumbidgee II River subcatchment areas were also in the high stress categories. Burra-Googong has high stress level due to over extraction, rural residential and urban pressures, and fish passage. Jugiong has issues related to cropping and salinity. The Murrumbidgee II sub catchment was given the highest environmental stress category due to its proximity to Canberra and the resulting human settlement impacts such as urban runoff, littering, and development. The Goodradigbee and the Queanbeyan River subcatchment areas were both found to have low extraction rates and environmental stress while the Molonglo River subcatchment was found to have low extraction rates and medium environmental stress due threatened species present and the stocked of Silver Perch.

IWCM Issue: Yass River catchment is under hydrological (Upper) and environmental (Upper and Lower) stress.

As discussed in **Section 2.1.1**, YVC is considering purchasing bulk water from the ActewAGL's Googong system which comprises a 124,500 ML dam fed by the Queanbeyan and Molonglo-Burra-Googong River subcatchment area.

The implementation of the YVC bulk water purchasing option may potentially increase the subcatchment extraction rate and environmental stress in the long term.

Table 8: Yass River Catchment Stress Classifications.

Subcatchment Area	Hydrology Stress Rating	Environmental Stress Rating	Identified Conservation Area by	
			NPWS	NSW Fisheries
Yass Upper	HIGH	HIGH	YES	YES
Yass Lower	LOW	HIGH	NO	YES
Goodradigbee	LOW	LOW	NO	YES
Queanbeyan	LOW	LOW	YES	YES
Burra - Googong	HIGH	HIGH	NO	YES
Molonglo	LOW	MEDIUM	NO	YES
Jugiong	HIGH	HIGH	NO	YES
Murrumbidgee II	HIGH	HIGH	YES	YES

Source: DLWC (1999)

Surface water quality of Yass River is affected not only by agricultural activities or natural processes but also from occasional industrial discharges and accidents. For example, a number of reported accidents on the Hume Highway have resulted in petroleum products and other chemicals spilling into the Yass River and its tributaries (MDBC 2006b).

IWCM Issue: Salinity problems in the Yass River.

The *1999 Salinity Audit of the Murray Darling Basin* (MDBC, 1999) identified severe salinity problems in various locations, including the Yass River catchment area. The electrical conductivity (EC) values in the lower reaches of the Yass River are moderately high, ranging between 239 µS/cm and 1081 µS/cm with a median value greater than 700 µS/cm. EC decreases with increasing stream flow due to the diluting effect of rainfall run-off. Salinity levels of over 1,400 µS/cm have been recorded in the Yass town water supply (MDBC 2006b) whereas the maximum level recommended by the 1996 Australian Drinking Water Guidelines (ADWG) is 833 µS/cm.

Total suspended solids (TSS) and turbidity values in the Yass River are generally low and below the ANZECC guidelines for ecosystem protection, except during periods of extreme flow or localised erosion. Nitrogen concentrations at Yass township often exceed recommended guidelines for ecosystem health. Likely sources of nitrogen are from grazing animals and to a lesser extent, over-application of fertilisers. Total phosphorous concentrations only exceed guidelines during periods of high flow as phosphorous molecules bond to sediment particles. As a result, high levels of sediment generally correspond with high concentrations of phosphorous (DIPNR 2004).

Water quality data for station 410026-Yass River at Yass was provided by YSC for this Study. When measured against the ANZECC 2000 Water Quality Objectives (WQOs), station 410026 rated very poor for four objectives.

Yass catchment has been categorized as being in the highest stress rating by the Stressed Rivers Assessment Report (DLWC, 1999).

IWCM Issue: Yass River quality is under heavily stressed.

Table 9: Water Quality Parameters for Yass River at Yass (Station # 410026).

Parameters Monitored	Compliance with ANZECC 2000 Interim Water Quality Objectives (WQOs)
Total Nitrogen (TN) Total Phosphorus (TP) Turbidity Salinity pH Temperature Total Suspended Solids (TSS)	Station 410026 rated: Very poorly for Aquatic ecosystem management, Primary contact recreation, Livestock, and Irrigation; Fairly for Homestead water supply; and Good for Drinking water.

Water quality data at Yass Dam is not available.

Data Gap: No dam water quality data.

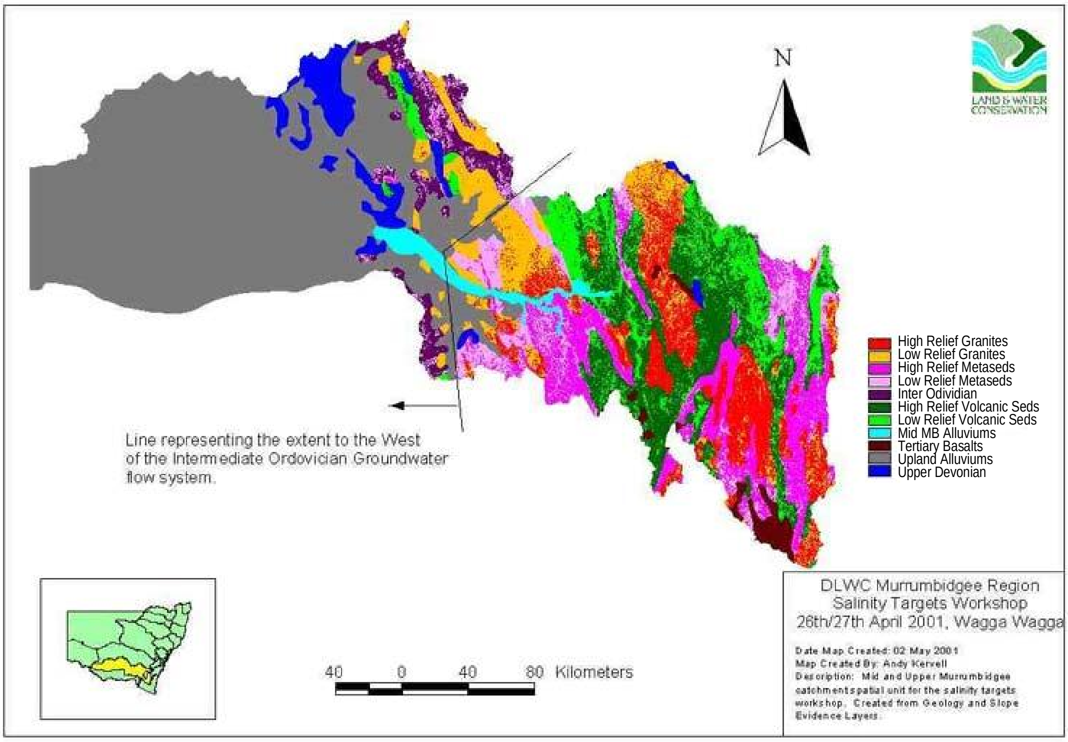
Data Sources: MDBC (2006b); EMAP (YVC, 2006d); SoE (ACT, 2004); Yass sustainability snapshot (DIPNR, 2004); Murrumbidgee Blueprint (MCMB, 2003); Stressed Rivers Report for Murrumbidgee Catchment (DLWC, 1999); MDBC (1999).

2.3.2 Groundwater

Groundwater resources in the LGA are located within the Murrumbidgee catchment, with its northern tip lying in Lachlan catchment. The groundwater flow is from local groundwater systems, mostly within Palaeozoic rocks or Mesozoic intrusives and intermediate flow systems within Precambrian rocks (Bureau of Rural Sciences 2000; Beale et al. 2004 cited by DIPNR 2004) in sedimentary aquifers and some fractured rock aquifers (Sinclair Knight Mertz 2003; Ife and Skelt 2004 cited by DIPNR 2004) such as the Murrumbateman fractured rock aquifers from which water is drawn for Murrumbateman township (**Figure 10**).

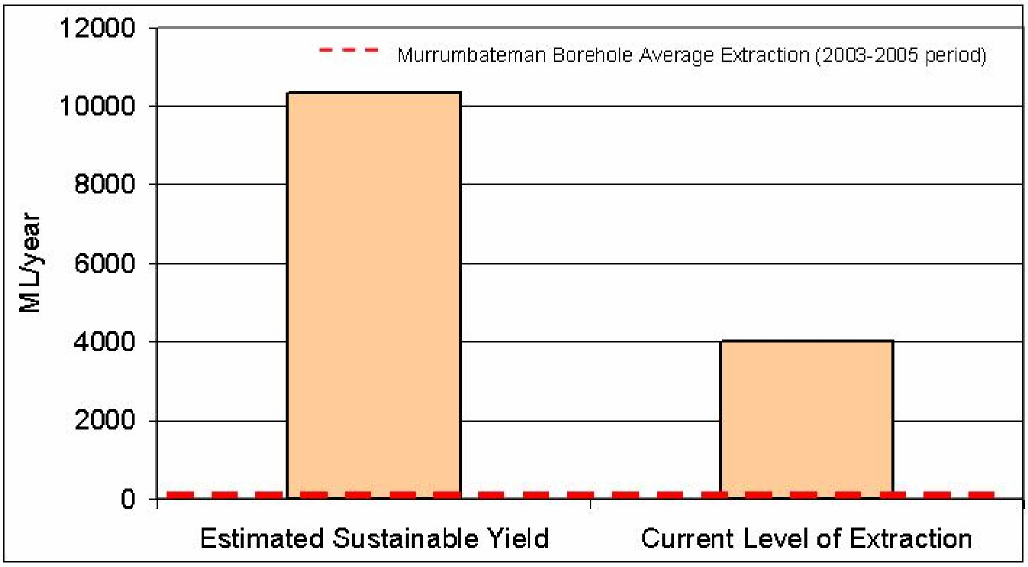
The estimated sustainable yield for the groundwater resources in the LGA is 10,335 ML/a while the current level of groundwater water utilisation is estimated to be 4,009 ML/a. The Murrumbateman borehole town water supply only accounts for 1.2% (45 ML/a) of the current level of extraction (**Figure** 11). Although **Figure 11** shows that the current groundwater use in the LGA is well below the estimated sustainable groundwater yield, isolated over extraction has been occurring within rural residential development areas of Murrumbateman and Sutton (DIPNR, 2004).

Figure 10: Murrumbidgee Catchment Regional Groundwater Flow Systems Map.



Source: MDBC (2006a); (Modified).

Figure 11: Yass Ground Water Sustainable Yield versus Current Extraction.



Source: DIPNR (2004) DEUS (2006, 2005).

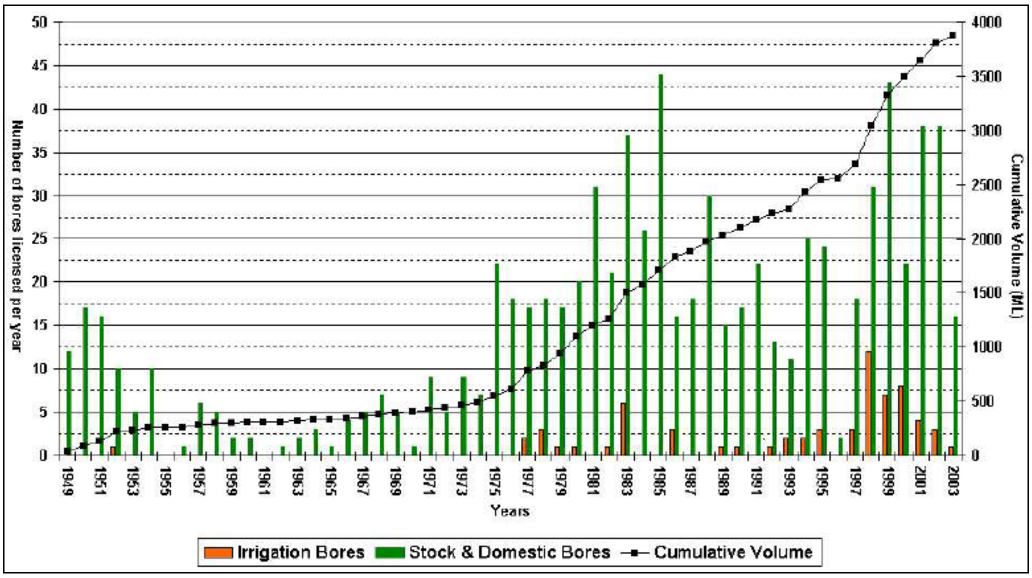
Groundwater over extraction in the Yass catchment is due to the increase in the number of licensed bores in the LGA resulting from an embargo on the issuing of new surface water irrigation licences in the Murray Darling Basin

(**Figure 12**). The groundwater system has an impact on the Yass River flows as the groundwater system has maintained the flows in the Yass River during dry times.

Groundwater sharing plans for the Lower Murrumbidgee and Lower Lachlan groundwater catchment areas were prepared and gazetted in February 2003 but deferred until July 2006. No groundwater sharing plans have currently been prepared specifically for the study area.

Information regarding groundwater extraction licences was not available.

Figure 12: Bore Numbers and Cumulative Groundwater Extraction Volume in the Yass Catchment.



Source: DIPNR 2004.

Groundwater levels in the Murrumbidgee and Lachlan catchments generally declined over the decade 1990–2000 as a result of increased pumping rates and reduced recharge. Groundwater pumping from the Lachlan subsystem also impacted on stream flow in areas with a direct hydraulic connection between the aquifer and the watercourses.

IWCM Issue: Unsustainable groundwater extraction has been occurring within rural areas of the LGA.

The 1998 Aquifer Assessment Risk Report has classified the Upper Murrumbidgee Alluvium and the Murrumbateman Fractured Rocks as high risk aquifers as their water extraction levels exceed their sustainable yield. No new groundwater licences have been issued from 2004 in order to reduce the localised stress level of the aquifers.

Data Gap: Limited groundwater quality data.

Ife & Skelt (2004 cited by ACT 2004) noted that limited data were available for groundwater quality in the LGA groundwater sources. They concluded that any local and intermediate groundwater flow systems associated with fractured rock landscapes in highland areas have a high salinity hazard in both the Lachlan and Murrumbidgee catchments, while in the Lachlan catchment there was potential for inflow of saline groundwater in the Lachlan subsystem from adjacent highland areas.

Most groundwater in the LGA yields salt concentrations of 1,000–3,000 mg/L, making it suitable for some domestic, agricultural and limited industrial uses.

The Murrumbateman borehole (located within the Murrumbateman Fractured Rocks) water supply has high values of total suspended solids (medians between 480 and 516 mg/L against the ADWG limit of 500 mg/L), total hardness (medians between 290 and 345 mg/L against the ADWG limit of 200 mg/L) and occasional total coliforms and E. coli (**Table 10**). This indicates that Murrumbateman ground water supply occasionally exceeds ADWG limits. Council is planning to install a chlorination unit in the near future.

IWCM Issue: Little potential of groundwater development as quality is poor and service is stressed.

Table 10: Water Quality Parameters for Murrumbateman Borehole at the Murrumbateman Fractured Rock and Compliance with ADWG.

Chemical Compliance						
(Median values in mg/L unless specified otherwise)	**2003**		**2004**		**2005**	
	Median	% compliance	Median	% compliance	Median	% compliance
pH (pH value)	7.2	100	7.25	100	7.5	100
Turbidity (NTU)	0.099	100	0.099	100	0.099	100
TDS	516	50	516	50	480	67
Aluminium	0.015	100	0.03	100	0.03	100
Antimony	0.001	100	0.001	100	0.001	100
Arsenic	0.001	100	0.001	100	0.001	100
Barium	0.0225	100	0.025	100	0.021	100
Boron	0.099	100	0.099	100	0.099	100
Cadmium	0.0005	100	0.0005	100	0.0005	100
Calcium	54.47	100	53.965	100	48.17	100
Chloride	126.25	100	128.1	100	112.6	100
Chromium	0.007	100	0.0095	100	0.011	100
Cooper	0.007	100	0.042	100	0.007	100
Cyanide	0.0099	100	0.0099	100	n/a	n/a
Fluoride	0.44	100	0.46	100	0.43	100
Iodide	0.0198	100	0.0199	100	0.099	100
Iodine	0.103	50	0.108	0	n/a	n/a
Iron	0.0099	100	0.0099	100	0.0099	100
Lead	0.002	100	0.002	100	0.002	100
Magnesium	47.28	100	51	100	41.19	67
Manganese	0.005	100	0.005	100	0.005	100
Mercury	0.0001	100	0.0001	100	0.0001	100
Molydbenum	0.005	100	0.005	100	0.005	100
Nickel	0.0099	100	0.01	100	0.01	100
Nitrate	42.5	100	43.7	100	36.2	100
Nitrite	0.099	100	0.099	100	0.099	100
Selenium	0.002	100	0.002	100	0.002	100

Chemical Compliance						
(Median values in mg/L unless specified otherwise)	**2003**		**2004**		**2005**	
	Median	% compliance	Median	% compliance	Median	% compliance
Silver	0.002	100	0.002	100	0.002	100
Sodium	90.25	100	87.95	100	83.8	100
Sulphate	33.2	100	35.2	100	33.4	100
Total Hardness ($CaCO_3$)	330.7	0	344.8	0	289.9	33
True Colour (Hazen Units - HU)	0.99	100	0.99	100	0.99	100
Zinc	0.03	100	0.045	100	0.02	100
Microbiological Compliance						
(% of compliance)	**2003**		**2004**		**2005**	
Total Coliforms	67		64		58	
E. Coli	96		100		100	

Source: YVC (2006a).

Data Sources: Water analysis results for Murrumbateman (YVC, 2006a); EMAP (YVC, 2006d); Catchment Classification Project Team (MDBC 2006a); DEUS (2005 and 2006); Sustainability snapshot (DIPNR, 2004); Boundaries Commission (DLG, 2004a); SoE (ACT, 2004), Murrumbateman Strategy (DPWS, undated).

2.4 Urban Information

Information on the urban water services (water supply, sewerage and stormwater) provided in the Yass Valley area is presented in the following sections.

2.4.1 Town Water Supply

Data on the existing water supply system is important for the IWCM process in order to determine how well the system is performing in terms of water services delivery. Records of the water volumes extracted, treated and consumed are used to determine how efficiently the water supply system is operated, and to identify places where water is lost or unaccounted for. Understanding how water is consumed allows water demand management planning to encourage people to use water wisely. Data on the capacity of the existing system is important for identifying areas where the system may be unable to deliver services in the future and may require improvement.

Bulk Supply

The Yass Valley LWU services the townships of Yass, Bowning and Binalong and the village of Murrumbatemen. Yass Valley Water supply system draws its water from Yass Dam except for the village of Murrumbatemen. Yass Dam is a 12.0 metre high concrete arch dam with a crest approximately 98 metres long and is located upstream of Yass town. Water supply to Murrumbateman was developed in 1984 with water sourced from a bore well located in the Murrumbateman Recreation Ground near Murrumbatemen Creek. The water is supplied untreated.

The dam was originally built in 1927 and provided a storage capacity of 1,125 ML. However, sedimentation over the past 75 years has reduced its capacity as there have been no further upgrades to the dam. A hydrographic survey conducted in 1987 reported that the available storage in the dam was 876 ML (YVC, 2005c). A hydrographic survey was conducted again in April 2006 and the available storage in the dam was 872 ML. 4 ML of storage was lost between the period of 1987 and 2006. The siltation rate is now in the range of 0.2 ML/year (YVC, 2006f). The secure yield was estimated at between 650 ML/year to 1000 ML/year (Yass Dam Yield Study, YVC, 2003).

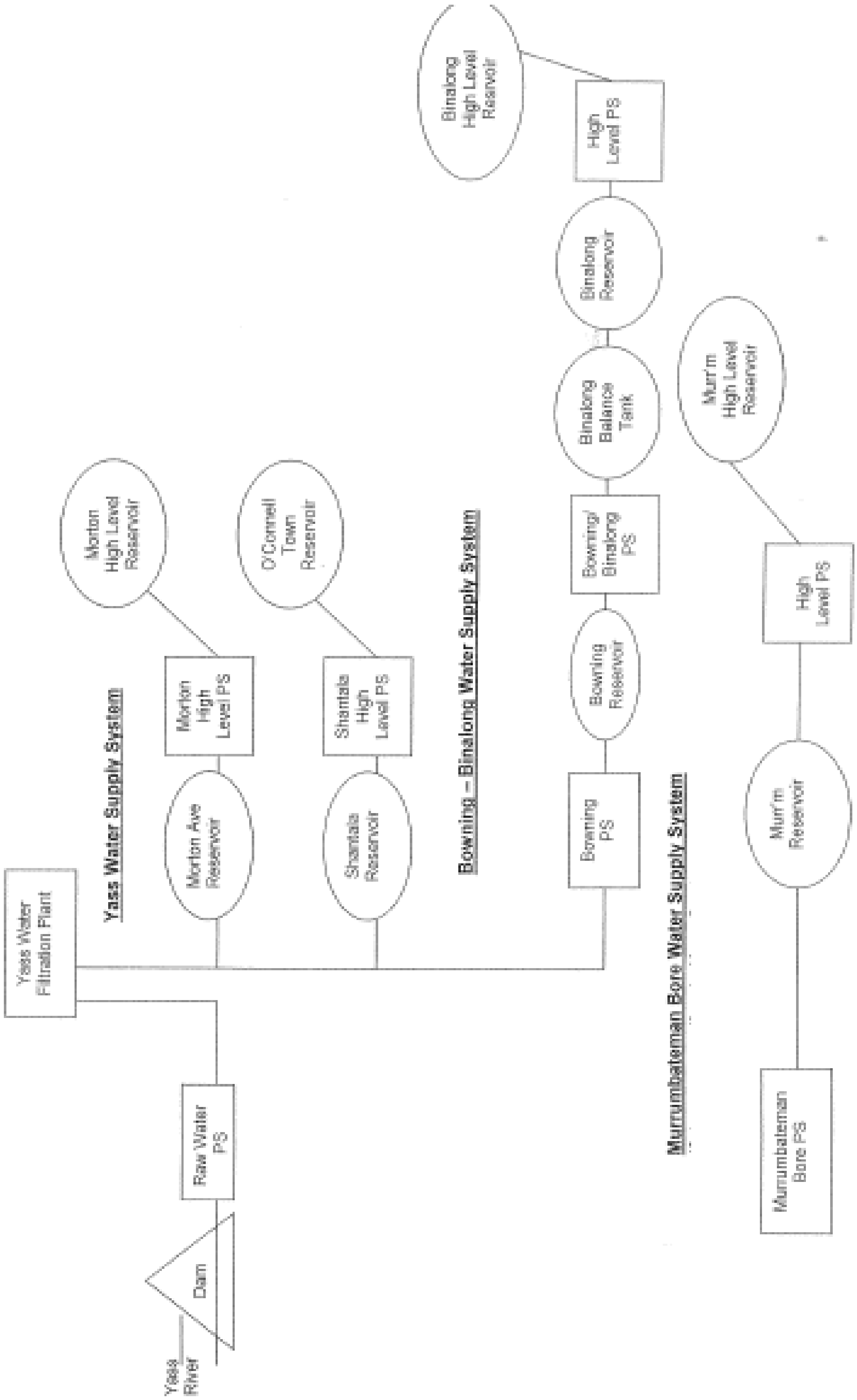
The raw water pumping station is located 300 meters downstream of the dam and pumps raw water from the dam through a 450 mm diameter pipe to the water filtration plant where the water is treated and distributed to the town through a system of pipes and reservoirs. The Yass water filtration plant was first constructed in 1938, and was augmented and modernised in 1990. The plant now has a capacity of 13 ML/day and includes dissolved air flotation and rapid gravity sand filtration. The villages of Bowning and Binalong are supplied with water through a 100 mm rising main that is connected to the Yass reticulated water supply. The pipeline from Bowning to Binalong can currently supply only 75% of peak day demand. When demand exceeds the pipeline capacity, Binalong can use water supplied from Illalong Off-Creek-Storage Dam.

IWCM Issue: Distribution of peak demands to Bowning and Binalong.

The system has 9 service reservoirs, 6 pumping stations, approximately 50 km of trunk mains and 57 km of reticulation (DEUS, 2006). The replacement cost of system assets was $33 M in 2004/05 (YVC, 2006f). **Figure 13** illustrates the Yass Valley water supply system. Energy consumption data for operating the water supply scheme is not available.

Data Gap: Energy consumption data.

Figure 13: Yass Valley Water Supply System.



Source: DSP (YVC, 2004a).

IWCM Issue:
Demand exceeds secure yield.

Due to the implementation of water restrictions, the current average annual water production of the Yass water supply system is approximately 900 ML/year (SBP for water supply, YVC, 2006b), which could potentially exceed the secure yield of the existing headworks (650 ML/year to 1000 ML/year). Further, demand is expected to increase with the population growth the region is experiencing. A future projected annual demand of 2,250 ML in 2021 is reported (Drought Strategy Report, YVC, 2005c).
Drought restrictions, based on daily monitoring of dam levels, are regularly enforced in Yass Valley. In the past few years, restrictions have reached level four and five with a 5 months of level 5 restrictions (recycled water only outside) in 2003.

To improve the level of supply security for the customers of YVC, and to support the growth of the region as a whole, YVC has developed six major options to provide the LGA with a dependable and sustainable supplementary water scheme (Drought Strategy Report, YVC, 2005c).

All six options were assessed in the Drought Strategy Report using Triple Bottom Line (TBL) criteria to help identify the best option for the Yass region. The assessment concluded that the pipeline connection to Burrinjuck Dam (on Murrumbidgee River) at Good Hope (option number 1 in **Table 11**) was the best option.

However, Yass community is concerned about the quality of water at the proposed intake at Good Hope during times of low flow. Initial geotechnical advice does not favour the bore field intake option at Good Hope (YVC, 2006f). Due to these constraints, YVC has decided to undertake further investigation into the following options (refer **Table 11**):

- Option 2 - Pipeline connection to ActewAGL (Googong system);
- Option 4 and 5 - Pipeline connection to the Murrumbidgee River (Childowla, Burrinjuck dam); and
- Option 3 - Pipeline connection to Goldenfields Water (Galong).

Initial discussions with Goldenfields Water indicate a limited supply is only possible (YVC, 2006f).

Further considerations in selecting the preferred option for Yass water supply will include legislative constraints, State approvals requirements, community preferences and environmental issues.

The table in the following page explains the Yass water supply options in order of feasibility and rank as documented in the Drought Strategy Report (YVC, 2005c).

Table 11: Water Supply Options for the YVC.

Option	Description	(ML/ day)	Required Pipe Size (mm)	Estimated Capital Cost ($M)	Estimated Operating Cost ($M) over 20 years	Estimated Net Present Value ($M)
1) Pipeline connection to Murrumbidgee River (Good Hope)	• Extraction through bores at Burrinjuck Dam above the Full Supply Level (FSL). • Water would then be lifted by submersible pumps to a settling tank, then transported by the raw water pumping station to a balance tank where the water gravitates to the filtration plant at Yass.	2 4 10	200 250 375	5.43 6.06 9.14	1.24 1.85 2.19	6.66 7.91 11.33
2) Pipeline connection to ActewAGL (Hall).	• Water is drawn from Googong dam and treated to potable quality at Googong water treatment works. • The supply connection at an ActewAGL trunk main close to Kuringa Road and the Barton Highway at Hall, ACT. • Water will be then pumped by clear water pumping station to a balance tank south of Murrumbateman. • The water will then gravitate to the Yass WTP where it will either be mixed with the Yass Dam water supply or transferred to existing service reservoirs.	2 4 10	200 250 375	9.31 10.28 14.84	0.66 0.90 0.86	9.97 11.17 15.70
3) Pipeline connection to Goldenfields (Galong)	• Goldenfields Water County Council (GWCC) sources their water from the Murrumbidgee River at Jugiong where it is purified. • Proposed route from Jugoing to Yass would be via trunk mains at Galong, approximately 47.7 km northwest of Yass. • The water will travel from Galong to a booster pumping station located at Aurville, 20 km from Galong. From here it will be pumped to the Yass Water Treatment Plant.	2 4 10	250 250-300 375	10.08 11.37 16.04	1.00 1.48 1.60	11.08 12.84 17.64

Option	Description	(ML/ day)	Required Pipe Size (mm)	Estimated Capital Cost ($M)	Estimated Operating Cost ($M) over 20 years	Estimated Net Present Value ($M)
4) Pipeline connection to Murrumbidgee River (Childowla) via Hume Highway	• From Childowla the water is pumped to a balance tank near Talmo. • Water will be then pumped to a balance tank at Conroys Gap via Childowla Road to Bookham to the Hume Highway. • From Conroys Gap the water will gravitate towards the Yass WTP parallel to the Hume Highway.	2 4 10	200-250 250-300 300-450	12.18 13.38 18.87	1.96 3.77 4.06	14.14 17.14 22.92
5) Pipeline connection to Murrumbidgee River (Childowla) via Black Range Road	• This option is a variation from option 4. • Rather than following Childowla Road to Bookham to the Hume Highway, this route parallels the power easements towards Yass. • From Talmo the piping will fallow the 132kV powerline to a balance tank where it then gravitates following the 330kV powerlines to Black Range Road. • The water continues to gravitate on Black Range Road to the Yass WTP.	2 4 10	150-250 200-250 300-375	11.79 12.95 18.39	2.17 2.94 3.35	13.96 15.89 21.64
6) Yass Dam wall raising with a larger on-stream storage	• Raising the Yass Dam wall up to 5.0 m • This would require large scale infrastructure works including, raising reinforced concrete crests by dowelling them to the existing structure, raising a concrete crest in combination with a beam over the full length of the dam, concrete gravity blocks on both abutments, raising of access platform and outlet pipe, the acquisition of the inundated or affected lands upstream.	**Raising (m)** 1.5 3.0 5.0	**Storage Increase (ML)** 340 700 1,170	**Cost Estimate ($M)** 2.2 6.2 10.4	**$/kL** 6.47 8.86 8.89	

Source: Emergency Drought Relief Strategy (YVC, 2005c).

Water Supply Quality

Community feedback has indicated that a large number of Yass residents are dissatisfied with the water quality and the concentration of total dissolved solids (TDS) and total hardness which frequently exceeds the ADWG. As a result, YVC conducted a softening trial in 2004 to help minimise the TDS by pre-dosing with lime and soda ash. Although the process created excess sludge it received good community feedback. Options are currently being considered to determine if treating this excess sludge would be economically and environmentally feasible.

IWCM Issue: Supply water qualities do not always comply with ADWG.

Hardness and turbidity are also a source of concern for Yass LGA residents. Hardness is caused by naturally occurring high levels of calcium and/or magnesium. The levels vary from 50 mg/l to 450 mg/l in the Yass River depending on the amount of rainfall, time of year and flow of the river. Levels of hardness that exceed 200 mg/l are considered to be of marginal to poor quality by the YVC. High turbidity levels occur only when water from the Yass dam turns over during February-March exceeding the chemical parameters of the ADWG (YVC, 2006f). Although they do not pose a health threat they do affect the taste and aesthetics of the water. A summary of Yass ADWG compliance is presented in the following table.

Table 12: Water Quality Compliance with ADWG.

Criteria	Percentage compliance		
	2002/03	2003/04	2004/05
Chemical	100%	98%	100%
Microbiological	94%	95%	96%

Source: DEUS (2005, 2006).

Water Consumption

Average annual consumption per connected residential property in Yass Valley is 195 KL as of 2004/2005, which is less than state median of 200 KL. However, water restrictions were in place for this year. Average annual consumption was 204 kL per connected property in 2003/04.
Water consumption figures for each of the water supply systems are presented in **Table 13**.

Table 13: Overall Reticulated Water Usage in Yass, Bowning and Binalong from 2000 to 2005.

Year	Location		
	Yass	Bowning	Binalong
	Consumption ML/year		
2000	917	42.3	61.5
2001	989	43.8	74.4
2002	873	36.6	63.1
2003	638	24.7	55.7
2004	731	23.8	70.1
2005	709	34.5	80.5

Source: Water usage and new water connections 1996 – 2005 (YVC, 2005d).

IWCM Issue: Water security identified as an urgent issue.

Data Gap: Limited consumption database customer categories.

Long term water security has been identified as one of the major challenges facing the YVC. Urban and rural growth causing higher demand for water consumption and water extraction is limited by head works capacity.
In addition, new surface water sources within the LGA are limited as five of the eight unregulated subcatchments within the LGA are considered to be under high hydrological stress, implying that demand for water already equals or exceeds supply (Supplementary SoE, YVC, 2004b).

Current consumption database divide customers into residential, commercial, farmland and non rate-able, limiting end use analysis. It would be more effective to have a more detail breakdown of customer categories including, industrial, motels, caravan facilities, schools, hospitals and nursing homes.

Table 14 shows the total water consumption of the LGA by category.

Table 14: Water Consumption in Yass LGA.

Category	Consumption ML/year (in 2004/05)
Single Residential	516
Commercial	100
Bulk Sales	6
Public Parks & Gardens	36
Leakage	100
Recycled Water (Agriculture and others)*	178
TOTAL	**936**

*Yass STP recycled 178 ML treated effluent to irrigate land adjoining to the STP due to insufficient flow in Yass River for required dilution in certain months.
Source: Data provided by Siva Sivakumar of YVC over telephone from DEUS Performance Monitoring Database and written comment from YVC (YVC, 2006f).

If the new STP produces high quality effluent, then all treated effluent will be discharged to river instead of present recycling for agricultural purposes mentioned in **Table 14** (YVC, 2006f). This will enable the Council to implement indirect treated effluent reuse schemes.

Increased water extraction and drought conditions have caused the YVC to implement various water conservation measures over the past 15 years. When necessary the Council has also applied water restrictions during periods of drought. A timeline of YVC's conservation efforts is presented below in **Table 15**.

Table 15: Water Efficiency Program Activities since 1990.

Year	Water Savings Action Undertaken
1990	Council begins a water main replacement scheme and replaces approximately one km of water mains annually.
2002	Comprehensive restriction policy enforced.

Year	Water Savings Action Undertaken
2003	New Houses fitted with rainwater tanks. New houses fitted with triple-A water saving shower heads and dual flush toilets. $200 subsidy for fitting new water tanks to existing houses that are connected to the town water supply. Shower flow regulations provided to increase efficiency of existing showers. Implemented water restrictions (five months of level 5 restriction). Investigated potential to supplement Yass Dam with groundwater supply
2003/04	Council introduces a two-part tariff system (an availability charge and usage component).
2004	Council limiting development to 20 new connections per year for the next 5 years.
2005	YVC conducted a water meter survey to pinpoint all defective meters.

Source: Emergency Drought Strategy, (YVC, 2005c) and State of the Environment, Supplementary Report (YVC, 2004b).

YVC implemented a user pays system for water consumption to help preserve town water resources. The user pays system has two main components, a water availability charge and a water consumption charge. The water availability charge is determined by the size of the water meter and is generally charged per meter. The water consumption charge is $1.15 per 1000 litres water used as of 2005/06. However there are some community facilities in Yass that receive discounted rates such as churches, Yass hospital and St Vincent de Paul.

Best Practice Management

Best-Practice Management (BPM) of water supply and sewerage enables communities like Yass to manage their water supply efficiently and sustainably. BPM uses a triple bottom line process that involves social, environmental and economic considerations to determine the best management strategy. In 2003/04 and 2004/05 YVC completely satisfied the BPM requirements for their town water supply. This is discussed further in Section 3.1.3.

Table 16: Water Supply: Outcome for 6 BMP Criteria.

Year	Complete SBP (1)	Pricing with full cost recovery (2)	Complying residential charges. (2a)	Complying non-residential charges (2b)	DSP (2c)	Complete performance reporting form (3)	water conservation (4)	Drought Management (5)*	IWCM (6)
03/04	yes	yes	yes	yes	yes	yes	yes	yes	In Progress
04/05	yes	yes	yes	yes	yes	yes	yes	yes	In Progress

Note: * Drought management best-practice criteria is achieved only through various levels of restrictions (YVC, 2006f).
Source: NSW performance monitoring report (DEUS, 2005 and 2006).

2.4.2 Sewerage Services

Yass is the only town within the LGA served by a reticulated sewerage system. The system consists of gravity pipes, seven sewage pumping stations (SPS) and a sewage treatment plant (STP). The Yass STP treats sewage from the town of Yass and receives septic tank effluent from throughout the LGA via septic tank pump outs. Yass STP characteristics are summarised in **Table 17**.

Table 17: YVC STP Treatment Type and Design Capacity.

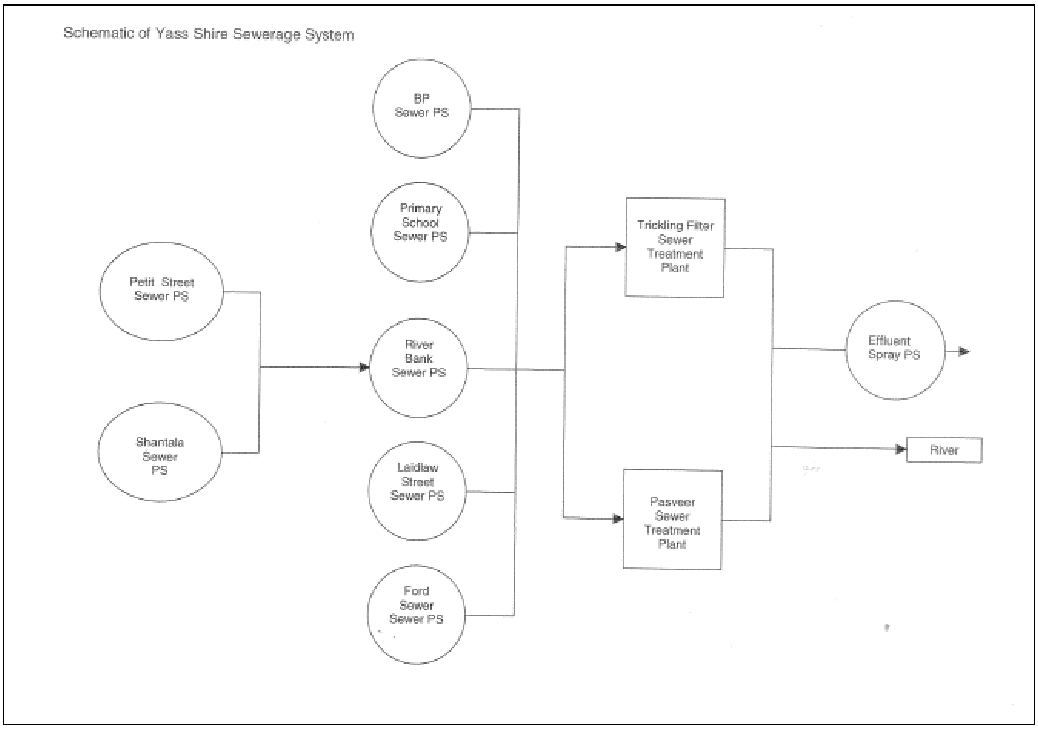
STP	Treatment Types	Design Capacity-Equivalent Population (EP)
Yass	Trickling Filters Extended Aeration (Two Pasveer Channels)	3,500 4,000 (2 X 2,000)

Source: SBP for sewerage (YVC, 2006c)

Data Gap: Energy consumption data.

The Yass STP was constructed in 1935 as a trickling filter system that had a capacity of 3500 EP. In 1982 the STP was upgraded and twin 2000 EP Pasveer Channels were added. Historically, almost all discharge flowed into the Yass River until an onsite effluent reuse system was established in 1987. YVC is currently investigating various effluent reuse schemes with the remaining effluent discharged into the Yass River via Banjo Creek. **Figure 14** illustrates Yass Sewerage System. Energy consumption data for operating the sewerage scheme is not available.

Figure 14: Yass Valley Sewerage System.



Source: DSP (YVC, 2004a).

The LGA is currently in the process of designing and installing a new treatment plant to replace the trickling filter system. The new system would operate using existing Pasveer channels as stormwater outflow. This will improve the quality of discharged effluent as well as operate at a higher capacity. A new extended aeration plant is proposed with a capacity of 6,800 EP.

Concerns about discharge to Yass River have caused YVC to create an effluent reuse scheme adjacent to the treatment works. This system is responsible for the irrigation of 40 ha of agricultural land during the summer months and distributes up to 40% of the treated effluent onto these lands. Other effluent reuse schemes that are in the process of being implemented or considered include irrigation of recreation grounds, the local golf course and new urban subdivisions. Present planning includes:

IWCM Issue: Proper management of excess effluent.

- Victoria Park, currently using 10 ML / year of river water;
- O'Connor Park, currently using 10 ML / year of river water;
- Golf Course, currently using 100 ML / year of river water; and
- Walker Park, currently using 40 ML / year of town water.

All river water extractions for the above three playing fields are located downstream of Yass dam. Only Walker Park uses treated water.

Yass Valley has no significant industrial discharges and hence effluent quality is generally free from toxic substances.

The villages of Bowning, Binalong and Murrumbateman are not currently serviced by a collection/transport system. These villages rely on a variety of on-site-sewage treatment and management systems. They use septic tanks, trench absorption systems, waterless composting systems and wet composting systems. The on-site sewage treatment systems were inspected in 2000 and given hazard ratings to identify areas for upgrade. There are approximately 2,400 locations within the LGA that are recognised users of on-site sewage treatment systems. A new inspection program regime is currently being programmed.

There is a plan to implement sewerage scheme for Bowning, Binalong and Murrumbateman in next 10 years (Sewerage SBP, YVC, 2006c).

The performance of absorption trenches in these villages is insufficient during wet weather. Poor absorptive qualities of the soil are the main cause of surcharges from absorption/evaporation trenches. The YVC is considering various strategies to manage the sewage. These include (YVC, 2004b and YVC 2006f):

- Centralised off-site treatment and effluent management;
- On-site treatment and off-site effluent management; and
- On-site effluent management.

IWCM Issue: Selection of most appropriate on-site wastewater management

After the on-site sewage treatment systems inspection in 2000, there was no follow up audit.

YVC is considering the implementation of an affordable sewerage system for the townships of Bowning, Binalong and Murrumbateman to reduce any adverse health and environmental impacts caused by the current on-site-sewage treatment and management systems.

Best Practice Management

According to the DEUS 2004/05 NSW performance monitoring report, Yass STP was 100% compliant with licence for BOD and SS.

The table below represents sewerage Best Practice Management compliance for Yass between 2003/04 and 2004/05. This is discussed further in Section 3.1.3.

Table 18: Sewerage: Outcomes for 4 BMP Criteria.

Year	Complete SBP (1)	Pricing with full cost recovery(2)	Residential charges. (2a)	Non-residential charges (2b)	Trade Waste Fees (2c)	DSP (2d)	Liquid Trade Waste (2e)	Performance Reporting (3)	IWCM (4)
03/04	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	In Progress
04/05	Yes	No*	No*	No*	No*	Yes	Yes	Yes	In Progress

Note: * These criteria have since been achieved (YVC, 2006f).
Source: NSW performance monitoring report (DEUS, 2005 and 2006),
Sewerage SBP (YVC, 2006c).

IWCM Issue: Failed to meet all criteria.

2.4.3 Stormwater

The Yass Valley LGA has a drainage network servicing urban areas consisting of kerb and guttering, pipes, surface flows, grass swales and natural drainage lines. The system discharges urban stormwater to Chinamans Creek, Golf Course Creek and the Yass River. The removal of stormwater ensures that the risk of flooding in urban areas is reasonably minor during periods of high rainfall events. However stakeholders have identified local deficiencies in the stormwater network including areas that have traditionally flooded and caused erosion (YVC, 2001 and YVC, 2006f). Stormwater from the urban areas generally receives limited treatment and can lead to the pollution of receiving waterways. However, water quality of dry and wet weather river flows, contaminant load and discharge volume are not available.

Data Gap: Limited data on dry and wet weather flow.

In order to counteract increased stormwater flows from urbanisation, the YVC has established a set of stormwater objectives specifically for new development. These objectives were defined to help decrease the occurrence of sedimentation and other pollutants from entering the waterways.

YVC prepared an Urban Stormwater Management Plan (SMP) in 2001 to meet the requirements set out by the DEC to effectively manage the impact of stormwater on aquatic ecosystems, public health and amenity. The SMP covers the town of Yass only.

IWCM Issue: Erosion contributing to sedimentation of the waterways.

The SMP assessed catchment conditions and stormwater issues in the LGA. It found that erosion was an identified problem, contributing fine and coarse sediments to the waterways and that the impacts of agriculture included addition of nutrients. Other issues identified in the SMP were trade waste, weed infestation, stormwater infrastructure, litter, degraded riparian habitat, changed flows and the designation of "hot spots". "Hot spots" are specific locations within the catchment that have a high chance of affecting stormwater discharges or being affected by them. The causes of these impacts were many and varied but the most often reported cause was development for residential, industrial and commercial uses.

Measures to improve the situation have involved the development of stormwater management objectives that outline short and long term actions that incorporate ecological, social and economic values. To help arrest impacts on water quality from development the YVC now implements stormwater management consultation throughout the planning, construction and the post construction phases of development. Educational measures have also been implemented including information and procedures for construction sites and Council practices, business auditing and community awareness programs.

The village of Murrumbateman has a relatively small stormwater drainage system that is comprised of underground concrete pipes, table drains and natural drainage lines which eventually drain into Murrumbateman Creek. The village has defined specific deficiencies with the current stormwater system including poor first flush water quality and isolated areas of waterlogging due to the incomplete drainage network. With the exception of Murrumbateman, none of the villages in the LGA have significant stormwater drainage infrastructure. YVC is currently developing strategies to minimise the stormwater deficiencies in the villages.

Data Source: YVC (2004b), SMP (YVC, 2001), DPWS (undated).

2.5 Adequacy of Data

Following the review and compilation of available information, a gap analysis was undertaken to identify those areas where critical information for developing an IWCM Strategy is missing or otherwise deficient. The DEUS data audit sheet was used to identify these gaps (App I, DEUS, 2004a). A copy of the audit conducted for YVC IWCM Study is provided in **Appendix C**. The areas of missing or inadequate data will need to be managed as part of the IWCM Strategy development process.

Table 19 is a summary of critical data gaps and possible measures to fill the gaps. These are to be collected prior to the first review of the IWCM strategy.

Table 19: Data Gap Analysis.

Section Reference	Data Gap	Measures to Remedy Gap
2.4.2	Limited data on on-site sewerage management (location, condition, pump out, etc.)	Review the audit of 2000 and program on-site assessment in unsurveyed areas, particularly Gundaroo and Sutton.
2.3.2	Limited groundwater quality data at Yass	DNR to devise a tracking set up
2.4.1 and 2.4.2	Energy consumption for WTP and STP	YVC to devise a tracking set up

Section Reference	Data Gap	Measures to Remedy Gap
2.3.1	Water quality at dam	Develop and implement monitoring program in conjunction with YVC's Environment Section.
2.4.3	Water quality of dry and wet weather river flows, contaminant load and discharge volume	To be determined as part of Yass STP investigation
2.2.5	Details of pollution discharge status from activities under POEO Act.	Design and implement catchment quality management
2.4.1	Water Consumption database customer categories. (Current records divide customers into business, residential, farmland and non ratable, limiting end use analysis.)	Review the customer database and include a more detailed breakdown of customer categories including: industrial, motels, caravan facilities, schools, nursing homes and hospitals.

3 What Are The Issues?

The purpose of this section is to identify issues within the catchment and urban water cycles. This involves:

- Auditing the available data to identify current and potential future water cycle management issues;
- Discussing the audit results with stakeholders to further clarify issues; and
- Prioritising the identified issues.

Auditing the available information on the water system against relevant policy frameworks and guideline documents is important for understanding how well the system is performing as well as identifying system issues. Issues identification also involves consultation with stakeholders to confirm the issues identified and to prioritise issues so that they can be systematically addressed.

3.1 Audit of Available Data to Identify Issues

Utilising the audit guide provided by DEUS, the audit of available data has been undertaken in three parts:

- Catchment audit;
- Water resource audit; and
- Urban area audit.

In each case, the system has been compared to existing policy and guideline frameworks which set objectives for system performance. A summary of the framework utilised is set out in **Table 20**.

Table 20: Audit Frameworks.

Audit Area	Audit Framework
Catchment	DEUS developed catchment icons representing the state wide catchment management policy framework (IWCM guidelines, DEUS, 2004a).
Water resource	DEC NSW Water Quality and River Flow Objectives (DEC, 2006b).
Urban area	DEUS Best-Practice Management Guidelines for LWUs (DEUS, 2004b).

The purpose of undertaking the audit is to identify relevant issues that the IWCM Strategy may contribute to addressing. The results of the audit are set out in the following sections.

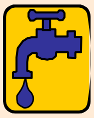
3.1.1 Catchment Audit

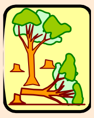
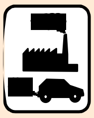
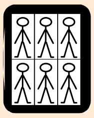
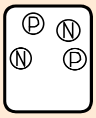
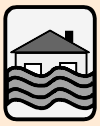
DEUS developed a series of catchment icons to represent the objectives of the NSW catchment policy framework. The information on the catchment system was compared to these objectives, using the descriptors set out in the DEUS IWCM guidelines (see **Table 21**). The results are interpreted as follows:

- Coloured icon: objective is identified as an issue;

- White icon: not enough information available on which to make an assessment; and
- Grey icon: Objective is not identified as an issue.

Table 21: Audit of the DEUS Catchment Objectives.

Objective	Discussion
Resource Scarcity: 	• Extended periods of no flow in the Yass River. • Current level of surface water utilisation is over 189% the estimated sustainable yield. • Majority of surface water extraction on the Yass River Catchment is from cropping, grazing and irrigation activities. • Current groundwater use in the local government area is well below the estimated sustainable groundwater yield. • Non-sustainable levels of groundwater licence allocation have occurred within rural residential development areas of Murrumbateman and Sutton.
Water Stress: 	• Yass River Upper catchment was found to be under high hydrological and environmental stress level due to rural residential development, rural dams and salinity. • The lower catchment area was categorised under low hydrological but high environmental stress due to town sewage (from Yass STP), the presence of weirs and salinity. Town water is drawn from the lower catchment. • The Burra-Googong, Jugiong and Murrumbidgee II River subcatchment areas were also in the high stress categories. The reasons that Burra-Googong has high stress level are over extraction, rural residential and urban pressure, and fish passage. Jugiong has issues related with cropping and salinity. The Murrumbidgee II obtained the highest category due to its proximity to Canberra and resulting human settlement impacts such as urban runoff, littering, and development. • Although there are two water sharing plans for the Murrumbidgee River, these plans do not cover the study area. There is no specific water sharing plan for the Yass River. • The Upper Murrumbidgee Alluvium and the Murrumbateman Fractured Rocks are classified as high risk aquifers as their level of extraction exceeds their sustainable yield. • Groundwater sharing plans for the Lower Murrumbidgee and Lower Lachlan groundwater catchment areas were prepared and gazetted on February 2003 but deferred until July 2006. No groundwater sharing plans have been prepared specifically for the study area.
Salinity: 	• Extensive land clearing from pioneering times and grazing in the Yass district caused dryland salinity. • Severe salinity problems were identified in various locations, including the Yass River subcatchment area. • High salinity in Yass town water supply. • Dryland and urban salinity accounts about 4% of the catchment area and are attributable to a rising water table or subsurface flow that brings dissolved salts within 1-2 metres of the soil surface and to soil erosion exposing naturally saline sub-soils. • Most groundwater in the LGA is not suitable for drinking due to high salinity.

Objective	Discussion
Acid Soils: 	• Many of the soils in the Yass Valley are very acidic. • A form of ASS has been reported sporadically under irrigation in the Yass Valley associated with dryland salinity and waterlogging. • Specific location of such soils is unknown.
Chemical Cocktails: 	• There are activities within the LGA licensed under POEO act (e.g. Quarrying, various industries) that have the potential to contribute to chemical releases into waterways and the environment. However, it has been identified as an issue as there is not enough information from which to make an assessment.
Soil Erosion: 	• Land clearing, including the loss of riparian vegetation, and agricultural uses including cattle grazing and cropping accounts for 81% of the catchment area land use, and results in sheet and gully erosion and dryland salinity. Frequent high turbidity is observed in the Yass River after significant rain events.
Deforestation: 	• About 72% of the original vegetation in the riparian zone has been cleared in the catchment representing an extensive decline in land quality in the past. This adds to the potential for soil erosion and impacts on water quality.
Greenhouse Gases: 	• Due to a lack of data, no assessment was made on the greenhouse impact of Yass. However, climate modelling predicts the region is likely to be affected by significant temperature increases and reductions in rainfall by the year 2030 due to climate change.
Monodiversity: 	• The majority of land in the catchment area is used for grazing (78%). Detailed information is not available about crop patterns or invasion of exotic plant species.
Algal Blooms and Nutrients: 	• Periodic occurrence of algal blooms has been recorded on the Yass Dam. Testing has confirmed that it is not a toxic variety (YVC, 2006f). • Nitrogen concentrations at Yass township often exceed recommended guidelines for ecosystem health. Likely sources of nitrogen are from grazing animals and to a lesser extent, over-application of fertilisers.
Flooding: 	• Flooding is not expected to be an issue. The last major floods registered were in 1894 and 1925 but since then streams in the Yass valley area have been highly modified resulting in reduction in the potential for flooding.

IWCM Issue: Issues identified through catchment audit are, resource scarcity, water stress, salinity, acid soils, soil erosion, and deforestation. Assessments were not possible for chemical cocktails, greenhouse gases, monodiversity and algal booms and nutrients.

3.1.2 Water Resource Audit

Ambient water quality assessment was undertaken systematically to clearly identify water quality issues and was based on *Interim Water Quality Objectives (WQO)* defined for *Murrumbidgee River and Lake George* catchment (DEC, 2006b). The objectives were developed in a whole of government process lead by the NSW DEC (then, the EPA). Objectives were developed through extensive community consultation and are intended to assist resource managers in assessing and setting targets for environmental values. Each of these objectives is defined by a series of icons representing an identified environmental value with associated water quality indicators defined by the Australian and New Zealand Environment and Conservation Council (ANZECC). However, it should be noted that this study was based on the available data and was restricted in its capacity to fully analyse water quality within the specified locations.

In total, there are eleven WQOs that provide reference levels to guide water quality planning and management. The objectives consist of three parts, environmental values, their indicators, and their numerical criteria. Environmental values outline values and beneficial uses of the environment that are important to a community. The primary contact recreation environmental value for example, includes swimming or any activity with a likelihood of water being swallowed. The indicators provide a measurement of specific environmental trends while the criteria provide the framework for measuring how close current water quality is to meeting the desired levels. For the purpose of this assessment only quantifiable indicators were used.

The WQOs used for the water resources audit were: aquatic ecosystem protection, visual amenity, primary contact recreation, secondary contact recreation, aquatic foods (cooked), livestock, irrigation, drinking water, and homestead. The environmental values, indicators and their numerical criteria are show in **Table 22**.

Table 22: WQOs used in YVC Water Resources Audit.

Environmental Value	Indicator	Numerical Criteria
Aquatic Ecosystem Protection	Total Phosphorous (TP)	<0.20 mg/L
	Total Nitrogen (TN)	0.1 – 0.75 mg/L
	Turbidity	<5 NTU
	Salinity	<1500 S/cm
	Dissolved Oxygen (DO)	>6mg/L
	pH	6.5-9
Visual Amenity	Not applicable	Not applicable
Primary Contact Recreation	Faecal Coliforms	<150cfu/100 mL
	Enterococci	<35 eu/100mL
	Algae & Blue Green Algae	<15000 cells/mL
	Temperature	15-35 C
	pH	5-9
	Turbidity	<6NTU
Secondary Contact Recreation	Faecal Coliforms	<1000cfu/100mL
	Algae & Blue Green Algae	<15000 cells/mL
	Enterococci	<230 eu/100mL

Environmental Value	Indicator	Numerical Criteria
Aquatic Foods (Cooked)	Faecal Coliforms	< 14 cfu/100mL
Livestock	Faecal Coliforms	< 1000 cfu/100Ml
	Algae & Blue Green Algae	<10000 cells/mL
	Salinity	<3000-9000 S/cm
Irrigation	Faecal Coliforms	< 1000 cfu/100Ml
	Salinity	<280 S/cm
	pH	4.5-9
Drinking Water	Salinity	Salinity <1500 S/cm
	Faecal Coliforms	0/100mL
	Dissolved Oxygen (DO)	>6.5 mg/L
	pH	6.5-8.5
Homestead	Turbidity	<5NTU
	Total Suspended Solids (TSS)	<500 mg/L
	Faecal Coliforms	0/100mL
	pH	6.5-8.5

Source: Interim Water Quality Objectives (DEC, 2006b)

As an environmental value is represented by a group of water quality indicators, all indicator criteria must be met for that environmental value to be considered protected. The extent to which the value was considered protected was ranked from very poor to good, based on the percentage of samples where the indicator criteria were met (see **Table 23**). The sample records generally only had results for basic water quality indicators such as (TN, TP, DO, pH, water temperature and total faecal coliforms). However, in some instances even these basic water quality indicators were not available or sample numbers were too low. The assessment of the protection of the environmental values is therefore limited. Where sufficient information is currently unavailable to assess criteria, the icons are presented in black and white.

Table 23: Ranking of Environmental Values.

Ranking	Lower Limit	Upper Limit	Icon Colour
Good	75%	100%	Green
Fair	50%	74%	Yellow
Poor	25%	49%	Orange
Very Poor	0%	24%	Red
Insufficient Data	-	-	Black and white

Surface Water

Table 24 shows the water quality gauging stations that were used to perform the Yass water quality assessment. The majority of the gauging stations are located on the Yass River, however there are three stations located on the Goodradigbee River and two located on the Murrumbidgee. Together, these locations represent the larger catchment area and provide a general assessment of water quality within the catchment with a focus on Yass River.

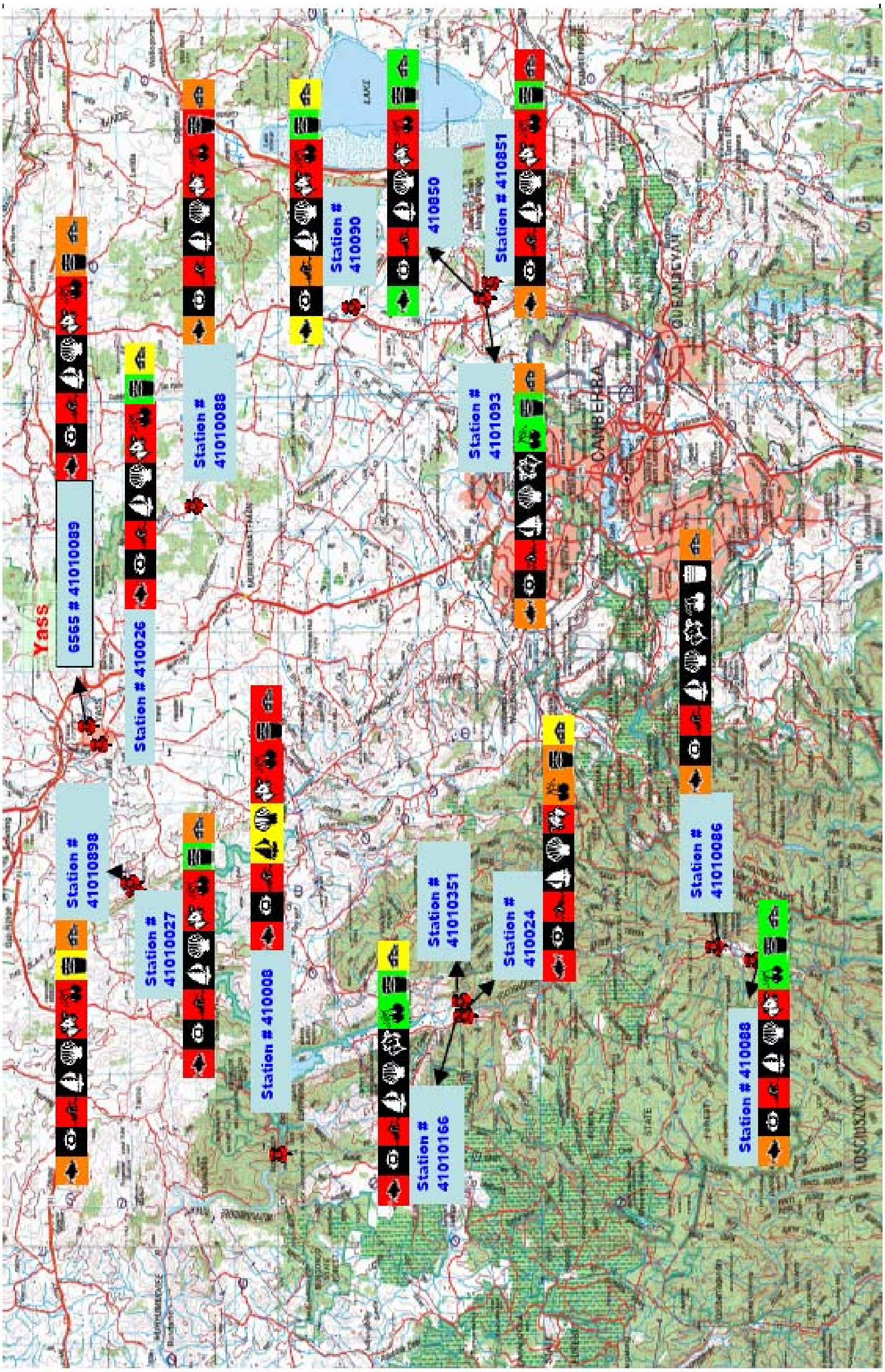
In most instances, the gauging stations were not able to provide all of the data that was required for the water quality assessment. For instance, station 410024 supplied TP but not TN. Some gauging stations provided very little data and these were generally left out of the assessment. However there were also stations that sampled many of the indicators required for the assessment. Although the available water quality data varied from station to station, the data as a whole identified the water quality issues.

Table 24: Water quality Gauging Stations.

Station Number	Location
41010027	Yass River @ Burrinjuck Dam
410851	Yass River @ Above Macs Reef Road
410090	Yass River @ Gundaroo
410850	Yass River @ Macs Reef Road
41010093	Yass River @ Macs Reef Road Bridge
41010898	Yass River @ Riverview
41010089	Yass River @ Yass Weir
41010088	Yass River @ Elizabeth Field
410026	Yass River @ Yass
41010086	Goodradigbee River @ Brindabella
410088	Goodradigbee River @ Brindabella No 2 and No 3 Cabbans
41010166	Goodradigbee River @ Swing Bridge Reserve
410024	Goodradigbee River @ Wee Jasper
41010104	Murrumbidgee River @ Island Bend
410008	Murrumbidgee River @ Burrinjuck Dam

The results of the assessment of surface water data are graphically set out in **Figure 15**. Details of the data used to undertake the assessment can be found in **Appendix C**.

Figure 15: Water Quality Sampling Sites and Environmental Indicator Results.

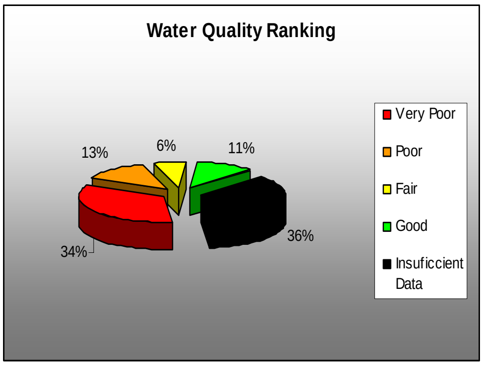


The following table shows the water quality parameters that contribute to the poor results in environmental values.

Table 25: Location Specific Major Water Quality Issues.

Audit Area	Major water quality issues
Yass River above Yass: Stations 41010088, 410090, 410850, 410851	Turbidity, salinity, dissolved oxygen and total suspended solids
Yass River, Yass Town: Stations 41010089 and 410026	Turbidity, high phosphorous, and high levels of salinity
Yass River below Yass: Stations 41010898 and 41010027	Turbidity, high phosphorous, nitrogen, and salinity
Murrumbidgee River: Station 410008	Turbidity, high levels of Chlorophyll, total Phosphorous, total nitrogen, and faecal coliforms
Goodradigbee River: Stations 41010166, 410024, 41010086, 410088	Turbidity, chlorophyll, total phosphorous, and salinity

The adjacent figure shows a total water quality ranking for the study area. The most prevalent water quality ranking is 'very poor' indicating the need for water quality improvement strategies.



General Water Quality Trends within the Assessment Area:

- Almost every station within the assessment area had poor or very poor rankings for aquatic ecosystem protection, primary contact recreation, irrigation and livestock and the causes can be attributed to total nitrogen, total phosphorous, chlorophyll, salinity and turbidity.
- For every station, there was generally insufficient data to determine the rankings for Visual Amenity, Secondary Contact Recreation, and Aquatic Foods (Cooked) because most of the gauging stations did not have data for faecal coliforms, algae and blue green algae, and enterococci.
- Drinking Water and Homestead Water Supply tended to vary from good to very poor throughout the assessment area.
- The three Environmental Values that used turbidity as an indicator, Aquatic Ecosystem Protection, Primary Contact Recreation and Homestead Drinking Water, in general, had readings of poor and very poor. Although turbidity is not generally a major health concern, high levels of turbidity can interfere with disinfection and/or provide a medium for microbial growth. Factors that generally contribute to turbidity are soil erosion, urban runoff, high flows, wastewater and septic system effluent, algal blooms and flooding.

IWCM Issue: Major water quality issues identified through water resources audit are, turbidity, salinity and phosphorus.

In general, the assessment area seems to show similar water quality traits with clearly defined trends. It is clear that when applying the ANZECC 2000 guidelines and the Interim Water Quality Objectives to this catchment area, much of the water system seems unhealthy.

Groundwater
There was no water quality information for the groundwater resources across the LGA.

3.1.3 Urban Area Audit

The Yass Urban Area Audit was undertaken in two parts:

- A preliminary environmental assessment of existing urban area impacts on the quality of the water resource; and
- An audit against DEUS Best-Practice Management Guidelines (DEUS, 2006b).

Environmental Impact of Urban Area
As detailed in **Appendix C**, desktop estimates of nutrient loads from urban water discharges (treated effluent and stormwater – but not the unmeasured impact of sewer overflows) were calculated. Stormwater quality was estimated using a catchment runoff coefficient of 30% and assumed average levels of Total Phosphorus and Total Nitrogen of 0.7mg/L and 1.0mg/L respectively based on data from the Yass Stormwater Management Plan (YVC, 2001) and other studies into stormwater pollutant concentrations in Sydney. The stormwater loads would be heavily influenced by these assumptions.

Sewage loads were estimated from monitored discharge quality and are more reliable than the stormwater estimates.

These estimates are summarised in **Table 26**, which demonstrates the significance of urban discharges on the total loads of nutrients in the river system. This is consistent with the findings presented in the water resource audit (refer **Section 3.1.2**).

Table 26: Estimated Nutrient Loads from the Urban Area of Yass.

Parameter	Stormwater (kg/year)	Sewage (kg/year) in 2004/05	Total Urban (kg/year)	Yass River (kg/year) in 1993*
Total Nitrogen	1,805	2,873	4,678	NA
Total Phosphorus	1,263	2,790	4,053	16,510

* Based on AQUALM model results, EPA, 1995, adopted from SMP (YVC, 2001)

It should be noted that the nutrient discharges from Yass STP are currently meeting the licence requirements. The licence limitations are 11,835 kg for total nitrogen and 4,734 kg for total phosphorus. The proposed augmentation of the STP will significantly reduce the phosphorus load from the STP.

IWCM Issue: Ambient water quality does not meet all ANZECC criteria.

The limited stormwater quality data in the Yass Stormwater Management Plan (YVC, 2001) indicated that salinity, dissolved oxygen, suspended solids and turbidity parameters all exceeded ANZECC criteria in 1996/97. The location of sampling sites and the frequency of sampling is not known. The Department of Land and Water Conservation (DLWC) has been monitoring the ambient water quality of the Yass River since May 1990. There are three sampling sites but the frequency is not known. The Yass Environment Impact Statement (1999) compared the DLWC data against ANZECC criteria and found that only total nitrogen and suspended solids exceed the criteria (YVC, 2001).

DEUS Best-Practice Guidelines
YVC achieved high compliance with guidelines for both drinking water and sewage discharges and recorded few complaints about water qualities and odours. YVC also achieved reduction in unit water consumption. A summary of the performance reported to DEUS is presented below.

Average annual residential water consumption for Yass is 195KL per year per connected property in 2004/05, below the state average of 200kL. This is a significant decrease from the previous year when it was reported as 204 KL/year and is a result of the restrictions imposed during 2004/05.

IWCM Issue: Low water consumption and decreasing trend.

Typical residential bill in 2005/06 for water supply is $421 per assessment. It decreased from $401 per assessment in 2003/04 to $386 per assessment in 2004/05 and again increased to the present level mainly due to an increase in access charge and usage charge in that period. Sewerage bills have risen steadily from $355 per assessment in 2003/04 to $370 per assessment in 2004/05 to $475 per assessment in 2005/06. This is also due to an increase in access charge and usage charge. The combined cost for water and sewerage in Yass is $896 per assessment, which is well above the state-wide median bill of $700 per assessment.

IWCM Issue: High and increasing residential bill for water and sewerage.

Drinking water quality compliance was 96% for microbiological parameters and 100% for chemical parameters in 2004/05. Both are much higher than NSW average.

Water quality and service complaints. Water quality complaints per thousand properties was 3 in 2000/01 but decreased to around 1 for the last 3 years. This is well below the state average number of complaints. However, water service complaints have increased from 2 in 2001/02 to 15 per thousand properties per year in 2003/04.

Sewage odour and service complaints. There was no sewage odour complaint recorded for three consecutive years from 2001/02 to 2003/04. However, 58 sewerage service complaints per thousand properties were recorded in 2003/04. This is well above the state average of 13 and increased from 44 complaints per thousand properties recorded in 2001/02 and 2002/03.

IWCM Issue: Rise in water and sewerage service complaints.

Sewerage licence compliance. Generally most STPs in NSW, including Yass, complied with the BOD requirements. Also, Yass fully complied with its licence requirements for suspended solids in the last 5 years. There were non-compliances related to volume discharged in 2004 (refer **Table 7**).

IWCM Issue: Rise in sewer main chokes due to aging infrastructure and penetration of tree roots.

Sewer main chokes and overflows to the environment. Sewer chokes and overflows have decreased across the state in the past 10 years with a state wide average of 7 overflows and 41 sewer chokes per 100km of mains in 2003/04. In the same year Yass had only 1 overflow per 100km of mains but 83 chokes. The number of overflows is up from zero reported in the two previous years. The number of chokes is up from 62 in the previous year and

IWCM Issue: Increase in operating cost for both water supply and sewerage.

64 in 2001/02. This can attributed to the aging infrastructure and penetration of tree roots.

Operating costs (including depreciation) for water supply per connected property in Yass were $401, $386 and $421 in 2001/02, 2002/03 and 2003/04 respectively, showing an increasing trend. Sewerage operating costs also show similar trends in those three years at $347, $349 and $376. The total operating cost for water supply and sewerage without depreciation in 2004/05 was $601 per connected property, up from $546 in 2003/04, against the state-wide median of $530.

IWCM Issue: Increase in management cost.

Management costs per connected property was $198 in 2004/05 for water supply and sewerage, up from $190 in 2003/05. The state-wide median was $200 in 2004/05.

The discussion above is summarised in the following table.

Table 27: Performance Summary of Yass LWU.

Performance Criteria	01/02	02/03	03/04	04/05	05/06	Sate-wide Median*
Average annual residential water consumption (KL)	-	201	204	195	-	*200*
Typical residential water bill ($/assessment)	-	-	401	386	421	-
Typical residential sewer bill ($/assessment)	-	-	355	370	475	-
Typical residential total bill ($/assessment)	-	-	756	756	896	*700*
Drinking water quality compliance (Microbiological)	-	94%	95%	96%	-	*78%*
Drinking water quality compliance (Chemical)	-	100%	100%	100%	-	*86%*
Water quality complaints (per thousand property)	2	1	1	1	-	*5*
Water service complaints (per thousand property)	2	3	15	-	-	-
Sewage odour complaints (per thousand property)	0	0	0	0	-	*1*
Sewage service complaints (per thousand property)	44	44	58	-	-	*13*
Sewerage licence compliance (BOD)	100%	100%	100%	100%	-	*100%*
Sewerage licence compliance (SS)	100%	100%	100%	100%	-	*100%*
Sewer overflows (per 100 kms of mains)	0	0	1	-	-	*1*
Sewer chokes (per 100 kms of mains)	64	62	83	-	-	*41*

Performance Criteria	01/02	02/03	03/04	04/05	05/06	Sate-wide Median*
Operating cost (water supply per connected property)	401	386	421	-	-	-
Operating cost (sewerage per connected property)	347	349	376	-	-	-
OMA cost without depreciation (total per connected property)	-	533	546	601	-	*530*
Management cost (total per connected property)	-	178	190	198	-	*200*

* Sate-wide median is for the latest year of data availability.
Source: DEUS (2005, 2006), compiled.

Yass LWU is actively working towards achieving each of the six best-practice criteria set out in the DEUS guidelines. Yass LWU's progress is set out in **Table 28**.

Table 28: Summary of Yass Compliance against Best-Practice Criteria.

Guideline Component	Requirements	Compliance
Integrated Water Cycle Management Plan	• Commencement of Concept Study.	Study commenced.
Strategic Business Plan	• Operating environment review; • Asset management plan (operation, maintenance, capital works); • Key performance indicators; • Customer service plan; • Levels of service; and • Human resources plan.	Strategic Business Plan completed.
Financial plan	• A period of at least 20 years; and • The lowest required stable typical residential bill (TRB).	The financial plan is compliant (included in the published SBP)
Tariffs	• Best-practice structures; • No allowance; and • Non-residential sewerage bill with appropriate sewer usage charge per kL.	Tariff structures implemented. Water from 2003/04 and sewer from 05/06 (YVC, 2006f)
Development Servicing Plan	• Commercial developer charges	Development Servicing Plan compliant.

Guideline Component	Requirements	Compliance
Water conservation strategies / Demand Management Plan	• Provides for the outcomes listed in the Best-Practice Management Guidelines.	Water conservation strategies compliant. A framework of demand management plan will be prepared as part of IWCM.
Drought Management	• Provides for the outcomes listed in the Best-Practice Management Guidelines.	Drought Management Plan yet to be completed. However, YVC implements efficient water restrictions.
Performance Reporting	• Lodge forms with DEUS annually.	Performance reporting forms regularly lodged.

3.1.4 Summary of Issues Arising from the Audit

Having undertaken individual assessments of the Catchment, Water Resource and the Urban Area, it is important to draw together, and link where possible the outcomes of those audit processes. By doing so, an integrated set of water resource and urban water service management issues can be identified.

A summary of the issues identified by the audit is set out in **Table 29**.

Table 29: Summary of Catchment, Water Resource and Urban Area Audit Issues.

Audit Component	Issues
Catchment	• Water scarcity is a critical issue. Surface water utilisation in the catchment is above the sustainable yield. • The Upper Yass River sub-catchment was found under the high hydrological and environmental stress level. Other sub-catchments are also under high stress. The main reasons for stress are extraction and salinity. • Extensive land clearing from pioneering times and grazing in the Yass district caused dryland salinity. • Most local ground water has high salt concentrations making it unsuitable as drinking water source. • Many of the soils in the Yass Valley are very acidic. • There are activities within the LGA (e.g. quarrying, various industries) that have the potential to contribute to chemical releases into waterways and the environment. • Traditional land use including land clearing, loss of riparian vegetation, deforestation, and agricultural uses results in poor fertility, soil erosion and dryland salinity. • Climate change may adversely alter the rainfall and temperature patterns in an area where evaporation already exceeds rainfall on an annual basis. • Changing land uses: rural to rural residential, grazing and cropping to viticulture/horticulture. • Alternate source for water supply is required. One potential option is interstate water transfer.

Audit Component	Issues
	• Lack of a water sharing process for the Yass River which is over-allocated. This is potentially threatening security of town water supply.
Water resources	• Water stress as identified in the catchment. • Town discharges (Yass treated sewage effluent) implicated in environmental stress (quality and flow regime disruption). • Town extractions (Yass water supply) implicated in the hydrologic stress. • Surface water quality is poor and being impacted by land uses on acidic, poor fertility and high erosion hazard soils. • Major water quality issues identified are occasional turbidity, salinity, nutrients (total phosphorus) and total suspended solids. Ambient water quality does not protect the identified environmental values for the Yass River. • Difficulty in determining the impact of point source industrial pollution on water quality. • Non-sustainable levels of groundwater licence allocation have occurred within rural residential developments areas of Murrumbateman and Sutton. • Poor groundwater quality: hardness and TDS limiting the potential use of this resource without treatment.
Urban area	• High growth potential of Yass due to proximity to Canberra, facilitation of Sydney-Canberra corridor, and opportunity for industrial and tourism growth. • Poor security of existing supply in terms of historical performance (demands exceeding secure yield) and diversity of sources. • Restrictions impacting on standard of living. • Development capped by lack of water. • Potential need for service extension: sewerage and stormwater services for existing towns. • Distribution of peak demands to Bowning and Binalong. • Poor comparative compliance with drinking water guidelines for total dissolved salts and hardness. • Raw surface water quality for town water supply poor in relation to salinity and TSS. • Groundwater quality for Murrumbateman town water supply is poor in relation to hardness and TDS. • Need for sustainable effluent management. • Need for improved selection and monitoring of on-site systems. • Limited stormwater collection, treatment and reuse. • Stormwater contributing to erosion and sedimentation in Yass. • High operating and management costs giving rise to bills for both water supply and sewerage services above the state median. • Recent rise in water service and sewerage complaints probably associated with an aging infrastructure and rise in sewer main chokes probably due to penetration of tree roots.

3.2 Issues Verification and Prioritisation

To assist in the verification and prioritisation of the issues identified in the IWCM Concept Study process, a project reference group (PRG) was formed by bringing together representatives of Council, state regulatory bodies, Murrumbidge Catchment Management Authority and the community. The issues identified in collating and auditing the data presented in the previous sections were summarised and presented to the PRG in a workshop on the 11th May 2006.

Table 30 lists all of the issues raised by the PRG, 24 in total. In a voting process, PRG participants were asked to identify their top issues. This resulted in 6 issues identified as priority issues.

Table 30: PRG Identified Issues and their Priority.

Priority	Issue
High	Lack of water storage.
	Funding of water supply and sewerage services by the state and federal governments.
	Providing urban water services for existing town and predicted growth, particularly water supply.
	Best use of treated sewer effluent and stormwater resources.
	Water for industry and town growth.
	Poor water quality in the Yass River
Other	Catchment clearing and poor land management in the catchment is leading to sheet and gully erosion which is causing siltation in the reservoir
	Salinity in water and dryland salinity
	Salinity of the town water source
	Increase in rural residential properties is leading to more stress to town dams. It is not clear, but this may be causing increased water competition and stress
	Affordability of reuse activities to end users (golf course)
	High water supply and sewer bills compared to the quality of water supplied
	Limited stormwater collection, treatment and reuse
	Stormwater quality is contributing to water quality issues below Yass Dam
	Rural residential properties have bores, the regulation of which is hard to enforce and it may be causing groundwater stress
	Lack of a water sharing process and information on who should be allowed to take what water and when
	Town water implicated in stress below Yass Dam
	Restrictions leading to reduced standard of living and social impacts in that people cannot have nice gardens and public areas
	Salt, taste and odour (turbidity occasionally) problems in town water supply for Yass, Binalong and Binalong
	Poor fertility soils are leading to fertiliser application which when washed off causes phosphorus issues in the waterways

Priority	Issue
	Murrumbateman groundwater quality is poor in relation to nitrates, hardness, total dissolved salts
	Peak day demand at Bowning and Binalong
	Potential health/management issues with rainwater tanks, septic and greywater sources
	Need for improved septic system selection in rural residential areas

It is important to remember that these issues were identified and prioritised by the PRG only, and are not representative of the wider stakeholder group. Additionally, the wording of these issues is considered indicative only and will be finalised in the Strategy Study. The solutions presented in the subsequent sections are those suggested in the workshop, and are not an exhaustive list of possibilities.

4 Where Do We Want To Be?

The purpose of this section is to identify where YVC wants to be in terms of water cycle management into the future. This involves setting water cycle management objectives based on the issues identified.

As part of the workshop outlined in **Section 3.2**, PRG members identified some objectives for the development and implementation of an IWCM Strategy. These objectives are set out in **Table 31**.

Table 31: PRG Identified Priority Issues, Objectives and Measures.

No	Issues	Objective	Measure
1.	Lack of water storage.	Improved security of water supply both now and into the future.	• Reduced frequency of high level restrictions.
2.	Lack of funding of water supply and sewerage services by the state and federal governments.	Sustainable funding to provide affordable services.	• Available grants realised. • Developers contributing their share. • Change in typical residential water and sewer bills. • Suitable infrastructure provided.
3.	Providing urban water services for existing town and predicted growth, particularly water supply.	*Objectives and measures to address this issue are included in other objectives and measures.*	
4.	Ensuring the best use of treated sewer effluent and stormwater resources.	Improved matching of water demand with available water sources.	• Improvement in meeting Interim Environmental Objectives (IEO) for water quality and quantity. • Change in cost of operating. • Increase in volume of water recycled. • Offset in potable water usage.
5.	Water for industry and town growth	*Objectives and measures to address this issue are included in other objectives and measures.*	
6.	Poor water quality in the Yass River	Improved catchment management practices.	• Improvement in meeting Interim Environmental Objectives (IEO) for water quality and quantity.

5 How Will We Get There?

The purpose of this section is to recommend a process for developing an IWCM Strategy that delivers against the objectives set by the PRG and assists in improving the management of the Yass Valley area water cycle. This involves:

- Examining options for integration; and
- Scoping the IWCM Strategy.

5.1 Preliminary Options

As part of the IWCM Strategy phase, a comprehensive assessment of options to address the issues raised in this Concept Study will be undertaken. However, as part of this Concept Study, some methods of addressing the priority issues raised have been identified. Preliminary assessment of some of these options has been undertaken to test their level of effectiveness in Yass LGA. Preliminary assessment has been conducted only where some additional information is required to develop the scope of works presented in **Section 5.2**. **Table 32** lists the options assessed and describes the results.

Table 32: Some Potential Options.

Issue	Potential Options	Preliminary Assessment
Lack of water storage.	• Storage options as set out in **Table 11.** • Rainwater tanks. • Groundwater. • Treated effluent and stormwater.	Rainwater tanks A simple spreadsheet model (**Appendix A**) was used to assess the effectiveness of rainwater tanks in the Yass area. The model demonstrated that: • Up to 45% of the outdoor and toilet flushing water needs of an individual home could be supplied by a 5,000 L rainwater tank in Yass; • Rainwater harvesting resulted in a 52 kL per year reduction of stormwater flow from this property, which equates to a 66% reduction in runoff; • A 2,000 L tank would supply 35% of the outside and toilet water demands and capture 40 kL per year of stormwater; while a 10,000 L tank would supply 53% of those water demands and capture 62 kL per year of stormwater. Rainwater tanks on new development should be included in bulk supply water modelling options.

Issue	Potential Options	Preliminary Assessment
Providing urban water services for existing town and predicted growth, particularly water supply. Water for industry and town growth.	• Options as described above. • Demand management. • Effluent reuse. • Stormwater reuse.	Demand management Four programs with various management measures were modelled using the DEUS Decision Support System (DSS) model (See **Appendix B** for details). The preliminary cost benefit assessment identified the most effective measures as: • An adjustment of price structure to send a clear price signal; • The regulatory impact of BASIX on new development; • An active program of unaccounted for water (UFW) investigation including leak detection and pressure reduction; and • An education program focussing on outdoor water use.
Ensuring the best use of treated sewer effluent and stormwater resources.	• Effluent reuse. • Stormwater reuse.	Effluent options Preliminary investigation of effluent options highlighted: • Net evaporation exceeds rainfall in Yass. So effluent irrigation activities would be effective; • Depending on the level of treatment achieved, there is still a potential for nutrients to enter the river system from effluent irrigation; • Possibility of dual reticulated supply to the new urban release area located in proximity to Yass STP with effluent/stormwater replacement of potable water; • Open space watering (particularly Yass Golf Course and playing fields), street cleaning, works depot, agricultural, industrial; and • Aquifer storage and recovery of effluent to reduce impact of extractive stress on groundwater aquifer. • Return flows and indirect potable reuse to alleviate hydrologic stress in Yass River.
Lack of funding of water supply and sewerage services by the state and federal governments.	• Grants • Full cost reflective Developer charges. • Groundwater.	No preliminary assessment required to scope strategy phase works.

Issue	Potential Options	Preliminary Assessment
Poor water quality in the Yass River.	• Stormwater quality management. • Improved effluent management. • Improved septic management. • Land use management.	No additional preliminary assessment required to scope strategy phase works.

5.2 Recommended Scope of Works for IWCM Strategy

Drawing on the issues identified and the preliminary assessment of options, a recommended scope of works for the development of the IWCM Strategy is presented in this section.

TASK ONE – Historical demand analysis and forecasting

The development of demand forecasts, informed in part by a historical demand analysis, has been commenced as part of the Concept Study. The purpose of this task is to finalise the draft models developed and further refine the cost-benefit analysis. This task should deliver:

- Establishment of climate corrected water production;
- Determination of peak to average demand
- Finalised indication of unaccounted for water (UFW);and
- Demand analysis report.

TASK TWO – Total water cycle (water, effluent and stormwater) source & needs forecasts

End use analysis with DSS model, an integral part of total water cycle source and needs forecast, has been commenced as part of Concept Study. This task will identify the long term water needs of the Yass water supply area. It will also identify those demands which can be replaced with effluent or rainwater. This task should deliver:

- Population forecast adopted
- Sensitivity testing of demographic data for existing DSS projections;
- Forecast of baseline end use water demand;
- Assessment of various demand management measures and their combination;
- Preliminary cost-benefit assessment of individual demand management measures using DSS; and
- Finalised water efficiency programs using DSS.

TASK THREE - Scenario development

The aim of this task is to develop a range of scenarios demonstrating the economic, environmental and social impact of urban water service integration. This task should deliver:

- Five scenarios highlighting different levels of water system integration starting from a business-as-usual case to a highly integrated case;

- A capital works program and operation, maintenance and administration schedule for each scenario;
- A financial assessment of each of the scenarios developed, utilising FINMOD, and demonstrating the impact of each scenario on the typical residential bills faced by customers;
- An economic, environmental and social (triple bottom line - TBL) assessment of each of the scenarios considering the objectives developed; and
- A workshop with the PRG and other stakeholders to review and evaluate the scenarios.

TASK FOUR - Bulk supply analysis

The purpose of this task is to complete a bulk water supply analysis, utilising WATHNET, if required, to assess the reliability of the existing system and to be able to test management options. This task should deliver:

- Water supply requirements for each of the five scenarios developed;
- An assessment of the safe yield of the existing system; and
- Assessment of the security, reliability and cost of current and future bulk supply.

TASK FIVE – Distribution analysis

The objective of this task is to determine the additional needs of the distribution system for each scenario so that costs can be assessed for the comparison of typical residential bills. If necessary, the Watercad model developed by YVC can be used for this task. This task should:

- Assess the capacity of the proposed systems to deliver water to new and existing developments; and
- Determine any likely infrastructure upgrades required in order to deliver the future supply needs.

TASK SIX – Economic and rate impact analysis

The goal of this task is to quantify the impact of the capital and operating costs of implementing the five scenarios on the customer bill. This task should deliver:

- Estimate costs of structural measures;
- Estimate costs of non structural measures;
- Estimate typical water and sewerage bills by scenario utilising FINMOD;
- Include a financial plan for future SBP preparation;
- Provide a sensitivity analysis for interest rates and lower growth; and
- Adjust the previous DSS model for revised capital works program.

TASK SEVEN – Community consultation

The key feature of the IWCM is to engage the community, council and other stakeholders in the planning process. Community consultation successfully provided valuable input into the Concept Study. One more workshop will be held to finalise scenario development and finally a broad community consultation workshop will be held to explain the IWCM strategy. This task should deliver:

- Briefing material for the workshop including summary of first round of workshop, draft bundled options and TBL criteria;
- A workshop to identify preferred scenario based on finalised TBL criteria (to be carried out as part of task number three);
- A workshop report to Council;
- Material for public meeting; and
- A brief report outlining the results of the public meeting.

TASK EIGHT – IWCM Strategy Report

The target of this task is to prepare a strategy document, identifying the preferred scenario for implementation that can be used by YVC to improve the management of the water cycle. This task should deliver:

- A draft report for review; and
- A final IWCM Strategy report incorporating collated comments from Council and DEUS.

6 References

ACT 2004, State of the Environment Report: Water Use in the Yass LGA, (http://www.envcomm.act.gov.au/soe/soe2004/YassValley/wateruse.htm)

Australian Bureau Statistics (ABS) 2006a, Census Data Yass LGA and Yass Urban Centre, http://www.abs.gov.au/ausstats/abs@cpp.nsf/DetailsPage/UCL1872002001?OpenDocument&tabname=Details&prodno=UCL187200&issue=2001&num=&view=&#Basic%20Community%20Profile

Australian Bureau of Statistics (ABS) 2006b, Regional Population Growth, Australia, 2004-05, http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/3218.0Main%20Features22004-05?opendocument&tabname=Summary&prodno=3218.0&issue=2004-05&num=&view=

Bureau of Meteorology (BOM) 2006, Climate Averages for Station 070091: Yass (Linton Hostel), http://www.bom.gov.au/climate/averages/tables/cw_070091.shtml

CSIRO 1999, Media Release: Risk Seen from Acid Sulfate Soils. 2 march 1999, http://www.csiro.au/news/mediarel/mr1999/mr9939.html

CSIRO – Climatic Impact Group 2004, Climate Change in New South Wales Part 2: Projected Changes in Climate Extremes.

Department of Energy, Utilities and Sustainability (DEUS) 2004a, Integrated Water Cycle Management Guidelines for NSW Local Water Utilities.

Department of Energy, Utilities and Sustainability (DEUS) 2004b, Best-Practice Management of Water Supply and Sewerage Guidelines.

Department of Energy, Utilities and Sustainability (DEUS) 2005, Water Supply and Sewerage NSW Benchmarking Report 2003/04.

Department of Energy, Utilities and Sustainability (DEUS) 2006, Water Supply and Sewerage NSW Benchmarking Report 2004/05.

Department of Environment and Conservation (DEC) 2006a, POEO Public Register, http://www.environment.nsw.gov.au/prpoeo/searchregister.aspx

Department of Environment and Conservation (DEC) 2006b, NSW Water Quality and River Flow Objectives, http://www.environment.nsw.gov.au/ieo/

Department of Infrastructure, Planning and Natural Resources (DIPNR) 2003, Capital Hume Region – Region Demographic, Social and Economic Analysis SGS Economics and Planning

Department of Infrastructure, Planning and Natural Resources (DIPNR) 2004, Yass Snapshot in Sustainability

Department of Land and Water Conservation (DLWC) 1999, Stressed Rivers Assessment Report: NSW State Summary.

Department of Land and Water Conservation (DLWC) 2000, NSW Salinity Strategy: Salinity Targets Supplementary Paper, http://www.dlwc.nsw.gov.au/care/salinity/pdf/salinity_targets.pdf

Department of Land and Water Conservation (DLWC) 2001, Yass Catchment: An Integrated Project to Assess Land Use and Catchment Condition in the Murrumbidgee Catchment.

Department of Land and Water Conservation (DLWC) 2002, Soil Landscapes of the Canberra 1:100,000 Sheet, http://www.dlwc.nsw.gov.au/care/soil/ssu/pubstat/canberra.html#Geology

Department of Lands 2003, Yass Valley LGA Existing Boundary.

Department of Local Government (DLG) 2004a, Boundaries Commission: New Councils, http://www.dlg.nsw.gov.au/dlg/boundariesCommission/ SAIndex.asp?areaindex=BC&index=35

Department of Local Government (DLG) 2004b, NSW Local Councils - Map Grouped by regions - October 2004, http://www.dlg.nsw.gov.au/dlg/dlghome/documents/ Downloads/MAP_LOCALAREASINNSWCOLOURED.jpg

Department of Planning (DoP) 2006 Basix Frequent Asked Questions http://www.basix.nsw.gov.au/information/faq.jsp#about1

Department of Public Works and Services (DPWS) undated, Murrumbateman Township: Scoping Study Report Based on Total Water Cycle management Approach DPWS Report No DC98044SS.

Environmental Protection Authority (EPA) 2000, State of the Environment Report 2000, http://www.environment.nsw.gov.au/soe/soe2000/bl/bl_4.htm

Murray Darling Basin Commission (MDBC) 1999, The Salinity Audit of the Murray Darling Basin, http://www.mdbc.gov.au/__data/page/303/Final_Salt_Audit2.pdf

Murray Darling Basin Commission (MDBC) 2006a, Catchment Classification Project Team, A Groundwater System Framework for Salinity Management, http://www.ndsp.gov.au/catchclass/reglmapf/mbidgee.htm

Murray Darling Basin Commission (MDBC) 2006b, Water Quality, http://www.mdbc.gov.au/nrm/water_management/water_issues/water_quality

Murray Darling Basin Commission (MDBC) 2006c Water and Land Salinity, http://www.mdbc.gov.au/salinity/land_and_water_salinity

Murrumbidgee Catchment Management Board (MCMB) 2003, Technical Supporting Information for the Murrumbidgee Catchment Blueprint, http://www.dlwc.nsw.gov.au/care/cmb/blueprints/pdf/murrumbidgee_techadd.pdf

National Library of Australia (NLA) 2006, Yass flood, 27 May 1925 [picture], http://nla.gov.au/nla.pic-vn3260837

Sydney Morning Herald (SMH) 2006, Yass (including Bookham, Jerrawa and Bowning) Pleasant Service Town Surrounded by Some of the Best Sheep Grazing Country, February 8 2004, http://www.smh.com.au/news/new-south-wales/yass/2005/02/17/1108500200174.html

Yass Valley Council (YVC) 2001, Yass Stormwater Management Plan prepared by Storm Consulting Pty Ltd

Yass Valley Council (YVC) 2003, Yass Water Supply: Yass Dam Yield Study Report No.: 03083 prepared by Department of Commerce

Yass Valley Council (YVC) 2004a Development Servicing Plan (DSP), prepared by Acroplan

Yass Valley Council (YVC) 2004b, State of the Environment 2003/2004 Supplementary Report, http://www.yass.nsw.gov.au/files/2623/File/2004SupplementarySoEReport8-2.pdf

Yass Valley Council (YVC) 2005a, Consulting Engagement for the Preparation of Yass Valley Council Integrated Water Cycle Management Strategy Engagement No: YVC /ENG/WS/05/01.

Yass Valley Council (YVC) 2005b, Yass Valley Council 2005/06 – 2007/08 Management Plan.

Yass Valley Council (YVC) 2005c, Yass Water Supply Emergency Drought Strategy: Final Report. Report No DC 01168, prepared by Department of Commerce.

Yass Valley Council (YVC) 2005d, Water Usage and New Water Connections 1996 – 2005, Supplied by YVC.

Yass Valley Council (YVC) 2006a, Chemical and Microbiological Analysis Results for Bore Water – Murrumbateman.

Yass Valley Council (YVC) 2006b, Strategic Business Plan for Water Supply 2005/06.

Yass Valley Council (YVC) 2006c, Strategic Business Plan for Sewerage Services 2005/06.

Yass Valley Council (YVC) 2006d, Environmental Management and Action Plan.

Yass Valley Council (YVC) 2006e, YVC Strategic Planning, http://www.yass.nsw.gov.au/planning/2961/2962.html.

Yass Valley Council (YVC) 2006f, Written comments on Draft IWCM Concept Study Rev 2 Report, August, 2006.

Appendix A – Rainwater Harvesting

A model of the impact of a range of rainwater tank sizes on mains water consumption and stormwater runoff was carried out utilising a spreadsheet approach originally developed by DEUS for the Kempsey IWCM Strategy.

Figure 16 illustrates the relative impact of a range of tank sizes on an average residential dwelling at Yass Town. The figure shows that the effectiveness of the rainwater tank increases greatly between the size range of 1,000 L and 5,000 L. Rainwater tanks larger than 5,000 L have less significant impact on water savings as they are oversized for areas of low average annual rainfall.

Figure 16: Rainwater Tank Size Comparison for Yass Town (1889-2005)

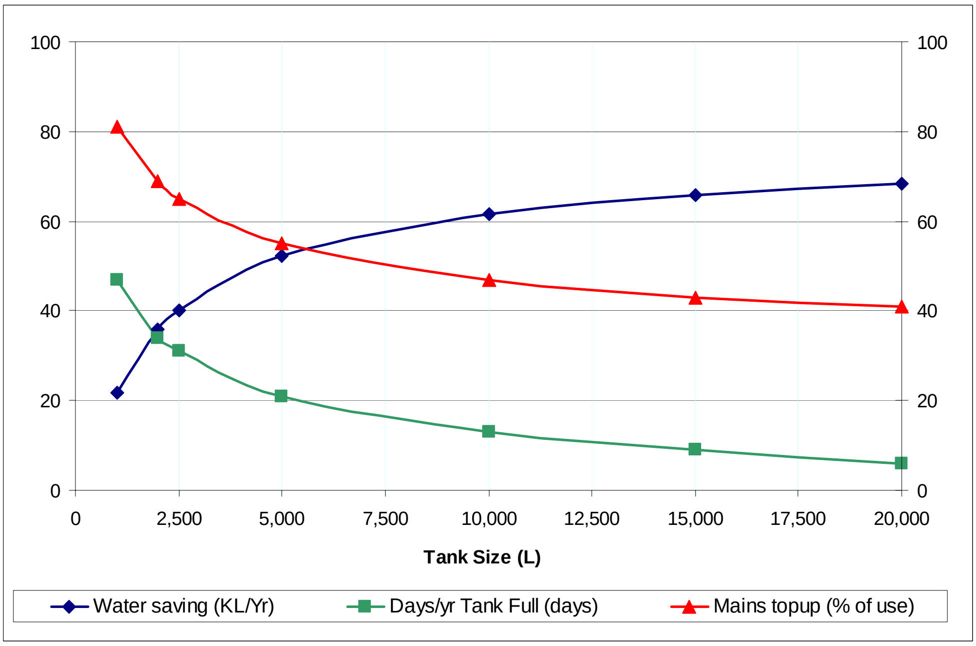


Table 33 outlines the assumptions used by the model and the resulting volumes captured, re-used and discharged when a 5,000 L tank is installed on an average single residential dwelling at Yass Town. It is assumed rainwater will be used for toilet flushing and outdoors.

Historical rainfall and temperature information available from SILO under BOM for Yass Town was used for the analysis.

The analysis indicated that:

- Harvesting of the rainwater that falls on the roof for outdoor and toilet flushing uses would result in preventing 52kL/y of stormwater flowing from each house, which equates to a 66% reduction in runoff; and

- Up to 45% of the total outdoor and toilet flushing water needs (which are currently supplied from the reticulation) could be supplied by a 5,000 L rainwater tank.

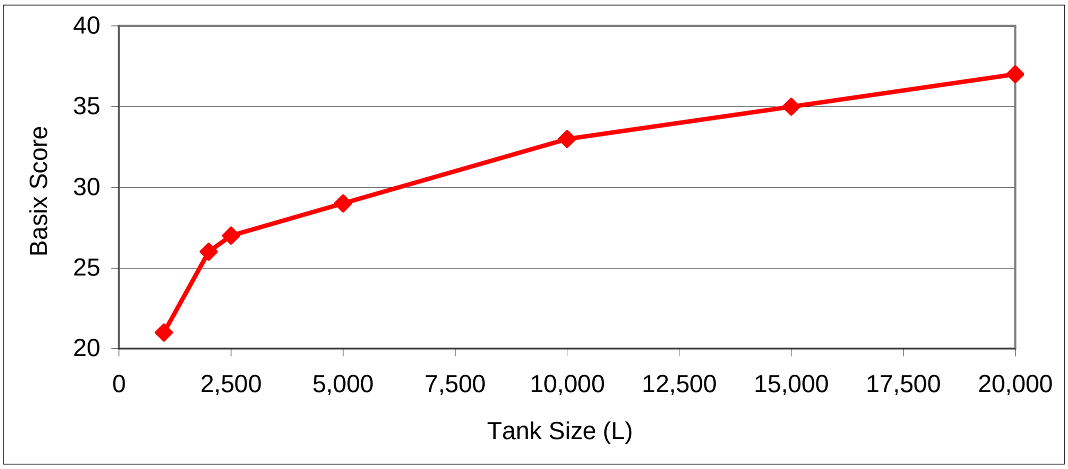
The contribution of a 5,000 L rainwater tank into water savings on a dwelling at Yass Town is significant. This analysis highlights the need to include rainwater tanks in new developments as a complementary way to save water.

Table 33: Assumptions and Results from Preliminary Rainwater Tank Modelling.

ASSESSMENT OF RAINWATER TANKS - PER HOUSHOLD IMPACT ON WATER MAINS SUPPLY AND ROOF STORMWATER RUNOFF Yass Town 5,000 L Rainwater Tank + Mains Supply (1889 to 2005) Uses: OUTSIDE + TOILET				
Assumptions used in the model		**Results for a 5,000 L Rainwater Tank**		
Roof Area (m^2)	150	Roof Runoff to Tank (L/Year)	79,293	
First Flush Vol/ Storm (L)	20	Tank Overflow (L/Year)	22,033	28%
Wetting & Evaporation/Storm (mm)	0.5	Rainwater Usage (L/Year)	57,259	72%
Roof Runoff Factor (%)	90	Average Tank Volume (L)	2,087	42%
Tank Starting Volume (L)	1	No. of overflow (Days/Year)	21	
Average Outside Usage (L/d)	218	Average Overflow (L/Day)	1,062	
Average Daily Toilet Usage (L/day)	98	Max Day Overflow (113years) (L)	18,350	
Mains Top-up Trigger Min Level (L)	600	Days per Year Tank is Full (days)	21	6%
Roof Runoff (Days/Yr)	90	Mains Top-up Usage per Year (L)	63,077	55%
Mains Water Saving & Roof Stormwater Runoff Reduction (KL/Yr)			**52.3**	**66%**

The findings of the preliminary rainwater tank modelling appear to be consistent with the BASIX water target assessment for rainwater tanks at Yass Town presented in **Figure 17**. This Figure shows that a 5,000 L rainwater tank on an average residential dwelling at Yass Town would score 29 out of the required 40 points to achieve the BASIX target. Thus, other complementary ways to save water are required to achieve a score of 40.

Figure 17: BASIX Water Target Score for Different Rainwater Tank Sizes on an Average Single Dwelling at Yass Town.



Appendix B – Demand Management

Demand management simply means implementing initiatives designed to reduce the demand for (potable) water by consumers, and make better use of the water resource. Demand management programs can include community driven initiatives such as the installation of more water efficient technologies (including showerheads, toilets, and washing machines), and education programs to promote water conservation.

Analysis - Decision Support System: DSS

The DSS is an Excel-based least cost planning evaluation framework for water demand management programs developed by DEUS. The model was set up using available data to give a broad indication of the relative merit and impact of various demand management methods. The DSS models changes in water consumption over time based on population data.

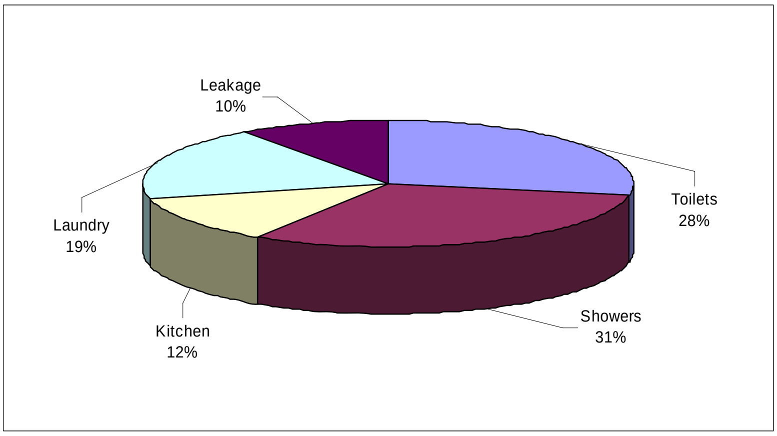
Method

The baseline, or do-nothing, scenario was set up and projected thirty years into the future. All water accounts within the town of Yass itself were modelled. The number of accounts for outside of the Yass town area is so small as to make the effort of deriving an end-use model unnecessary.

Water consumption data was split into user categories of residential and other (commercial). For each user category, the split of internal and external use was then assigned. Commercial and "other" were split 90% internal and 10% external. Residential water usage was split 50% internal 50% external, while other (commercial), 80% internal and 20% external.

The estimated breakdown of internal use by domestic customers is shown in **Figure 18**.

Figure 18: Assumed Breakdown of Internal Household Uses (ABS).



Water production data

Daily water production data from Yass WTP were used.

Results

The following demand management measures were modelled against the baseline:

- Implementation of best-practice pricing;
- Measures to reduce unaccounted for water;
- Education program targeted at outdoor water conservation;
- Household tune-up program retrofitting dual flush toilets and low flow showers; and
- Rainwater tanks (5,000 L tanks under the existing rebate program with YVC).

A preliminary cost-benefit analysis of the individual measures was then undertaken. The results are set out in **Table 34**.

Table 34: Preliminary Rankings of Demand Management Measures.

Measure	Utility Benefit	Community Benefit
Best-practice Pricing	Very High	Very High
Basix	Very High	High
UFW	Medium	Medium
Education	Medium	Medium
Household retrofit	Low	Low
UFW	Low	Low
Rainwater tanks	Low	Low

These measures were then grouped into 4 programs with progressively more measures.

Program 1: Pricing, BASIX.

Program 2: Pricing, BASIX, UFW and education.

Program 3: Pricing, BASIX, UFW and education, and toilet and shower retrofit program.

Program 4: Pricing, BASIX, UFW and education, toilet and shower retrofit program and rainwater tanks.

Appendix C – Data Audit

The spreadsheets on the following pages are the DEUS data audit template completed for Yass Valley Water.

Factor	Information required	Information		Notes/Source
General background	What are the current urban issues within your LGA particularly in relation to infrastructure requirements e.g. are there PRPs on any STPs?	1.Meeting the service needs of growth, particularly in terms of a secure water supply.		
		2. Yass STP upgrade. 3. Water conservation and sustainability issues, particularly sustainable effluent management. 4. customer dissatisfaction with the water supplied. Particularly the difficulty in complying with TDS and hardness at Yass and nitrates at Murrumbateman.		
What is the area of your LGA?	Give area in sq. km.	**Area (sq.km)**		Yass Valley 2003/04 SoE Supplementary Report page: 11
		3,650		
What other LGAs adjoin your LGA?	Name all the LGAs	**Name**		
		Boorowa		Department of Local Government NSW 2004 new Local Councils- Map http://www.dlg.nsw.gov.au/dlg/dlghome/documents/Downloads/MAP_LOCALAREASINNSWCOLOURED.jpg
		Tumut		
		Palarang		
		ACT		
		Upper Lachlan		
		Harden		
		Gundagai		
What catchment/s are within your LGA?	Give names of all catchments	**Name**	**Area (sq. km)**	
		Murrumbidgee	84,000	(91% of LGA within catchment)
		Lachlan	88,540	(9% of LGA within catchment)

Yass Valley Council - General Description

Appendix C

Factor	Information required	Information		Notes/Source
Subcatchments within Yass LGA		**Sub Catchments within Yass LGA**	**Area (sq. km)**	
		Goodradigbee	13000 total for upper Murrumbidgee (above Burinjuck Dam), but this includes other sub catchments such as Tantangara, Murrumbidgee 1, Bredbo, Numeralla (east and west), Queanbeyan, Malonglo, Burrinjuck Dam)	Draft Yass Valley Environmental Management & Action Plan (2006) Page: 22 (Taken from Draft)
		Murrumbidgee II		
		Jugoing		
		Murrumbidgee Burrinjuck to Berembed		
		Burrinjuck Dam		
		Yass Upper		
		Yass Lower		
		Chinamans Creek (part of Yass Lower subcatchment)		Yass Stormwater Management Plan 2001 p.13
		Golf Course Creek (part of Yass Lower subcatchment)		
		Sub Total	**13,000**	

Factor	Information required	Information		Notes/Source
Urban areas of Yass LGA	Give names of all urban and village areas	**Name**	**Sq. Km**	
		Yass	**9.24**	Yass Environmental Management and Action Plan,
		Bowning		

Factor	Information required	Information		Notes/Source
		Binalong		2006, Table 1, Page 18
		Murrumbateman		
		Gundaroo		
		Sutton		
		Wee Jasper		
		Bookham		

1.0 Landscape Characteristics Audit Questions **Appendix C**

Ref.	Factor	Yes/ No?	Information				Notes/Source
1.1	**What is the forested area of the subcatchments in Yass LGA?**		**Area (Ha)**	**Description**		**Proportion (%)**	
			11,685	Including national park and environmental protection areas. Native forests charaterized by Dry Sclerophyll Forests and Savannah Woodland		3.20	Draft Yass Valley Environmental Management and Action Plan 2006 page: 18
			28,500	Area included in the above. 1 National Park, 7 Nature Reserves, 1 State Conservation Reserve.		7.81	Draft Yass Valley Environmental Management and Action Plan 2006 page: 11 (error in draft
			741	Area included in the above. Pine Plantations: Consisting of single species		0.20	Yass Snapshot on Sustainability 2004, page 9
1.2	**Have the subcatchments of the Yass LGA been subject to clearing?**		**Description**	**Area (sq. km)**	**Proportion (%)**		Draft Yass Valley Environmental Management and Action Plan 2006 page: 11
		Yes	Throughout the LGA	2701	74		
1.3	**What is the upstream extent of your estuary (tidal and saline)?**		**Location**	**Upstream Extent of Estuary (km)**			
		N/A					
1.4	**Are there wetlands in your catchment?**		**Subcatchment Location**	**Area (sq. km)**	**Description**		State of the env. 2004, http://www.envcomm.act.gov.au/soe/soe2004/YassValley/ecologicalcommunities.htm Lake George wetlands borders the LGA on a large section of the eastern side; Australian wetlands database http://www.deh.gov.au/cgi-bin/wetlands/search.pl?smode=BOTH
		yes	Micalong Swamp	5.26			
			Coree Flats	0.40			

Ref.	Factor	Yes/ No?	Information				Notes/Source
1.5	**What are the predominant vegetation types in Yass LGA?**		**Area (ha)**	**Cover (%)**	**Type**		State of the env. 2004, http://www.envcomm.act.gov.au/soe/soe2004/YassValley/ecologicalcommunities.htm Lake George wetlands borders the LGA on a large section of the eastern side:
			There are 36 vegetation Communities in the Yass LGA, 14 of those are considered vulnerable. They consist of a wide variety of grasses, shrubs, and Eucalypts. Severe fragmentation has occurred.				

Ref.	Factor	Yes/ No?	Information				Notes/Source
1.6	**Does your catchment have potential acid sulphate soils?**		**Location**	**Catchment Affected (sq. km)**	**Description**	**Occurrence Class (1 = highest potential)**	
			Acid Sulphate Soils are generally rare in non-coastal areas. However, A form of ASS has been reported sporadically under irrigation in the Yass Valley associated with dryland salinity and waterlogging	Unknown			1. State of Environment, 2000 2. Media Release: Risk seen from scid sulfate soils, 2 March, 1999, CSIRO
			Total				

Ref.	Factor	Yes/ No?	Information				Notes/Source
1.7	**Are there acid impacts in your catchment waters?**		**Descrition**				
		Not Likely					

Ref.	Factor	Yes/ No?	Information				Notes/Source
1.8	**Are urban areas located in areas of potential acid sulphate soil?**		**Description**				
		No					

Ref.	Factor	Yes/ No?	Information				Notes/Source
1.9	**Are there acid impacts in your urban areas?**	Not known					

Ref.	Factor	Yes/ No?	Information				Notes/Source
1.10	**Does either dry land or irrigation salinity occur in your catchment?**		**Location**	**Type**			Yass Stormwater Management Plan 2001 p. 21
		Yes	Yass River Catchment	Both			

Ref.	Factor	Yes/ No?	Information				Notes/Source
1.11	**What is the area of catchment salt affected?**		**Location**	**Area (ha)**			Yass Stormwater Management Plan 2001 p. 21
			Yass River Catchment	1900			
1.12	**Are urban areas salt affected?**		**Location**	**Proportion**			Draft Yass Valley Environmental Management and Action Plan 2006 p. 19
		Yes	Not available	12 percent			
1.13	**Are there salinity targets for waterways?**	Yes	Set out in the CAP		A number of projects and studies have been conducted, such as Yass Snapshot on Sustainability and Yass River Healthy Valley Project to help set salinity standards. Env. Management and Action Plan p. 23		
1.14	**What are the predominant soil types in your catchment?**		**Description**				
			There is a diverse range of soil types in Yass and all of them tend to be low in fertility and acidic, however three main types stand out.				Draft Yass Valley Environmental Management and Action Plan 2006 page: 16 Yass Stormwater Management Plan 2001 p. 18
			1) Red Podzolic and minor yellow Podzolics found on the mid to lower slopes.				
			2) Lithosols are found on the steeper slopes, they are characterized by shallow soils				
			3) Soloth-solodic and the alluvial soils are found on the footsteps and drainage lines				
1.15	**Are there national parks (NP) in your catchment?**	Yes	**Description**	**Area within catchment (sq. km)**		Although there is only 1 NP in the LGA there are 6 nature reserves, 1 State Conservation Areas, 2 State Forests, and 1 state Park. Yass Valley Environmental Management and Action Plan p.11	
			Brindabella NP	946.60			
			Total				
1.16	**Are there protected areas (including water supply catchments and aquifers) in your catchment?**		**Description**	**Area within catchment (sq. km)**			
		Yes	Environmental protection areas	221.9			Draft Yass Valley Environmental Management and Action Plan 2006 page: 18

Ref.	Factor	Yes/ No?	Information				Notes/Source
1.17	**What is the topography of your catchment?**		It is characterized by undulating land with wide valleys and low round ridges, with moderate slopes. Elevations range from 500m to 691m.				Yass stormwater management Plan 2001 p. 18
1.18	**What is the average catchment runoff?**		**Catchment**	**Catchment Runoff (%)**			
			Murrumbidgee	Not known			
			Lachlan	Not known			

Ref.	Factor	Yes/ No?	Information					Notes/Source
2.1	**Are there STPs in the Yass Local Government Area?**		**Name**	**Location**	**Description**		**EP**	
		Yes	Yass		Trickling Filter		3,500	Yass Sewer DSP, page. 16
					Activated Sludge unit (Pasveer Ditch)		4,000	
2.2	**Is STP effluent quality monitored?**		**Name (of STP)**	**TP (mg/L)**	**TN (mg/L)**			2002/03 Water Supply and Sewerage Performance Monitoring
		Yes	Yass	7.35	7.40	2004-2005		Mean data
				8.48	7.92	2003-2004		
				5.58	12.20	2002-2003		
2.3	**Is the STP discharge volume monitored?**		**Annual Discharge to irrigation (ML/year)**	**Annual Discharge to river (ML/year)**	**Mean Flow to river (ML/day)**	**Maximum Flow to river (ML/day)**	**Date**	
		Yass	172.30	215.62	0.59	4.02	2004-2005	Yass STP Inflow, River Discharge & Reuse 2003//04/05 (Evaporation is taken into account)
			169.05	228.53	0.57	3.50	2003-2004	
			235.68	128.32	0.36	2.65	2002-2003	
2.4	**Where are the STP discharge locations?**		**Name**	**Description**				Yass STP Effluent Discharge Locations, article obtained from Yass LGA. Page. 1
			Yass River via	The main river that flows through Yass				
			Banjo Creek	Small tributary to the Yass River				
			Land irrigation area	Created as a reuse scheme to lessen				
			owned /operated by	impact on Yass river and supplement				Yass Draft SBP page. 15
2.5	**What is the load of nutrients and any other monitored contaminants from the STP discharge?**		**Name**	**Annual TN Load (kg)**	**Annual TP Load (kg)**	**Annual TSS Load (kg)**	**Annual BOD Load (kg)**	
			Yass STP					Not entered into the Performance Monitoring Report
			2002/3	4367.3	1981.39	6929.64	2341.62	
			2003/4	3176.2	3444.70	5442.87	2448.62	
			2004/5	2872.5	2790.00	7690.24	2468.82	
			Licence limitations max kg					Yass EPA License #1730 p.9
			BOD	7890				
			Nitrogen (total)	11835				
			Oil and Grease	5260				
			Phosphorus (total)	4734				
			Total suspended solids	11835				

Ref.	Factor	Yes/ No?	Information					Notes/Source
2.6	**What is the expected effluent flow (total and dry weather only) in 30 years time?**	Based on % growth per annum	**STP**	**Current Average Effluent Discharge (ML/year)**	**Expected Average Effluent Discharge (ML/year)**			
		2	Yass	393	711			
2.7	**What is the expected load of nutrients and any other monitored contaminants in 30 years time?**	Based on % growth	**STP**	**Annual TN Load (kg)**	**Annual TP Load (kg)**	**Annual TSS Load (kg)**	**Annual BOD Load (kg)**	
	Population now	2	Yass	6288.98	4960.77	12113.63	4382.93	
2.8	**Are there WTPs in your catchment?**		**Name**	**Type**				Yass Water DSP page. 17
		Yes	Yass Water Filtration Plant	Filtration Plant				
2.9	**Is WTP final water quality monitored?**		**Name**	**Parameters**				
		Yes	Yass Water Treatment Plant	pH, Faecal Coliforms, Total Suspended Solids				EPA WTP License 2005 p. 8
2.10	**What is the WTP treatment capacity?**		**Name**	**Daily capacity of plant (ML)**				EPA WTP License 2005 p. 8
			Yass WTP	13				
2.11	**Size and location of aquaculture?**		**Location**	**Type**	**Size (Approximate % of Foreshore Area)**			
		NA						
2.12	**What is the urban area in your catchment?**		**Name**	**Size (sq. Km)**				
			All towns and villages	9.2				
			Total Urban Area					
2.13	**What types of agriculture are there in your catchment?**		**Description**	**Numbers**	**Area (Ha)**	**Location**		
			Grazing		124,679	Throughout		Yass Environmental Management and Action Plan page. 17
			Cropping		5,127	Throughout		
			Total		129,086			

Ref.	Factor	Yes/ No?	Information					Notes/Source
2.14	**What is the location and area of this agriculture?**	See 2.13	Agriculture is spread throughout the LGA, with rural and agricultural being the main land uses. Grazing is the main agricultural practice throughout the LGA.					Yass Environmental Management and Action Plan Table page. 17
2.15	**Is there modified or contaminated runoff or wastewater generated from this agriculture?**		Land Use	**Nitrogen (kg/year)**	**Phosphorus (kg/year)**			
		Agricultural/ horticultural activities: pesticides, herbicides, fungicides, fertilisers, defoliants, desiccants	Cropping and Horticulture	Not known				
			Forest					
			Grazing					
			Total					
2.16	**What is Yass LGA population?**			**Population (2001 census)**	**Population (1996 census)**			ABS http://www.abs.gov.au/ausstats/abs@cp.nsf/DetailsPage/UCL1872002001?OpenDocument&tabname=Details&prodno=UCL187200&issue=2001&num=&view=&#Basic%20Community%20Profile
				9,708	9,128			
				11631 (including new areas resulting from amalgamation)	**N/A**			
2.17	**What is the urban population?**		**Location**	**Population (2001 census)**	**Population (1996 census)**			
			Urban Area	4,909	4,840			ABS Yass (UCL 187200) Basic Community Profile
2.18	**What is the expected urban population growth?**		**Year**	**Population projection - Yass Township**	**Population ABS data- Yass Township**	**Population Projection - Bowning**	**Population Projection- Binalong**	Population projection sourced from YVC population forecast (2004). ABS population projection based on ABS Yass (UCL 187200) Basic Community Profile and portion of 2001 Yass population within urban area
			2001	5,207	4,909	138	286	Yass Supplied Population Projections March 2006
			2002	5,337	4,961	142	294	
			2003	5,467	5,013	146	300	
			2004	5,650	5,066	150	308	
			2005	5,909	5,120	154	314	
			2006	6,169	5,174	158	322	
			2007	6,377	5,229	162	328	
			2008	6,507	5,294	165	336	
			2009	6,638	5,340	170	343	
			2010	7,028	5,396	174	350	

Ref.	Factor	Yes/ No?	Information					Notes/Source
			2011	7,418	5,453	178	357	

2.19	What is the expected rural population growth?		Year	Population projection - Yass Council data				Sourced from YVC Population Forecast (2004).
			2001	2.5%				Average between 2001 and 2036 is 2.1%
			2005	4.4%				
			2010	5.6%				

2.20	How many on-site sewage systems		Location	Number				
			Throughout LGA	Not known				

2.21	What types of industry operate within the catchment?	Licence No. (if applicable)	Industry	Type of Licence/Waste	Parameters	Volume (kL/d)	Monitoring?	Discharge Location
		4082	Boral Resources Pty. Limited (Kaveneys Rd)	Quarrying	Airblast overpressure levels. Ground Vibration Levels	N/A	N/A	NA
		901	Boral Resources Pty. Limited (Kaveneys Rd)	Concrete Batching	NA	N/A	N/A	NA
		1062	Concrete Pty. Ltd (Waroo Rd)	Concrete Batching	N/A	N/A	N/A	N/A
		4323	G C Schmidt Pty Ltd (Greenwood Rd)	Quarrying	N/A	N/A	N/A	N/A
		2685	Glenlee Quarries Pty Ltd (Mundetom Rd)	Quarrying	pH, CaC03, Sulphate, Total Iron, Total Zinc,"pump out" volume	N/A	Yes	N/A
		1611	Perenc; Valent (Dog Trap Rd)	Pig Production	Rainfall, BOD, COD, TN, TP, Orthophosphate, Potassium, TSS, EC, Chloride, Sodium, Calcium, Magnesium, Sulphure, Sodium Absorption Ratio, Alkalinity, Amonia	N/A	Yes	N/A

Ref.	Factor	Yes/ No?	Information					Notes/Source
		4219	T.J. & R.F. Fordham Pty Ltd (Paynes Rd)	Quarrying and Bitumen Premix	Wet Weather Discharge	NA	NA	NA
		2343	Tharwa Sands Pty Ltd (Cavan Rd)	Dredging	Discharge to waters, TSS	476	YES	NA
		11363	Transgrid (Perry St)	Generated/Stored Waste	Noise and Wind	N/A	Yes	NA
		1730	Yass Valley STP (Faulder Av)	Sewage Treatment	BOD, N, Oil and Grease, P, TSS, pH	1,300	Yes	Yass River and adjacent irrigation field
		1805	Yass Valley WTP (Cooks Hill Rd)	Water Treatment	pH, Faecal Coliforms, TSS,	140	Yes	N/A
		5895	Yass Waste Facilities (Isabel Dr)	Landfill	CaC03, Ammonia, BOD, EC, Nitrate, pH	N/A	Yes	N/A
2.22	**Where is this industry located?**		See 2.21					
2.23	**Is the volume of industry waste discharge monitored?**	Yes	See 2.21					Monitored through EPA Licensing and local council
2.24	**Where is industry wastewater discharged?**		See 2.21					The STP & WTP are the industries that strictly monitored
2.25	**Is there wastewater/ reclaimed water use in the catchment?**		**Location**		**Volume (ML) 2004/05**			
			Yass STP currently reuses excess effluent on a 40 Ha plot adjacent to the STP. They are also considering using		172.3			Yass Website (http://www.yass.nsw.gov.au/roads/2207/2209.html)
2.26	**Is reuse water monitored?**		**Location**	**Wastewater Source**	**Parameters Monitored**	**Meadian values**		
		Yes	**Yass**	**Sewage**	TSS	19.50	mg/L	
					BOD	6.5	mg/L	EPA Annual Return 2004/2005
					pH	8.7	pH units	
					TP	7.4	mg/L	
					TN	7.4	mg/L	
					Oil & Grease	1.3	mg/L	

Ref.	Factor	Yes/ No?	Information					Notes/Source
2.27	**What is the annual volume of urban stormwater generated by each urban centre?**	**Urban Subcatchments**	**Catchment Area (sq km)**	**Av Annual Rainfall (mm)**	**Volume (ML)**	**TN (kg)**	**TP (kg)**	
		Yass	9.2	651	1,805	1,805	1,263	Assume TN = 1.0 mg/l
								Assume TP = 0.7 mg/l
								Assume run-off co-efficient = 0.3
2.28	**Is stormwater quality monitored?**		**Location**					
		Yes,						Yass Stormwater Management Plan 2001 page. 23
			Yass River inflow to Burrinjuck Dam	**Compliance with ANZECC guidelines**				
			Yass River at Yass Weir	Exceeded ANZECC guidelines for salinity (1996/97) Exceeded ANZECC guidelines for Dissolved oxygen (1996/97) Exceeded ANZECC guidelines for Turbidity (1996/97) Exceeded ANZECC guidelines for Suspended Solids (1996/97)				
			Yass River at Elizabeth Fields					
				Estimated Pollutant loads - Average and Range				
			Faecal coliforms (cells/100ml)	Not known				
			Dissolved reactive P (mg/L)					
			Total P (mg/L)					
			Nitrate and Nitrite (mg/L)					
			Total Nitrogen (mg/L)					
			Total Kjeldahl N (mg/L)					
			Lead (ug/L)					
			Copper (ug/L)					
			Zinc (ug/L)					
2.29	**What is the expected stormwater flow volume in 30 years time?**	**Pop. Growth (%pa)**	**Urban Centre**	**Predicted Volume (ML)**	**Predicted TN (tonnes)**	**Predicted TP (tonnes)**		
		2	All urban areas	3,269	3268.73	2288.11		Based on data from question 2.27
			Total	3,269	3,269	2,288		

Ref.	Factor	Yes/ No?	Information					Notes/Source
2.30	**What is the expected stormwater load of nutrients and any other monitored contaminants in**	See 2.29						
2.31	**Are there landfills in your catchment?**		**Location**	**Type**	**Amount (tonnes)**			
						2002/3	**2003/4**	SoE 2004
		Yes	Yass	Landfill		4434.1	3694	http://www.envcomm.act.gov.au/soe/soe
				Recycling Plant		4793.13	3934	2004/YassValley/solidwaste.htm
				Total		**9227.23**	**7628**	
2.32	**Are there contaminated sites in your catchment?**		**Potential Contaminant Type**	**Number**				
		Yes	Engine works / Service Station	9				SoE 2004 http://www.envcomm.act.gov.au/soe/soe 2004/YassValley/contaminatedsites.htm
			Unnamed	6				
			Agriculture	1				
			Garbage Depot	1				
			Joinery Workshop	1				
			Total	**18**				
2.33	**Have algal blooms been recorded in your catchment?**		**Location**	**Subcatchment**				
		No						(No details or evidence have been provided)
2.34	**What are your water demands?**		**Category**	**Volume (ML/year)**	**Date**			
			CMA target: reduce 2000/01 reticulated water consumption by 10% by 2012.					
				2004/05	2003/04	2002/03	2001/02	
			Residential	516	528	N/A	N/A	DEUS Performance reports
			Commercial	100	N/A	N/A	N/A	
			Rural		N/A	N/A	N/A	
			Institutional	N/A	N/A	N/A	N/A	
2.35	**What is your water consumption?**		**Category**	**Annual consumption (ML)**				
				1999/00	2000/01	2001/02	20002/03	DEUS Performance reports
				960	930	1,030	810	
			TOTAL	3,730				Four year total (1999/2003)

Ref.	Factor	Yes/ No?	Information					Notes/Source
2.36	**What is your energy consumption for your water and wastewater facilities and what**		**Item (Top 14 Power users)**	**Energy consumed (KW hours) 2002/03**	**Energy Bill 2002/03**	**Tariff Type and/or Electricity supplier**		
			Not available					
2.37	**What is your sewerage and water supply operating cost per 100km of mains?**		$533					2002/03 NSW Water Supply and Sewerage Benchmarking Report
2.38	**What is your sewerage and water supply operating cost per property?**		$601					2004/05 NSW Water Supply and Sewerage Benchmarking Report
2.39	**Sewerage and water supply complaints per thousand properties**		47					2002/03 NSW Water Supply and Sewerage Benchmarking Report
2.40	**Water supply quality complaints per 1000 properties**		1					2002/03 NSW Water Supply and Sewerage Benchmarking Report
2.41	**Number of supply main breaks per 100 km**		15					2002/03 NSW Water Supply and Sewerage Benchmarking Report
2.42	**Sewer chokes and collapses per 100km of main**		62					2002/03 NSW Water Supply and Sewerage Benchmarking Report
2.43	**Sewer overflows to the environment per 100km of main**		1					2003/04 NSW Water Supply and Sewerage Benchmarking Report

Ref.	Factor	Yes/ No?	Information					Notes/Source
2.44	**Are sewer overflows monitored?**	Yes						
2.45	**Typical developer charges for water supply per ET**		$8283 (Includes Bowning, Binalong and Yass)					Yass Water DSP page. 4 (2004/05)
2.46	**Average residential bill for sewerage services per property**		$370					2004/5 NSW Water Supply and Sewerage Performance Monitoring Report
2.47	**Volume of sewage treated kL per property**		194					2002/03 NSW Water Supply and Sewerage Benchmarking Report
2.48	**Urban properties without reticulated sewerage and water supply**		Not known					2003/4 NSW Water Supply and Sewerage Performance Monitoring Report
2.49	**Water usage charge c/kL**		110 c/KL					2004/5 NSW Water Supply and Sewerage Performance Monitoring Report
2.50	**Annual water allowance (if given)**		NA					2003/4 NSW Water Supply and Sewerage Performance Monitoring Report
2.51	**Water access charge per property**		$171					2004/5 NSW Water Supply and Sewerage Performance Monitoring Report
2.52	**Drinking water quality tests**		**Physical**	**Chemical**	**Microbiological Ecoli**	**Total coliforms**		2003/4 NSW Water Supply and Sewerage Performance Monitoring Report.
		Compliance 2003/4	100%	100%	95%	67%		
2.53	**Rainwater quality data at extraction point**	No						

Ref.	Factor	Yes/ No?	Information	Notes/Source
2.54	**STP quality licence monitoring results**	Yes		Results in EPA annual return of license 1730
2.55	**Water quality monitoring results for local waterways**	Limited	Parameters: pH, conductivity/salinity, dissolved oxygen, temperature, TP, TN, faecal coliforms and TSS at 12 sites	
2.56	**Water supply, sewerage and stormwater system maps**	Yes		Strategic Business Plans for Water Supply and Sewerage (Yass Stormwater Management Plan)
2.57	**Number of connected properties**		4660 (Water=2670; Sewer=1990)	2002/03 NSW Water Supply and Sewerage Benchmarking Report
2.58	**Range of typical residential block sizes**		N/A	
2.59	**Number and size of rainwater tanks**			
2.60	**Number of tanks connected to the potable system for top-up**	Not available		
2.61	**Rainwater tank rebate**	Yes	$200 per property existed before 30th June 2003 and had water connected.	All new houses connected to Yass UWS after from July 2003 are required to install a rainwater tank with a capacity of at least 4,500 Litres
2.62	**Is there polluted atmospheric fallout over the urban area?**	Unlikely		SoE 2004 (Under emissions)
2.63	**Is there an OSD policy?**	Applied where required, at the discretion of the approving officer. Not documented in formal policy.		

Ref.	Factor	Yes/ No?	Information		Source/Notes
3.1	**What is the mean annual rainfall for the catchment or catchment regions?**		**Location**	**Mean Annual Rainfall (mm)**	
			Yass	665	SILO
3.2	**What is the mean annual evaporation for the catchment or catchment regions?**		**Location**	**Mean Annual Evaporation (mm)**	
			Yass	1,294	SILO

Ref.	Factor	Yes/ No?	Information			Location of available information*
4.1	**What is the water quality of dry weather river flows**		Not available			
4.2	**What is the total annual dry weather discharge volume**		**Location**	**Volume ML/year**		
			Not available			
4.3	**What is the annual dry weather contaminant load**			**TN (kg/year)**	**TP (kg/year)**	
			Not available			
4.4	**What is the water quality of wet weather river flows**		Not available			
4.5	**What is the wet weather mean annual discharge**		**Location**	**Volume ML/year**		
			Not available			
4.6	**What is the annual wet weather contaminant load**			**TN (kg/year)**	**TP (kg/year)**	
			Not available			
4.7	**Have environmental flow requirements been identified for catchment streams?**	Yes	Interim river flow objectives have been set but they are largely qualitative rather than quantitative. However as part of the Yass STP investigation, particular requirements are being investigated.			
4.8	**What is the location of all catchment dams?**		**Location**	**Type**	**Area (sq. km)**	
			Yass Dam, Located directly upstream of Yass	On Stream Dam		Yass Water DSP, page 16

Ref.	Factor	Yes/ No?	Information			Location of available information*
4.9	**What is the capacity of each catchment dam?**		**Location**	**Capacity (ML)**		
			Yass Dam	872		draft IWCM concept study corrections made by YVC (Based on a 2006 survey)
4.10	**What is the secure yield of each catchment dam?**		**Location**	**Secure Yield (ML)**		Yass Dam Yield Study p.13
			Yass Dam	660 to 1080 (ML)		
			Total yield			
4.11	**What is the water quality in each**		**Yass Dam**			
	Parameter	units	To be determined as part of Yass STP investigation			
	Total Coliforms	mg/L				
	Chlorine	mg/L				
	Total Hardness	mg/L				
	Total Iron	mg/L				
	TN	mg/L				
	TP	mg/L				
	Turbidity	mg/L				
	TDS	mg/L				
	Metals	mg/L				
4.12	**What is the location of all catchment weirs?**		**Location**	**Area (sq. km)**	**Notes**	
			Yass Railway Weir	**N/A**	The weir is shown in the Yass STP Effluent Discharge Locations	
4.13	**What is the capacity of all catchment weirs?**		**Location**	**Capacity (ML)**		
			Yass Railway Weir	N/A		
4.14	**What is the secure yield of all catchment weirs?**		**Location**	**Secure Yield (ML)**		
			Yass Railway Weir	Unknown		

Ref.	Factor	Yes/ No?	Information			Location of available information*
4.15	What is the water quality in each weir?		**Yass Weir**	**Value**		
		N/A	Total Coliforms	To be determined as part of Yass STP investigation.		
			Chlorine			
			Total Hardness			
			Total Iron			
			TN			
			TP			
			Turbidity			
			TDS			
			Metals			
4.16	Are returned flows provided from, or intended to be provided to catchment storage/s or weirs?	No				
4.17	Is the water quality of the return flows expected to be the same as the water quality in dam or weir?	NA				
4.18	What is the extent and nature of groundwater resources within the catchment?		**Groundwater Extraction Licences**	**Volume extracted (ML/Year)**		DIPNR (2004) DEUS (2006, 2005). Obtained from Water Resource Info Draft B, page 4
			Groundwater resources are located primarily within the Murrumbidgee Catchment. The current level of ground water extracted is 4,009 ML/a, however the estimated sustainable yield is 10,335 ML/a.	4,009		
4.19	Does catchment include one or more estuary habitats?	No				

Ref.	Factor	Yes/ No?	Information			Location of available information*
4.20	**Are there licensed extractions in the catchment?**	Yes	**Licensed under Water Act 1919**			
			SURFACE WATER: Extraction of Water fro River/Creeks			
			Extraction Purpose	**Volume ML/year 2003**	**Volume ML/year 2004**	
			Domestic	Unknown	9	SoE Report 2004, Yass Valley Water Use. http://www.envcomm.act.gov.au/soe/soe2004/YassValley/wateruse.htm
			Industrial	Unknown	Unknown	
			Irrigation & Farming	Unknown	1929	
			Recreation	Unknown	137	
			Stock	Unknown	35	
			Town Water Supply		1700	
			TOTAL (ML/yr)	**708**	**730**	
			GROUND WATER			
			Extraction Purpose	**Volume ML/year 2003**	**Volume ML/year 2004**	
			Stock	Unknown	Unknown	Yass SoE Report 2004, Reported by Ife and Skelt
			Domestic	Unknown	Unknown	
			Farming	Unknown	Unknown	
			Property	Unknown	Unknown	
			LWU			
			TOTAL (ML/yr)	**4009**		
4.21	**Are there licensed town water extractions in the catchment?**	Yes	**Licence**	**Volume (ML)**		
			Murrumbateman Bore Hole (Town Water Supply)	50		Murrumbateman Township Scoping study report p.1
			Yass River (Town Water Supply)	1700		

Factor	Information required	Information		Notes/Source
General background	What are the current urban issues within your LGA particularly in relation to infrastructure requirements e.g. are there PRPs on any STPs?	1.Meeting the service needs of growth, particularly in terms of a secure water supply.		
		2. Yass STP upgrade. 3. Water conservation and sustainability issues, particularly sustainable effluent management. 4. customer dissatisfaction with the water supplied. Particularly the difficulty in complying with TDS and hardness at Yass and nitrates at Murrumbateman.		
What is the area of your LGA?	Give area in sq. km.	**Area (sq.km)**		Yass Valley 2003/04 SoE Supplementary Report page: 11
		3,650		
What other LGAs adjoin your LGA?	Name all the LGAs	**Name**		
		Boorowa		Department of Local Government NSW 2004 new Local Councils-Map http://www.dlg.nsw.gov.au/dlg/dlghome/documents/Downloads/MAP_LOCALAREASINNSWCOLOURED.jpg
		Tumut		
		Palarang		
		ACT		
		Upper Lachlan		
		Harden		
		Gundagai		
What catchment/s are within your LGA?	Give names of all catchments	**Name**	**Area (sq. km)**	
		Murrumbidgee	84,000	(91% of LGA within catchment)
		Lachlan	88,540	(9% of LGA within catchment)

Factor	Information required	Information		Notes/Source
Subcatchments within Yass LGA		**Sub Catchments within Yass LGA**	**Area (sq. km)**	
		Goodradigbee	13000 total for upper Murrumbidgee (above Burinjuck Dam), but this includes other sub catchments such as Tantangara, Murrumbidgee 1, Bredbo, Numeralla (east and west), Queanbeyan, Malonglo, Burrinjuck Dam)	Draft Yass Valley Environmental Management & Action Plan (2006) Page: 22 (Taken from Draft)
		Murrumbidgee II		
		Jugoing		
		Murrumbidgee Burrinjuck to Berembed		
		Burrinjuck Dam		
		Yass Upper		
		Yass Lower		
		Chinamans Creek (part of Yass Lower subcatchment)		Yass Stormwater Management Plan 2001 p.13
		Golf Course Creek (part of Yass Lower subcatchment)		
		Sub Total	**13,000**	
Urban areas of Yass LGA	Give names of all urban and village areas	**Name**	**Sq. Km**	
		Yass	**9.24**	Yass Environmental Management and Action Plan, 2006, Table 1, Page 18
		Bowning		

Factor	Information required	Information		Notes/Source
		Binalong		2006, Table 1, Page 18
		Murrumbateman		
		Gundaroo		
		Sutton		
		Wee Jasper		
		Bookham		

Ref.	Factor	Yes/ No?	Information				Notes/Source
1.1	**What is the forested area of the subcatchments in Yass LGA?**		**Area (Ha)**	**Description**		**Proportion (%)**	
			11,685	Including national park and environmental protection areas. Native forests charaterized by Dry Sclerophyll Forests and Savannah Woodland		3.20	Draft Yass Valley Environmental Management and Action Plan 2006 page: 18
			28,500	Area included in the above. 1 National Park, 7 Nature Reserves, 1 State Conservation Reserve.		7.81	Draft Yass Valley Environmental Management and Action Plan 2006 page: 11 (error in draft
			741	Area included in the above. Pine Plantations: Consisting of single species		0.20	Yass Snapshot on Sustainability 2004, page 9
1.2	**Have the subcatchments of the Yass LGA been subject to clearing?**		**Description**	**Area (sq. km)**	**Proportion (%)**		Draft Yass Valley Environmental Management and Action Plan 2006 page: 11
		Yes	Throughout the LGA	2701	74		
1.3	**What is the upstream extent of your estuary (tidal and saline)?**		**Location**	**Upstream Extent of Estuary (km)**			
		N/A					
1.4	**Are there wetlands in your catchment?**		**Subcatchment Location**	**Area (sq. km)**	**Description**		State of the env. 2004, http://www.envcomm.act.gov.au/soe/soe2004/YassValley/ecologicalcommunities.htm Lake George wetlands borders the LGA on a large section of the eastern side; Australian wetlands database http://www.deh.gov.au/cgi-bin/wetlands/search.pl?smode=BOTH
		yes	Micalong Swamp	5.26			
			Coree Flats	0.40			

Ref.	Factor	Yes/ No?	Information				Notes/Source
1.5	**What are the predominant vegetation types in Yass LGA?**		**Area (ha)**	**Cover (%)**	**Type**		State of the env. 2004, http://www.envcomm.act.gov.au/soe/soe2004/YassValley/ecologicalcommunities.htm Lake George wetlands borders the LGA on a large section of the eastern side:
			There are 36 vegetation Communities in the Yass LGA, 14 of those are considered vulnerable. They consist of a wide variety of grasses, shrubs, and Eucalypts. Severe fragmentation has occurred.				
1.6	**Does your catchment have potential acid sulphate soils?**		**Location**	**Catchment Affected (sq. km)**	**Description**	**Occurrence Class (1 = highest potential)**	
			Acid Sulphate Soils are generally rare in non-coastal areas. However, A form of ASS has been reported sporadically under irrigation in the Yass Valley associated with dryland salinity and waterlogging	Unknown			1. State of Environment, 2000 2. Media Release: Risk seen from scid sulfate soils, 2 March, 1999, CSIRO
			Total				
1.7	**Are there acid impacts in your catchment waters?**		**Descrition**				
		Not Likely					
1.8	**Are urban areas located in areas of potential acid sulphate soil?**		**Description**				
		No					
1.9	**Are there acid impacts in your urban areas?**	Not known					
1.10	**Does either dry land or irrigation salinity occur in your catchment?**		**Location**	**Type**			Yass Stormwater Management Plan 2001 p. 21
		Yes	Yass River Catchment	Both			

Ref.	Factor	Yes/ No?	Information				Notes/Source
1.11	**What is the area of catchment salt affected?**		**Location**	**Area (ha)**			Yass Stormwater Management Plan 2001 p. 21
			Yass River Catchment	1900			
1.12	**Are urban areas salt affected?**		**Location**	**Proportion**			Draft Yass Valley Environmental Management and Action Plan 2006 p. 19
		Yes	Not available	12 percent			
1.13	**Are there salinity targets for waterways?**	Yes	Set out in the CAP		A number of projects and studies have been conducted, such as Yass Snapshot on Sustainability and Yass River Healthy Valley Project to help set salinity standards. Env. Management and Action Plan p. 23		
1.14	**What are the predominant soil types in your catchment?**		**Description**				
			There is a diverse range of soil types in Yass and all of them tend to be low in fertility and acidic, however three main types stand out.				Draft Yass Valley Environmental Management and Action Plan 2006 page: 16 Yass Stormwater Management Plan 2001 p. 18
			1) Red Podzolic and minor yellow Podzolics found on the mid to lower slopes.				
			2) Lithosols are found on the steeper slopes, they are characterized by shallow soils				
			3) Soloth-solodic and the alluvial soils are found on the footsteps and drainage lines				
1.15	**Are there national parks (NP) in your catchment?**	Yes	**Description**	**Area within catchment (sq. km)**		Although there is only 1 NP in the LGA there are 6 nature reserves, 1 State Conservation Areas, 2 State Forests, and 1 state Park. Yass Valley Environmental Management and Action Plan p.11	
			Brindabella NP	946.60			
			Total				
1.16	**Are there protected areas (including water supply catchments and aquifers) in your catchment?**		**Description**	**Area within catchment (sq. km)**			
		Yes	Environmental protection areas	221.9			Draft Yass Valley Environmental Management and Action Plan 2006 page: 18

Ref.	Factor	Yes/ No?	Information				Notes/Source
1.17	**What is the topography of your catchment?**						
			It is characterized by undulating land with wide valleys and low round ridges, with moderate slopes. Elevations range from 500m to 691m.				Yass stormwater management Plan 2001 p. 18
1.18	**What is the average catchment runoff?**		**Catchment**	**Catchment Runoff (%)**			
			Murrumbidgee	Not known			
			Lachlan	Not known			

Ref.	Factor	Yes/ No?	Information					Notes/Source
2.1	**Are there STPs in the Yass Local Government Area?**		**Name**	**Location**	**Description**		**EP**	
		Yes	Yass		Trickling Filter		3,500	Yass Sewer DSP, page. 16
					Activated Sludge unit (Pasveer Ditch)		4,000	
2.2	**Is STP effluent quality monitored?**		**Name (of STP)**	**TP (mg/L)**	**TN (mg/L)**			2002/03 Water Supply and Sewerage Performance Monitoring
		Yes	Yass	7.35	7.40	2004-2005		Mean data
				8.48	7.92	2003-2004		
				5.58	12.20	2002-2003		
2.3	**Is the STP discharge volume monitored?**		**Annual Discharge to irrigation (ML/year)**	**Annual Discharge to river (ML/year)**	**Mean Flow to river (ML/day)**	**Maximum Flow to river (ML/day)**	**Date**	
		Yass	172.30	215.62	0.59	4.02	2004-2005	Yass STP Inflow, River Discharge & Reuse 2003//04/05 (Evaporation is taken into account)
			169.05	228.53	0.57	3.50	2003-2004	
			235.68	128.32	0.36	2.65	2002-2003	
2.4	**Where are the STP discharge locations?**		**Name**	**Description**				Yass STP Effluent Discharge Locations, article obtained from Yass LGA. Page. 1
			Yass River via Banjo Creek	The main river that flows through Yass				
				Small tributary to the Yass River				
			Land irrigation area owned /operated by	Created as a reuse scheme to lessen impact on Yass river and supplement				Yass Draft SBP page. 15
2.5	**What is the load of nutrients and any other monitored contaminants from the STP discharge?**		**Name**	**Annual TN Load (kg)**	**Annual TP Load (kg)**	**Annual TSS Load (kg)**	**Annual BOD Load (kg)**	
			Yass STP					Not entered into the Performance Monitoring Report
			2002/3	4367.3	1981.39	6929.64	2341.62	
			2003/4	3176.2	3444.70	5442.87	2448.62	
			2004/5	2872.5	2790.00	7690.24	2468.82	
			Licence limitations max kg					Yass EPA License #1730 p.9
			BOD	7890				
			Nitrogen (total)	11835				
			Oil and Grease	5260				
			Phosphorus (total)	4734				
			Total suspended solids	11835				

Ref.	Factor	Yes/ No?	Information					Notes/Source
2.6	**What is the expected effluent flow (total and dry weather only) in 30 years time?**	Based on % growth per annum	**STP**	**Current Average Effluent Discharge (ML/year)**	**Expected Average Effluent Discharge (ML/year)**			
		2	Yass	393	711			
2.7	**What is the expected load of nutrients and any other monitored contaminants in 30 years time?**	Based on % growth	**STP**	**Annual TN Load (kg)**	**Annual TP Load (kg)**	**Annual TSS Load (kg)**	**Annual BOD Load (kg)**	
	Population now	2	Yass	6288.98	4960.77	12113.63	4382.93	
2.8	**Are there WTPs in your catchment?**		**Name**	**Type**				Yass Water DSP page. 17
		Yes	Yass Water Filtration Plant	Filtration Plant				
2.9	**Is WTP final water quality monitored?**		**Name**	**Parameters**				
		Yes	Yass Water Treatment Plant	pH, Faecal Coliforms, Total Suspended Solids				EPA WTP License 2005 p. 8
2.10	**What is the WTP treatment capacity?**		**Name**	**Daily capacity of plant (ML)**				EPA WTP License 2005 p. 8
			Yass WTP	13				
2.11	**Size and location of aquaculture?**		**Location**	**Type**	**Size (Approximate % of Foreshore Area)**			
		NA						
2.12	**What is the urban area in your catchment?**		**Name**	**Size (sq. Km)**				
			All towns and villages	9.2				
			Total Urban Area					
2.13	**What types of agriculture are there in your catchment?**		**Description**	**Numbers**	**Area (Ha)**	**Location**		
			Grazing		124,679	Throughout		Yass Environmental Management and Action Plan page. 17
			Cropping		5,127	Throughout		
			Total		129,086			

Ref.	Factor	Yes/ No?	Information					Notes/Source
2.14	**What is the location and area of this agriculture?**	See 2.13	Agriculture is spread throughout the LGA, with rural and agricultural being the main land uses. Grazing is the main agricultural practice throughout the LGA.					Yass Environmental Management and Action Plan Table page. 17
2.15	**Is there modified or contaminated runoff or wastewater generated from this agriculture?**		Land Use	**Nitrogen (kg/year)**	**Phosphorus (kg/year)**			
		Agricultural/ horticultural activities: pesticides, herbicides, fungicides, fertilisers, defoliants, desiccants	Cropping and Horticulture	Not known				
			Forest					
			Grazing					
			Total					
2.16	**What is Yass LGA population?**			**Population (2001 census)**	**Population (1996 census)**			ABS http://www.abs.gov.au/ausstats/abs@cp p.nsf/DetailsPage/UCL1872002001?Ope nDocument&tabname=Details&prodno= UCL187200&issue=2001&num=&view= &#Basic%20Community%20Profile
				9,708	9,128			
				11631 (including new areas resulting from amalgamation)	**N/A**			
2.17	**What is the urban population?**		**Location**	**Population (2001 census)**	**Population (1996 census)**			
			Urban Area	4,909	4,840			ABS Yass (UCL 187200) Basic Community Profile
2.18	**What is the expected urban population growth?**		**Year**	**Population projection - Yass Township**	**Population ABS data- Yass Township**	**Population Projection - Bowning**	**Population Projection- Binalong**	Population projection sourced from YVC population forecast (2004). ABS population projection based on ABS Yass (UCL 187200) Basic Community Profile and portion of 2001 Yass population within urban area
			2001	5,207	4,909	138	286	Yass Supplied Population Projections March 2006
			2002	5,337	4,961	142	294	
			2003	5,467	5,013	146	300	
			2004	5,650	5,066	150	308	
			2005	5,909	5,120	154	314	
			2006	6,169	5,174	158	322	
			2007	6,377	5,229	162	328	
			2008	6,507	5,294	165	336	
			2009	6,638	5,340	170	343	
			2010	7,028	5,396	174	350	

Ref.	Factor	Yes/ No?	Information						Notes/Source
			2011	7,418	5,453	178	357		
2.19	**What is the expected rural population growth?**		**Year**	**Population projection - Yass Council data**					Sourced from YVC Population Forecast (2004).
			2001	2.5%					Average between 2001 and 2036 is 2.1%
			2005	4.4%					
			2010	5.6%					
2.20	**How many on-site sewage systems**		**Location**	**Number**					
			Throughout LGA	Not known					
2.21	**What types of industry operate within the catchment?**	**Licence No. (if applicable)**	**Industry**	**Type of Licence/Waste**	**Parameters**	**Volume (kL/d)**	**Monitoring?**	Discharge Location	
		4082	Boral Resources Pty. Limited (Kaveneys Rd)	Quarrying	Airblast overpressure levels. Ground Vibration Levels	N/A	N/A	NA	
		901	Boral Resources Pty. Limited (Kaveneys Rd)	Concrete Batching	NA	N/A	N/A	NA	
		1062	Concrete Pty. Ltd (Waroo Rd)	Concrete Batching	N/A	N/A	N/A	N/A	
		4323	G C Schmidt Pty Ltd (Greenwood Rd)	Quarrying	N/A	N/A	N/A	N/A	
		2685	Glenlee Quarries Pty Ltd (Mundetom Rd)	Quarrying	pH, CaC03, Sulphate, Total Iron, Total Zinc,"pump out" volume	N/A	Yes	N/A	
		1611	Perenc; Valent (Dog Trap Rd)	Pig Production	Rainfall, BOD, COD, TN, TP, Orthophosphate, Potassium, TSS, EC, Chloride, Sodium, Calcium, Magnesium, Sulphure, Sodium Absorption Ratio, Alkalinity, Amonia	N/A	Yes	N/A	

Ref.	Factor	Yes/ No?	Information					Notes/Source
		4219	T.J. & R.F. Fordham Pty Ltd (Paynes Rd)	Quarrying and Bitumen Premix	Wet Weather Discharge	NA	NA	NA
		2343	Tharwa Sands Pty Ltd (Cavan Rd)	Dredging	Discharge to waters, TSS	476	YES	NA
		11363	Transgrid (Perry St)	Generated/Stored Waste	Noise and Wind	N/A	Yes	NA
		1730	Yass Valley STP (Faulder Av)	Sewage Treatment	BOD, N, Oil and Grease, P, TSS, pH	1,300	Yes	Yass River and adjacent irrigation field
		1805	Yass Valley WTP (Cooks Hill Rd)	Water Treatment	pH, Faecal Coliforms, TSS,	140	Yes	N/A
		5895	Yass Waste Facilities (Isabel Dr)	Landfill	CaC03, Ammonia, BOD, EC, Nitrate, pH	N/A	Yes	N/A
2.22	**Where is this industry located?**		See 2.21					
2.23	**Is the volume of industry waste discharge monitored?**	Yes	See 2.21					Monitored through EPA Licensing and local council
2.24	**Where is industry wastewater discharged?**		See 2.21					The STP & WTP are the industries that strictly monitored
2.25	**Is there wastewater/ reclaimed water use in the catchment?**		**Location**		**Volume (ML) 2004/05**			
			Yass STP currently reuses excess effluent on a 40 Ha plot adjacent to the STP. They are also considering using		172.3			Yass Website (http://www.yass.nsw.gov.au/roads/2207/2209.html)
2.26	**Is reuse water monitored?**		**Location**	**Wastewater Source**	**Parameters Monitored**	**Meadian values**		
		Yes	**Yass**	**Sewage**	TSS	19.50	mg/L	
					BOD	6.5	mg/L	EPA Annual Return 2004/2005
					pH	8.7	pH units	
					TP	7.4	mg/L	
					TN	7.4	mg/L	
					Oil & Grease	1.3	mg/L	

Ref.	Factor	Yes/ No?	Information					Notes/Source
2.27	**What is the annual volume of urban stormwater generated by each urban centre?**	**Urban Subcatchments**	**Catchment Area (sq km)**	**Av Annual Rainfall (mm)**	**Volume (ML)**	**TN (kg)**	**TP (kg)**	
		Yass	9.2	651	1,805	1,805	1,263	Assume TN = 1.0 mg/l
								Assume TP = 0.7 mg/l
								Assume run-off co-efficient = 0.3

Ref.	Factor	Yes/ No?	Location	Information	Notes/Source
2.28	**Is stormwater quality monitored?**	Yes,			Yass Stormwater Management Plan 2001 page. 23
			Yass River inflow to Burrinjuck Dam	**Compliance with ANZECC guidelines**	
			Yass River at Yass Weir	Exceeded ANZECC guidelines for salinity (1996/97) Exceeded ANZECC guidelines for Dissolved oxygen (1996/97) Exceeded ANZECC guidelines for Turbidity (1996/97) Exceeded ANZECC guidelines for Suspended Solids (1996/97)	
			Yass River at Elizabeth Fields		
				Estimated Pollutant loads - Average and Range	
			Faecal coliforms (cells/100ml)	Not known	
			Dissolved reactive P (mg/L)		
			Total P (mg/L)		
			Nitrate and Nitrite (mg/L)		
			Total Nitrogen (mg/L)		
			Total Kjeldahl N (mg/L)		
			Lead (ug/L)		
			Copper (ug/L)		
			Zinc (ug/L)		

Ref.	Factor	Pop. Growth (%pa)	Urban Centre	Predicted Volume (ML)	Predicted TN (tonnes)	Predicted TP (tonnes)		Notes/Source
2.29	**What is the expected stormwater flow volume in 30 years time?**	2	All urban areas	3,269	3268.73	2288.11		Based on data from question 2.27
			Total	3,269	3,269	2,288		

Ref.	Factor	Yes/ No?	Information					Notes/Source
2.30	**What is the expected stormwater load of nutrients and any other monitored contaminants in**	See 2.29						
2.31	**Are there landfills in your catchment?**		**Location**	**Type**	**Amount (tonnes)**			
						2002/3	**2003/4**	SoE 2004
		Yes	Yass	Landfill		4434.1	3694	http://www.envcomm.act.gov.au/soe/soe
				Recycling Plant		4793.13	3934	2004/YassValley/solidwaste.htm
				Total		**9227.23**	**7628**	
2.32	**Are there contaminated sites in your catchment?**		**Potential Contaminant Type**	**Number**				
		Yes	Engine works / Service Station	9				SoE 2004 http://www.envcomm.act.gov.au/soe/soe 2004/YassValley/contaminatedsites.htm
			Unnamed	6				
			Agriculture	1				
			Garbage Depot	1				
			Joinery Workshop	1				
			Total	**18**				
2.33	**Have algal blooms been recorded in your catchment?**		**Location**	**Subcatchment**				
		No						(No details or evidence have been provided)
2.34	**What are your water demands?**		**Category**	**Volume (ML/year)**	**Date**			
			CMA target: reduce 2000/01 reticulated water consumption by 10% by 2012.					
				2004/05	2003/04	2002/03	2001/02	
			Residential	516	528	N/A	N/A	DEUS Performance reports
			Commercial	100	N/A	N/A	N/A	
			Rural		N/A	N/A	N/A	
			Institutional	N/A	N/A	N/A	N/A	
2.35	**What is your water consumption?**		**Category**	**Annual consumption (ML)**				
				1999/00	2000/01	2001/02	20002/03	DEUS Performance reports
				960	930	1,030	810	
			TOTAL	3,730				Four year total (1999/2003)

Ref.	Factor	Yes/ No?	Information					Notes/Source
2.36	**What is your energy consumption for your water and wastewater facilities and what**		**Item (Top 14 Power users)**	**Energy consumed (KW hours) 2002/03**	**Energy Bill 2002/03**	**Tariff Type and/or Electricity supplier**		
			Not available					
2.37	**What is your sewerage and water supply operating cost per 100km of mains?**		$533					2002/03 NSW Water Supply and Sewerage Benchmarking Report
2.38	**What is your sewerage and water supply operating cost per property?**		$601					2004/05 NSW Water Supply and Sewerage Benchmarking Report
2.39	**Sewerage and water supply complaints per thousand properties**		47					2002/03 NSW Water Supply and Sewerage Benchmarking Report
2.40	**Water supply quality complaints per 1000 properties**		1					2002/03 NSW Water Supply and Sewerage Benchmarking Report
2.41	**Number of supply main breaks per 100 km**		15					2002/03 NSW Water Supply and Sewerage Benchmarking Report
2.42	**Sewer chokes and collapses per 100km of main**		62					2002/03 NSW Water Supply and Sewerage Benchmarking Report
2.43	**Sewer overflows to the environment per 100km of main**		1					2003/04 NSW Water Supply and Sewerage Benchmarking Report

Ref.	Factor	Yes/ No?	Information					Notes/Source
2.44	**Are sewer overflows monitored?**	Yes						
2.45	**Typical developer charges for water supply per ET**		$8283 (Includes Bowning, Binalong and Yass)					Yass Water DSP page. 4 (2004/05)
2.46	**Average residential bill for sewerage services per property**		$370					2004/5 NSW Water Supply and Sewerage Performance Monitoring Report
2.47	**Volume of sewage treated kL per property**		194					2002/03 NSW Water Supply and Sewerage Benchmarking Report
2.48	**Urban properties without reticulated sewerage and water supply**		Not known					2003/4 NSW Water Supply and Sewerage Performance Monitoring Report
2.49	**Water usage charge c/kL**		110 c/KL					2004/5 NSW Water Supply and Sewerage Performance Monitoring Report
2.50	**Annual water allowance (if given)**		NA					2003/4 NSW Water Supply and Sewerage Performance Monitoring Report
2.51	**Water access charge per property**		$171					2004/5 NSW Water Supply and Sewerage Performance Monitoring Report
2.52	**Drinking water quality tests**		**Physical**	**Chemical**	**Microbiological Ecoli**	**Total coliforms**		2003/4 NSW Water Supply and Sewerage Performance Monitoring Report.
		Compliance 2003/4	100%	100%	95%	67%		
2.53	**Rainwater quality data at extraction point**	No						

Ref.	Factor	Yes/ No?	Information	Notes/Source
2.54	**STP quality licence monitoring results**	Yes		Results in EPA annual return of license 1730
2.55	**Water quality monitoring results for local waterways**	Limited	Parameters: pH, conductivity/salinity, dissolved oxygen, temperature, TP, TN, faecal coliforms and TSS at 12 sites	
2.56	**Water supply, sewerage and stormwater system maps**	Yes		Strategic Business Plans for Water Supply and Sewerage (Yass Stormwater Management Plan)
2.57	**Number of connected properties**		4660 (Water=2670; Sewer=1990)	2002/03 NSW Water Supply and Sewerage Benchmarking Report
2.58	**Range of typical residential block sizes**		N/A	
2.59	**Number and size of rainwater tanks**			
2.60	**Number of tanks connected to the potable system for top-up**	Not available		
2.61	**Rainwater tank rebate**	Yes	$200 per property existed before 30th June 2003 and had water connected.	All new houses connected to Yass UWS after from July 2003 are required to install a rainwater tank with a capacity of at least 4,500 Litres
2.62	**Is there polluted atmospheric fallout over the urban area?**	Unlikely		SoE 2004 (Under emissions)
2.63	**Is there an OSD policy?**	Applied where required, at the discretion of the approving officer. Not documented in formal policy.		

Ref.	Factor	Yes/ No?	Information		Source/Notes
3.1	**What is the mean annual rainfall for the catchment or catchment regions?**		**Location**	**Mean Annual Rainfall (mm)**	
			Yass	665	SILO
3.2	**What is the mean annual evaporation for the catchment or catchment regions?**		**Location**	**Mean Annual Evaporation (mm)**	
			Yass	1,294	SILO

Ref.	Factor	Yes/ No?	Information			Location of available information*
4.1	**What is the water quality of dry weather river flows**		Not available			
4.2	**What is the total annual dry weather discharge volume**		**Location**	**Volume ML/year**		
			Not available			
4.3	**What is the annual dry weather contaminant load**			**TN (kg/year)**	**TP (kg/year)**	
			Not available			
4.4	**What is the water quality of wet weather river flows**		Not available			
4.5	**What is the wet weather mean annual discharge**		**Location**	**Volume ML/year**		
			Not available			
4.6	**What is the annual wet weather contaminant load**			**TN (kg/year)**	**TP (kg/year)**	
			Not available			
4.7	**Have environmental flow requirements been identified for catchment streams?**	Yes	Interim river flow objectives have been set but they are largely qualitative rather than quantitative. However as part of the Yass STP investigation, particular requirements are being investigated.			
4.8	**What is the location of all catchment dams?**		**Location**	**Type**	**Area (sq. km)**	
			Yass Dam, Located directly upstream of Yass	On Stream Dam		Yass Water DSP, page 16

Ref.	Factor	Yes/ No?	Information			Location of available information*
4.9	What is the capacity of each catchment dam?		Location	Capacity (ML)		
			Yass Dam	872		draft IWCM concept study corrections made by YVC (Based on a 2006 survey)
4.10	What is the secure yield of each catchment dam?		Location	Secure Yield (ML)		Yass Dam Yield Study p.13
			Yass Dam	660 to 1080 (ML)		
			Total yield			
4.11	What is the water quality in each		Yass Dam			
	Parameter	units	To be determined as part of Yass STP investigation			
	Total Coliforms	mg/L				
	Chlorine	mg/L				
	Total Hardness	mg/L				
	Total Iron	mg/L				
	TN	mg/L				
	TP	mg/L				
	Turbidity	mg/L				
	TDS	mg/L				
	Metals	mg/L				
4.12	What is the location of all catchment weirs?		Location	Area (sq. km)	Notes	
			Yass Railway Weir	N/A	The weir is shown in the Yass STP Effluent Discharge Locations	
4.13	What is the capacity of all catchment weirs?		Location	Capacity (ML)		
			Yass Railway Weir	N/A		
4.14	What is the secure yield of all catchment weirs?		Location	Secure Yield (ML)		
			Yass Railway Weir	Unknown		

Ref.	Factor	Yes/ No?	Information			Location of available information*
4.15	**What is the water quality in each weir?**		**Yass Weir**	**Value**		
		N/A	Total Coliforms	To be determined as part of Yass STP investigation.		
			Chlorine			
			Total Hardness			
			Total Iron			
			TN			
			TP			
			Turbidity			
			TDS			
			Metals			
4.16	**Are returned flows provided from, or intended to be provided to catchment storage/s or weirs?**	No				
4.17	**Is the water quality of the return flows expected to be the same as the water quality in dam or weir?**	NA				
4.18	**What is the extent and nature of groundwater resources within the catchment?**		**Groundwater Extraction Licences**	**Volume extracted (ML/Year)**		DIPNR (2004) DEUS (2006, 2005). Obtained from Water Resource Info Draft B, page 4
			Groundwater resources are located primarily within the Murrumbidgee Catchment. The current level of ground water extracted is 4,009 ML/a, however the estimated sustainable yield is 10,335 ML/a.	4,009		
4.19	**Does catchment include one or more estuary habitats?**	No				

Ref.	Factor	Yes/ No?	Information			Location of available information*
4.20	**Are there licensed extractions in the catchment?**	Yes	**Licensed under Water Act 1919**			
			SURFACE WATER: Extraction of Water fro River/Creeks			
			Extraction Purpose	**Volume ML/year 2003**	**Volume ML/year 2004**	
			Domestic	Unknown	9	SoE Report 2004, Yass Valley Water Use. http://www.envcomm.act.gov.au/soe/soe2004/YassValley/wateruse.htm
			Industrial	Unknown	Unknown	
			Irrigation & Farming	Unknown	1929	
			Recreation	Unknown	137	
			Stock	Unknown	35	
			Town Water Supply		1700	
			TOTAL (ML/yr)	**708**	**730**	
			GROUND WATER			
			Extraction Purpose	**Volume ML/year 2003**	**Volume ML/year 2004**	
			Stock	Unknown	Unknown	Yass SoE Report 2004, Reported by Ife and Skelt
			Domestic	Unknown	Unknown	
			Farming	Unknown	Unknown	
			Property	Unknown	Unknown	
			LWU			
			TOTAL (ML/yr)	**4009**		

Ref.	Factor	Yes/ No?	Information			Location of available information*
4.21	**Are there licensed town water extractions in the catchment?**	Yes	**Licence**	**Volume (ML)**		
			Murrumbateman Bore Hole (Town Water Supply)	50		Murrumbateman Township Scoping study report p.1
			Yass River (Town Water Supply)	1700		

Appendix B

Consolidation of Issues

YASS IWCM - Combined IWCM Issues

PRG Issues		Related Data Audit Issues		IWCM Issues	
1	Lack of water storage.	21	Poor security of existing supply in terms of historical performance (demands exceeding secure yield) and diversity of sources.	1	Lack of water storage / Poor security of existing source
18	Restrictions leading to reduced standard of living and social impacts in that people cannot have nice gardens and public areas	10	Alternate source for water supply is required. One potential option is interstate water transfer.		
		22	Restrictions impacting on standard of living.		
2	Funding of water supply and sewerage services by the state and federal governments.		*Not identified in Data Audit*	2	Insufficient funds to provide required works
3	Providing urban water services for existing town and predicted growth, particularly water supply.	24	Potential need for service extension: sewerage and stormwater services for existing towns.	3	Need for extension / upgrade of water supply, sewerage and stormwater to serve existing and future customers.
22	Peak day demand at Bowning and Binalong	20	High growth potential of Yass due to proximity to Canberra, facilitation of Sydney-Canberra corridor, and opportunity for industrial and tourism growth.		
		25	Distribution of peak demands to Bowning and Binalong.		
4	Best use of treated sewer effluent and stormwater resources.	29	Need for sustainable effluent management.	4	Need to maximize sustainable effluent and stormwater management
11	Affordability of reuse activities to end users (golf course)	13	Town discharges (Yass treated sewage effluent) implicated in environmental stress (quality and flow regime disruption).		
13	Limited stormwater collection, treatment and reuse	31	Limited stormwater collection, treatment and reuse.		
23	Potential health/management issues with rainwater tanks, septic and greywater sources				
5	Water for industry and town growth	23	Development capped by lack of water.	5	Development restricted by lack of water
		20	High growth potential of Yass due to proximity to Canberra, facilitation of Sydney-Canberra corridor, and opportunity for industrial and tourism growth.		

YASS IWCM - Combined IWCM Issues

PRG Issues		Related Data Audit Issues		IWCM Issues	
		2	The Upper Yass River sub-catchment was found under the high hydrological and environmental stress level. Other sub-catchments are also under high stress. The main reasons for stress are extraction and salinity.		
		1	Water scarcity is a critical issue. Surface water utilisation in the catchment is above the sustainable yield.		
		8	Climate change may adversely alter the rainfall and temperature patterns in an area where evaporation already exceeds rainfall on an annual basis.		
6	Poor water quality in the Yass River	27	Raw surface water quality for town water supply poor in relation to salinity and TSS.	6	Poor water quality in the Yass River affects the quality of the water supply.
8	Salinity in water and dryland salinity	16	Major water quality issues identified are occasional turbidity, salinity, nutrients (total phosphorus) and total suspended solids. Ambient water quality does not protect the identified environmental values for the Yass River.		
9	Salinity of the town water source				
7	Catchment clearing and poor land management in the catchment is leading to sheet and gully erosion which is causing siltation in the reservoir	7	Traditional land use including land clearing, loss of riparian vegetation, deforestation, and agricultural uses results in poor fertility, soil erosion and dryland salinity.	7	Traditional land use including land clearing, loss of riparian vegetation, deforestation, and agricultural uses has resulted in poor fertility, soil erosion, acidic soils and dryland salinity
20	Poor fertility soils are leading to fertiliser application which when washed off causes phosphorus issues in the waterways	15	Surface water quality is poor and being impacted by land uses on acidic, poor fertility and high erosion hazard soils.		
		5	Many of the soils in the Yass Valley are very acidic.		
8	Salinity in water and dryland salinity	3	Extensive land clearing from pioneering times and grazing in the Yass district caused dryland salinity.	8	Extensive land clearing and grazing has contributed to dryland salinity
10	Increase in rural residential properties is leading to more stress to town dams. It is not clear, but this may be causing increased water competition and stress		*Not identified in Data Audit*	9	Some rural residential developments are not sustainable
12	High water supply and sewer bills compared to the quality of water supplied	33	High operating and management costs giving rise to bills for both water supply and sewerage services above the state median.	10	High operating and management costs resulting in high bills
14	Stormwater quality is contributing to water quality issues below Yass Dam	32	Stormwater contributing to erosion and sedimentation in Yass.	11	Stormwater contributing to water quality issues in Yass River

YASS IWCM - Combined IWCM Issues

PRG Issues		Related Data Audit Issues		IWCM Issues	
15	Rural residential properties have bores, the regulation of which is hard to enforce and it may be causing groundwater stress	18	Non-sustainable levels of groundwater licence allocation have occurred within rural residential developments areas of Murrumbateman and Sutton.	12	Potential groundwater over extraction
16	Lack of a water sharing process and information on who should be allowed to take what water and when	11	Lack of a water sharing process for the Yass River which is over-allocated. This is potentially threatening security of town water supply.	13	Lack of water sharing process
17	Town water implicated in stress below Yass Dam	14	Town extractions (Yass water supply) implicated in the hydrologic stress.	14	Town water extractions contributes to hydrologic stress in Yass River
		12	Water stress as identified in the catchment.		
19	Salt, taste and odour (turbidity occasionally) problems in town water supply for Yass, Bowning and Binalong	26	Poor comparative compliance with drinking water guidelines for total dissolved salts and hardness.	15	Occasional non compliance with drinking water guidelines
21	Murrumbateman groundwater quality is poor in relation to nitrates, hardness, total dissolved salts	28	Groundwater quality for Murrumbateman town water supply is poor in relation to hardness and TDS.	16	Groundwater quality for MBU town water supply is poor
		19	Poor groundwater quality: hardness and TDS limiting the potential use of this resource without treatment.		
		4	Most local ground water has high salt concentrations making it unsuitable as drinking water source.		
24	Need for improved septic system selection in rural residential areas	30	Need for improved selection and monitoring of on-site systems.	17	Need for sustainable on-site systems
	Not identified in PRG	6	There are activities within the LGA (e.g. quarrying, various industries) that have the potential to contribute to chemical releases into waterways and the environment.	18	There are activities within the LGA that have the potential to pollute waterways
	Not identified in PRG	17	Difficulty in determining the impact of point source industrial pollution on water quality.		
	Not identified in PRG	9	Changing land uses: rural to rural residential, grazing and cropping to viticulture/horticulture.	19	Changing land use leading to increased water demand
	Not identified in PRG	34	Recent rise in water service and sewerage complaints probably associated with an aging infrastructure and rise in sewer main chokes probably due to penetration of tree roots.	20	Increase in water service and sewerage complaints and sewer main chokes

Appendix C

Stakeholder Consultation

PRG Workshop 2 Briefing Paper and Summary Paper

Yass IWCM Strategy Plan

Project Reference Group Workshop 2 Briefing Paper

1 Introduction

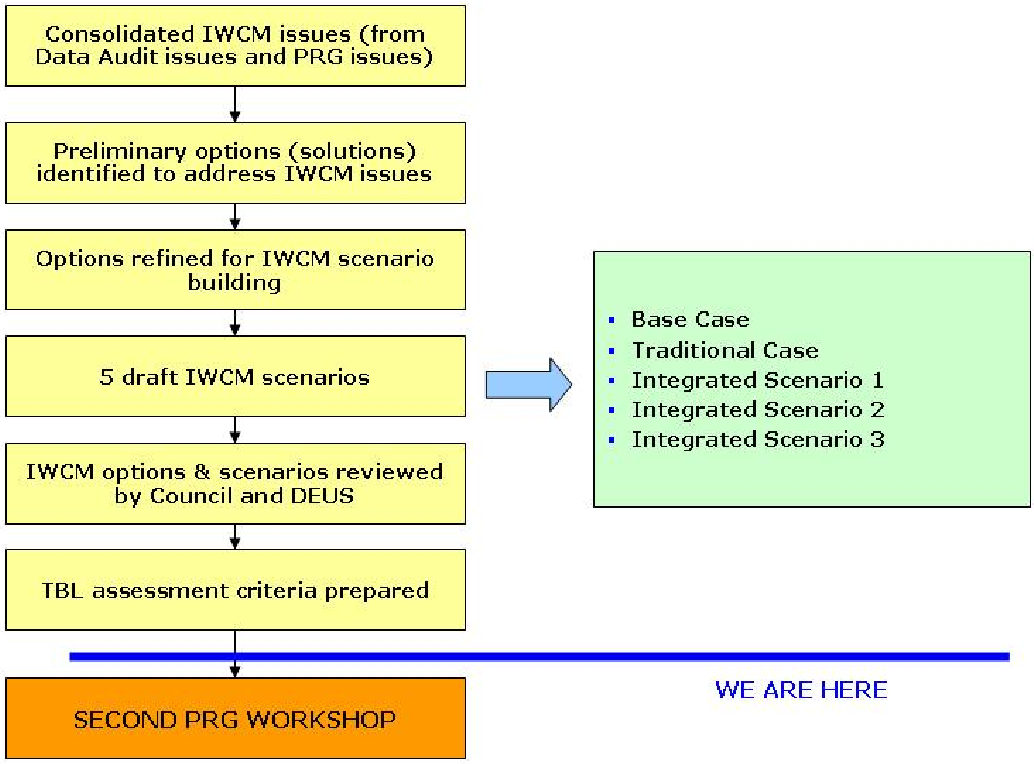
This paper is the second briefing note to the Project Reference Group (PRG) for the development of an Integrated Water Cycle Management Strategy (IWCMS) for Yass Valley Council (YVC). As a member of the PRG, you were invited to the first PRG workshop held on 11 May 2006. At that workshop we:

- introduced the NSW Department of Energy, Utilities and Sustainability (DEUS) concept of IWCM;
- identified and prioritised water cycle management issues; and
- agreed on a set of IWCM objectives and measures.

2 What happened since the first PRG workshop?

A number of steps on the IWCM process have been completed since the first PRG workshop as shown in Figure 1.

Figure 1 - What Happened Since the First PRG Workshop?



Data audit issues and PRG identified issues were consolidated into a set of IWCM issues in consultation with YVC. Based on the consolidated IWCM issues, a preliminary list of options (ie. solutions) that could potentially address the identified issues were developed.

The merits of each identified potential option were assessed. A refined list of options was selected to solve the IWCM issues and thus be carried through for inclusion in the IWCM scenario development.

Five IWCM scenarios were developed (See Attachment A) based on the refined list of options as follows:

- A “base” case (also known as “business as usual”) which does not include any solutions beyond what YVC is already doing to improve or maintain the water supply and sewerage businesses;
- A “traditional” case based on traditional solutions that solve issues in an isolated, non-integrated way; and
- Three “integrated” solutions that incorporate combinations of various build and non-build options and an increasing level of integration of water supply, sewerage and stormwater management by including recycled water use and stormwater harvesting, among other options.

A capital works program, OMA (Operation, maintenance, administration) schedule and financial model was set up for each IWCM scenario in order to compare levels of expenditure and typical residential bills (TRB) to be paid by water and sewerage customers under each IWCM scenario. This enabled the IWCM scenarios to be compared in terms of TRB, a key social criteria identified by the PRG.

A preliminary Triple Bottom Line (TBL – social, environmental, economic) assessment for each IWCM scenario was prepared (See Attachment B) in order to make comparisons of environmental, social and economic outcomes between IWCM scenarios. This was based on the agreed set of objectives and measures developed at the first PRG meeting.

Consolidated issues, options (solutions), developed scenarios and TBL criteria were also reviewed at a steering committee meeting between YVC, JWP and DEUS on 6 February 2007.

3 What is happening at the second PRG workshop?

Based on the five scenarios developed (See Attachment A) and the preliminary TBL assessment (See Attachment B) the PRG will:

- Review the draft scenarios;
- Rank the five IWCM scenarios considering the social, economic and environmental costs and benefits of each scenario; and
- Identify a preferred scenario or preferred scenario components.

The proposed agenda for the second PRG workshop is detailed in Table 1.

Table 1 – Second PRG Workshop Agenda.

Time	Details	Leader
11.00 am	Welcome and introduction	Council
11.10	Objectives, review of IWCM process, role of PRG for Workshop 2 and discussion of work done to date	JWP
11.30	Present project elements to PRG and discussion	All, facilitated by JWP
12.30	Lunch	
1.00 pm	Discussion of Scenarios	All, facilitated by JWP
2.00	Discussion of TBL Analysis	All, facilitated by JWP
2.30	The Way Forward	All, facilitated by JWP
3.00	Close	

Workshop Date	Workshop Time	Workshop Venue
Tuesday, March 13th 2007.	11.00 am – 3.00 pm	Council Chambers 209 Comur St, Yass NSW 2582

4 What will happen after the second PRG workshop?

Following the workshop, a summary paper will be forwarded to participants. The planning team will finalise the draft scenarios and prepare a strategy document.

Community consultation on the draft strategy will be also undertaken to inform the community about the outcomes of the IWCM process and the adoption of a preferred scenario.

5 Who Can I Contact?

Should you have any queries regarding the second PRG workshop or about the IWCM Strategy, Council's primary contact for this project is Siva Sivakumar, YVC Water and Sewer Business Manager on 02 6226 1477, email siva.sivakumar@yass.nsw.gov.au.

6 Attachments

A IWCM Scenarios

B TBL assessment

YASS IWCM - Project elements of draft scenarios

			Projects				
	IWCM Issues	**Strategy**	**Base case (B) (04/05)**	**Traditional (T)**	**Integrated 1 (IN 1)**	**Integrated 2 (IN 2)**	**Integrated 3 (IN 3)**
1	Lack of water storage / Poor security of existing source	Demand management	No demand management Present avg. demand (in 2006): Yass 2.25 ML/d, MBU 0.13 ML/d Projected avg. demand (in 2036); Yass 4.7 ML/d, MBU 0.4 ML/d GUN has no reticulated supply at present.	Demand management including pricing, education and BASIX for new development Projected demand 4.2 ML/d (Yass in 2036)	High level demand management (T + showerhead retrofit and UFW reduction) Projected demand 3.4 ML/d (Yass in 2036)	same as IN 1	same as IN 1
		Yass source augmentation	Safe yield 2.2 ML/d (800ML/y) Augmentation required 2.5 ML/d (for Yass WS scheme) Off river storage gives extra storage of 500 ML (~1 ML/d) Dam raise by 3 m gives extra storage of 1,590 ML (~4 ML/d) Council started off river storage implementation	Augmentation required 2 ML/d Off river storage + Dam raise	Augmentation required 1.2 ML/d Only off river storage	Dual retic demand 0.7 ML/d Augmentation required 0.5 ML/d Only off river storage	No augmentation required Additional demand supplied by indirect potable reuse in Yass scheme (available 1.8 ML/d, DSS)
		Emergency drought relief	Lowest yield 1.8 ML/d (650 ML/d) Emergency bore 1.6 ML/d Total 3.4 ML/d Max Can cover low flow for Yass system only	B + Preparation of drought management plan + Study on sensitivity of Yass dam yield	Same as T	Same as T	Same as T
		Effluent management	Current effluent reuse 40% in summer (160 ML/y) in direct agricultural applications	All effluent first to river and then indirect use of 160 ML/y for park and golf course irrigation (Town water demand reduction of 40 ML/y)	Same as T	Dual reticulation for new development areas (Only Yass, ET 1800) Insignificant benefit for other towns	Indirect potable reuse (Available 1.8 ML/d from Yass WS area, Source: DSS)
		MBU WTP	Murrumbateman (MBU) present supply capacity 3.5 l/s (0.3 ML/d) Augmentation to 0.8 ML/d planned (by 2007/08) Shower and kitchen requirement to be supplied by RWT Requirement is 0.9 ML/d for external, laundry and toilet use (refer to DSS for end use) (only chlorination for bore water) (But required is 1.1 ML/d if no RWT, and will require advanced treatment for nitrate removal)	Augmentation to 0.9 ML/d (Shower and kitchen requirements to be supplied by RWT)	Same as T	Same as T	Same as T
		GUN water supply	Groundwater Source for Gundaroo (GUN) as identified in SBP (by 2013/14) Projected Pop 350, avg demand 350L/c/d, capacity required 0.12 ML/d	Same as B	Same as B	Same as B	Same as B
2	Insufficient funds to provide required works	Financial management	Update DSP & F.P. (cost included in SBP OMA) Uncertainty in continuation of Country Town Water Supply and Sewerage (CTWSS) funding	B + Apply full cost recovery pricing	T + Designed to be self funding and less costly. Greater access to funds through diversified services and product delivery (No cost included)	same as IN 1	same as IN 1
3	Need for extension / upgrade of water supply, sewerage and stormwater to serve existing and future customers.	Asset renewal	Asset renewal as stated in SBP	Matching renewal for investment (mains, bores, pumps, reticulation, reservoirs)	Same as T	Same as T	Same as T
		New water mains in Yass scheme	Service extension as stated in SBP	Same as B	Same as B	B + Dual reticulation piping (for effluent management as in 1)	B + transfer of treated effluent to upstream of water intake (for effluent management as in 1)
		Bowning and Binalong	Only 75% of full peak day demand can be supplied by 100mm main connected to Yass reticulated water supply. Duplicate 150mm pipe from Yass to Binalong as per SBP.	Yass to Binalong & Bowing - as per DPWS strategy study, 3B option: store excess filter water from Yass in Binalong dam and filter in a 1.1ML/d microfiltration plant + telemetry system update.	Same as T	Same as T	Same as T
		New water mains in MBU scheme	MBU extension as stated in SBP	Same as B	Same as B	Same as B	Same as B
		Sewer extension	Yass, BIN, BOW, MBU and GNU as stated in SBP	Same as B	Same as B	Same as B	Same as B
4	Need to maximize sustainable effluent and stormwater management	Effluent management	*Effluent management as in 1*				
		Demand management	*Rainwater tanks as in 1*				
5	Development restricted by lack of water	Yass source augmentation	*As in 1*				
		MBU WTP	*As in 1*				
		Effluent management	*As in 1*				
		New water mains in Yass and MBU scheme	*As in 3*				
		Sewer extension	*As in 3*				
6	Poor water quality in the Yass River affects the quality of the water supply.	Yass STP upgrade	Existing STP 7500 EP (3500 EP TF unit not working properly, working Pasveer Channel is 4,000 EP) SBP proposed to change treatment process (secondary with P removal) 6800 ep (1.22 ML/d) in 2009 and 10800 ep (1.94 Ml/d) in 2032 But required is 2.0 ML/d in 2036	Capacity required 1.9 ML/d in 2036	Capacity required 1.8 ML/d in 2036	IN 1 + Advanced STP process (filtration) for dual reticulation requirements Capacity 1.8 ML/d	1 + Advanced STP processes (filtration + membrane) to satisfy indirect potable reuse requirements Capacity 1.8 ML/d
		Stormwater management	SWM activities as identified in SBP	Update SWM plan + Implement SW initiatives as SWM plan (partial funding through SW levy)	Same as T	Same as T	Same as T
		Catchment initiative	No integrated catchment initiative	Same as B	Implement Catchment initiatives (partial funding through catchment levy to be paid to CMA) + Water quality monitoring (cost by CMA) + implement Evn Mgt Action Plan	Same as IN 1	Same as IN 1
		STP for other towns	STP for MBU, Binalong (BIN), Bowning (BOW) and Gunderoo (GUN) as identified in SBP	Same as B	Same as B	Same as B	Same as B
		On-site sewerage management (monitoring)	Last monitoring was conducted in 2000	On-site systems audit every 3 years (cost to be included in General Fund)	Same as T	Same as T	Same as T

YASS IWCM - Project elements of draft scenarios

IWCM Issues		Strategy	Projects				
			Base case (B) (04/05)	Traditional (T)	Integrated 1 (IN 1)	Integrated 2 (IN 2)	Integrated 3 (IN 3)
		Water Treatment in MBU	*As in 1*				
		Water Treatment in Yass	*As in 15*				
		On-site sewerage management (incentive)	Present regime (No incentive for better on site technologies)	Same as B	Same as B	Incentives (@$2500) for better on site technologies. Assumed 25% upgrade of total over 10 years (cost to be included in General Fund)	Same as IN 2
7	Traditional land use including land clearing, loss of riparian vegetation, deforestation, and agricultural uses has resulted in poor fertility, soil erosion, acidic soils and dryland salinity	Catchment initiative	*As in 6*				
8	Extensive land clearing and grazing has contributed to dryland salinity	Catchment initiative	*As in 6*				
9	Some rural residential developments are not sustainable	Development control	Do nothing	Drought management plan to identify emergency drought supply + Development Control Planning (no cost included in draft scenario) + Liaison with DNR for water licence control (no cost included in draft scenario)	Same as T	Same as T	Same as T
10	High operating and management costs resulting in high bills	Infrastructure upgrades	*As in 1, 3 and 6*				
		Asset renewal	*As in 3*				
11	Stormwater contributing to water quality issues in Yass River	Stormwater management	*As in 6*				
12	Potential groundwater over extraction	Groundwater strategy	Do nothing	Audit bores and GW quality monitoring (DNR to fund) + Liaison with DNR to prepare GW strategy plan (no cost included in draft scenario)	Same as T	Same as T	Same as T
13	Lack of water sharing process	Water Sharing Plan	As usual (No water sharing plan)	Liaison with DNR to prepare water sharing plan (no cost included in draft scenario)	Same as T	Same as T	Same as T
14	Town water extractions contributes to hydrologic stress in Yass River	Demand management	*As in 1*				
		Effluent management	*As in 1*				
15	Occasional non compliance with drinking water guidelines	Water treatment in Yass	Water softening as identified in SBP will address salt problem only	Improve management of Powdered Activated Carbon (PAC) unit to address taste and odour	Same as T	Same as T	Same as T
		MBU WTP	*As in 1*				
16	Groundwater quality for MBU town water supply is poor	MBU WTP	*As in 1*				
		Groundwater strategy	*As in 12*				
17	Need for sustainable on-site systems	On-site sewerage management (monitoring)	*As in 6*				
		On-site sewerage management (incentive)	*As in 6*				
18	There are activities within the LGA that have the potential to pollute waterways	Licensing and regulation	As usual	Liaison with DEC (through POEO licensing) Update LEP (included in SWM plan)	Same as T	Same as T	Same as T
19	Changing land use leading to increased water demand	Stormwater management	*As in 6*				
		Growth planning	*As in 5*				
		Licensing and regulation	*As in 18*				
		Water Sharing Plan	*As in 13*				
20	Increase in water service and sewerage complaints and sewer main chokes	Asset renewal	*As in 3*				

Measures	Criteria Weighting	Scenarios: Base case	Traditional	Integrated 1	Integrated 2	Integrated 3	Notes
Change in combined residential water and sewage bill compared to current ($/year)		**$1,350**	**$1,650**	**$1,590**	**$1,805**	**$1,640**	TRBs from financial modelling
% increase in TRB		0%	22%	18%	34%	21%	compared to current (base case)
Score (Social)	1.0	5.0	1.7	2.4	0.0	1.8	Score out of 5, best result got 5 and worst got 0.
OMA expenditure per residential assessment compared to current ($/year)		**$214**	**$280**	**$291**	**$326**	**$309**	NPV of OMA cost (WS & S) over 30 years, each program divided by number of assessments at 2035.
% increase in OMA		0%	31%	36%	52%	44%	compared to current (base case)
Score (Economic)	1.0	5.0	2.0	1.6	0.0	0.8	Score out of 5, best result got 5 and worst got 0.
Annual Cost per kL of water produced ($/kL)		**$1.46**	**$1.91**	**$2.23**	**$2.42**	**$2.19**	NPV capital and operating cost divided by total average water production per annum.
% increase in cost		0%	31%	52%	66%	50%	compared to current (base case)
Score (Social)	1.0	5.0	2.6	1.0	0.0	1.2	
Water consumption per assessment (kL/year)		**171**	**144**	**84**	**84**	**84**	From DSS. Residential consumption per account at 2036 with savings due to demand management.
% reduction		0	16%	51%	51%	51%	compared to base case
Score (Environmental)	1.0	0	1.5	5.0	5.0	5.0	Score out of 5, best result got 5 and worst got 0.
Increase in System Drought-Proofing							Inclusion of DrMP
Drought Management Plan implemented		**0**	**1**	**1**	**1**	**1**	Yes (1) or No (0)
Score (Social)	1.0	0	5.0	5.0	5.0	5.0	Score out of 5, best result got 5 and worst got 0.
Satisfaction of remaining pre-requisites for grants from DEUS (DMP and DrMP)							
Drought Management Plan and Demand Management Plan implemented		**1**	**2**	**2**	**2**	**2**	According to Concept Study, all other criteria are satisfied.
Score (Economic)	1.0	3	5.0	5.0	5.0	5.0	
Improvement in water quality in Yass River through increased level of effluent treatment and reduction in pollution from on-site systems and stormwater							
% of samples complying with Interim WQO		**40**	**60**	**70**	**75**	**75**	Subjective, based on capital works provided and activities undertaken
Score (Environmental)	1.0	2.7	4.0	4.7	5.0	5.0	
Catchment improvements implemented ($/assessment) through stormwater and catchment levy		**$5.69**	**$27.62**	**$68.30**	**$68.30**	**$68.30**	stormater levy and catchment levy (divided by average no. water and sewer assessments at 2035 - total rateable assessments N/A)
Score (Environmental)	1.0	0.4	2.0	5.0	5.0	5.0	
Implementation of measures to achieve Yass River Flow Objectives		**0**	**1**	**1**	**1**	**2**	Implementation of WSP (1) and indirect potable reuse (1)
Score (Environmental)	1.0	0	2.5	2.5	2.5	5.0	
Levels of Service (water supply quantity for Bowning and Binalong) achieved							
LOS achieved		**0**	**1**	**1**	**1**	**1**	Based on capital works provided
Score (Social)	1.0	0	5.0	5.0	5.0	5.0	
Compliance with ADWG (%)		**96**	**100**	**100**	**100**	**100**	Subjective, based on capital works to improve compliance
Score (Social)	1.0	4.8	5.0	5.0	5.0	5.0	Score out of 5, best result got 5 and worst got 0.
Improvement in Yass STP effluent quality (%)		**70**	**70**	**70**	**80**	**90**	Subjective, based on proposed STP upgrade
Score (Environmental)	1.0	3.9	3.9	3.9	4.4	5.0	Score out of 5, best result got 5 and worst got 0.
Replacement of raw water extraction with alternative water sources (effluent, stormwater etc) (ML/a effluent reused)		**160**	**160**	**160**	**416**	**657**	Total reuse volume (ML/a)
% replacement (of total raw water extracted)		9%	10%	12%	30%	47%	compared to total water extracted (for each program)
Score (Environmental)	1.0	0.9	1.0	1.2	3.2	5.0	Score out of 5, best result got 5 and worst got 0.
Asset Replacement Program ($'000)		**$3,839**	**$5,530**	**$5,530**	**$5,530**	**$5,530**	Total 30 year renewal expenditure, based on asset value and depreciation
% of total renewals required		69%	100%	100%	100%	100%	Compared to maximum renewal expenditure (IN1, IN2)
Score (Social)	1.0	3.5	5.0	5.0	5.0	5.0	Score out of 5, best result got 5 and worst got 0.
Uptake of water efficient technologies (% of accounts)		0	5	25	25	25	Estimate based on WSPs
Score (Environmental)	1.0	0	1.0	5.0	5.0	5.0	Score out of 5, best result got 5 and worst got 0.
Percentage of on-site systems improved or replaced with reticulated sewerage or best practice technologies		**0**	**12%**	**12%**	**25%**	**25%**	No. lots sewered (600) as % of total assessments + no. on-site systems improved (subjective). JWP has assumed that the Incentive for better on-site sewerage systems (Integrated scenarios 2 and 3) will address the problems of 25% of all on-site sewage systems in the LGA.
Score (Social)	1.0	0	2.4	2.4	5.0	5.0	Score out of 5, best result got 5 and worst got 0.
Capital cost over thirty years ($'000)		**$53,255**	**$59,412**	**$54,248**	**$57,663**	**$50,306**	NPV of capital cost (WS & S) over 30 years, each program
Operating cost over thirty years ($'000)		**$28,229**	**$36,971**	**$38,336**	**$42,987**	**$40,743**	NPV of OMA cost (WS & S) over 30 years, each program

Appendix D

Demand Forecasting Report

Success through Partnership
Success through People

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Yass Valley Council

Water Demand Analysis and
Water and Effluent Forecasting Report

July 2007

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Yass Valley Council

Water Demand Analysis and Water and Effluent Forecasting Report

July 2007

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Executive Summary

This report sets out the Water Demand Analysis and Water and Effluent Forecasting undertaken for Yass Valley Council (YVC) as part of their Integrated Water Cycle Management (IWCM) Plan.

The key components of this study included:

- Data collection and review: to establish the adequacy of available water production, consumption, restriction and demand management information held by YVC.
- A water demand analysis: to climate-correct YVC's historical water demand records, establish the level of unaccounted for water, and establish the categories of existing YVC consumers and the breakdown of their water use activities.
- Water demand effluent forecasts: to identify the drivers of future demand in the YVC service area in order to establish a baseline forecast of the water demands and effluent flows that would be expected in the service area over the next 30 years.
- A water efficiency analysis: to determine a preliminary cost-benefit assessment of potential water efficiency measures, and assess the impact of a set of three potential water efficiency programs (demand-side management programs) for YVC.

The key outcomes of this analysis are set out in **Error! Reference source not found.**.

Table 1: Key outcomes and recommendations of the analysis.

Element	Key outcomes and recommendations
Data collection and review	Review the customer consumption database customer categories and confirm the number of dwellings on multi-residential assessments.
Water demand analysis	The climate corrected potable water production within YVC's service area was 848 ML/a in 2004/05 with: • Yass 801 ML/a; and • Murrumbateman 47 ML/a. Average UFW in the Yass scheme was found to be 26% of the total production volume for the baseline. In the absence of better data for Murrumbateman at the time of analysis an UFW of 26% was also assumed, despite 40% UFW being calculated using the available production and consumption records. Around half of the UFW is non-revenue water use such as fire fighting, mains flushing and filter backwash and it is not possible to reduce these uses except non-revenue water such as unbilled metered use or under registration of consumer meters. The other half of the UFW is physical losses due to leakage. The target UFW is 20% (10% from leakage and 10% non revenue use). Residential demand accounts for 72% of consumption in Yass and 80% in Murrumbateman.
Water demand and effluent forecasts	Population growth in Yass and Murrumbateman is expected to follow similar trends and will be the most important driver of town water demand and effluent forecasts in YVC. Baseline water forecasts predict that annual average production rise by approximately 53% in Yass and 50% in Murrumbateman by 2036.

Element	Key outcomes and recommendations
Water efficiency analysis	By applying a number of individual demand management measures to the baseline forecast and examining the costs and benefits, the relative merit of each measure was determined. The best performing individual measures were progressively bundled together as a number of efficiency programs. A review of YVC's best-practice pricing is expected to be the most cost-effective measure for reducing water demand over the planning horizon, combined with the impact of BASIX, and a community education program. The adopted WSP is expected to reduce the total baseline annual average demand by up to 17% by 2036 based on current demand trends. However, further review of costing for each water efficiency measure is required to finalise the cost benefit analysis used to develop these water efficiency programs. This is expected to be undertaken during the review and updating of the YVC Demand Management Plan.

Table of Contents

1 Introduction

In 2006, Yass Valley Council (YVC) engaged JWP to develop an Integrated Water Cycle Management (IWCM) Strategy Plan. As part of that commission, a study of historical demand and forecasts of future water demands and effluent volumes was undertaken. This "Historical Demand Analysis and Water and Effluent Forecasting Report" sets out the findings of that study.

1.1 Study Aims

The aims of this study were to:

- Climate-correct YVC's historical water production records, to ensure that appropriate historical production volumes are used for developing forecasts of future production levels;
- Establish the level and potential sources of unaccounted for water;
- Examine the categories of existing YVC water consumers and establish the breakdown of their water use activities, to forecast future consumption volumes for different ens-uses and to assist in the development of appropriate water efficiency programs;
- Identify the drivers of future demand in the YVC service area. This analysis is important for developing baseline forecasts of the water demands and effluent flows that could be expected in the YVC service area over the next 30 years;
- Develop a preliminary cost-benefit assessment of potential water efficiency measures. This analysis formed the basis from which three potential water efficiency programs for YVC could be developed and applied to the baseline forecasts of water demands; and
- To identify the water savings that could be achieved by each water efficiency program, and the consequent impact of these on effluent flows.

The water demand and effluent forecasts developed will be an important input into the development of a demand management program and the assessment of the future water and sewerage infrastructure requirements of YVC's customers. In addition, this study identifies the potentially replaceable non-potable end-uses for water and the volume of the potential effluent resource available.

1.2 Important Demand Analysis Terms

Different organisations use different terms when discussing water demands. For consistency, the following definitions (Table 2) have been adopted for the purposes of the analysis presented in this report.

Table 2: Important demand analysis terms.

Term	Adopted definition
Production	Total water that is passed through bulk meters and treatment facilities into the reticulation system.
Consumption	Total water passing from reticulation mains into customer's service lines and captured by a water meter.
Distribution	System used for conveying bulk water to a water utility.
Reticulation	System used for conveying water from the distribution points to the customer's service lines.
Demand-side management	Process of improving efficiency in demand for services rather than augmenting the supply available. Sometimes simply referred to as demand management.

Term	Adopted definition
External use	Water that is used for irrigation and cooling, and hence is influenced by climate.
Internal use	Water that is used within buildings and any other water consumption that is not influenced by climate. This demand is assumed to remain unchanged by seasonal effects.
Non-revenue water	The difference between the amount of water produced and that which is metered as consumed and subject to the utility's pricing structure.
Unaccounted for water	The difference between metered consumption and production. Strictly speaking, a reticulation system with no consumption metering would have 100% unaccounted for water.

1.3 Structure of this document

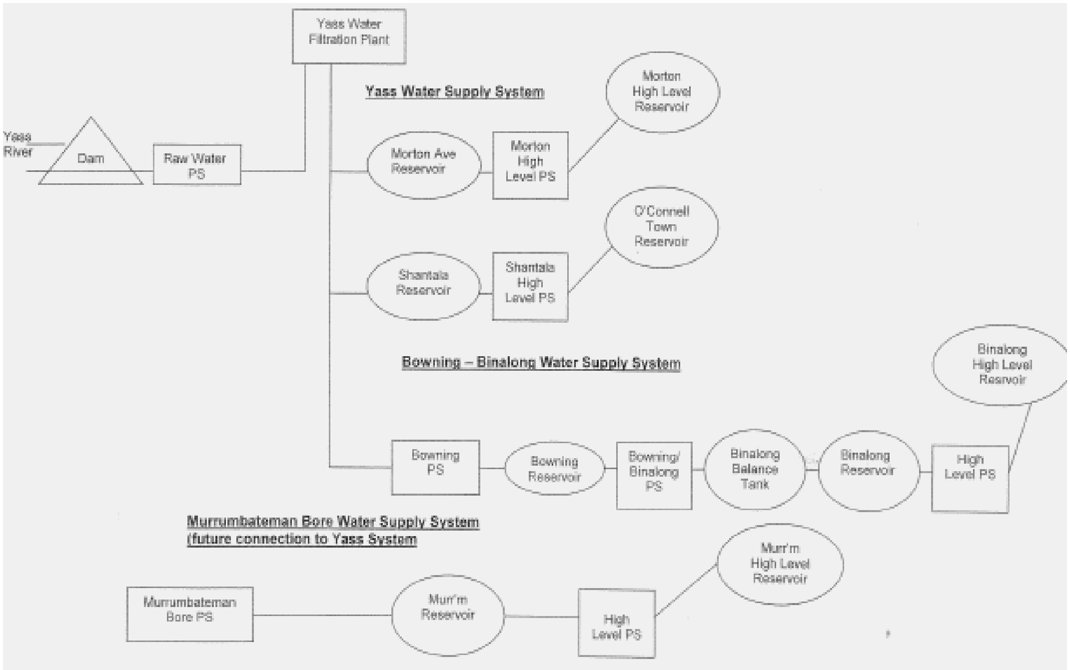
The scope of this study can be summarised as follows:

- **Section 2 System Background:** sets out details of the YVC water supply system;
- **Section 3 Data Collection & Review:** sets out the available sources of data for the analysis and the limitations of the data set;
- **Section 4 Water Demand Analysis:** establishes historical water production (corrected for climate), water consumption and unaccounted for water in the YVC supply system;
- **Section 5 Water Demand and Effluent Forecasts:** examines the likely consumption drivers for the YVC service area into the future and establishes a baseline forecast of the resultant water demands. In addition, consideration is also given to the resultant effluent generated;
- **Section 6 Water Efficiency Analysis:** details a cost-benefit assessment of a variety of water efficiency measures that could be used to reduce the baseline forecast of water demands; and
- **Section 7 Conclusions:** sets out the pertinent aspects of the analysis for YVC's business planning activities.

2 System Background

As the Local Water Utility (LWU) for the Yass Valley local government area (LGA), Yass Valley Council (YVC) provides water supply to the towns and villages of Yass, Bowning, Binalong and Murrumbatemen through two separate water supply networks, as illustrated in Figure 1.

Figure 1: Yass Water Supply Systems



The main network consists of Yass Dam located on the Yass River, a pump station located 300 m downstream of the Dam, a water filtration plant and a distribution network of reservoirs, pump stations and pipelines. This system supplies water to Yass, Bowning and Binalong.

When constructed in 1927 the Yass Dam has a storage capacity of 1,125 ML, however since then it is estimated that sedimentation has reduced its storage capacity to 872 ML in 2006. The siltation rate is now in the range of 0.2 ML/yr. The secure yield of the Yass Dam was estimated as part of the Yass Dam Yield Study to be between 650 ML/yr and 1000 ML/yr.

The water filtration plant has a treatment capacity of 13 ML/d using dissolved air floatation and rapid gravity sand filtration processes.

Murrumbateman is serviced by the Murrumbateman bore well located in the Murrumbateman Recreation Ground. The water is supplied untreated.

A summary of the key features of YVC water supply schemes are listed in Table 3.

Table 3: YSC Water Supply

Population Served		
YVC Population Forecast (2006)	Yass, Bowning and Binalong Murrumbateman Total Served	6,649 339 6,988
DWE Performance Report (2004/05)	Total Served	6,800
Number of Assessments		
YVC Customer Database	Yass, Bowning and Binalong Murrumbateman Total Served	2,775 161 2,936
DWE Performance Report (2004/05)	Total Served	2,900
Raw Water Source	Yass, Bowning and Binalong Murrumbateman	Yass River Groundwater source
Extraction licence	Yass : Murrumbateman:	1,700 ML/y N/A
Water Extracted for Town Supply (2004/05)	Yass : Murrumbateman:	840 ML/a 45 ML/a
Scheme Treatment Capacity	Yass WFP Murrumbateman WFP	13 ML/d N/A
Current Peak Day demand (2006)	Yass, Bowning and Binalong Murrumbateman	5.9 ML/d 0.4 ML/d
Treatment Process	Yass Murrumbateman	Dissolved air flotation, rapid gravity sand filtration No treatment
Potable Water Quality compliance	2004/05	100% with physical parameters 100% with chemical parameters 96% for E. coli 74% for Total Coliforms
	2003/04	100% with physical parameters 98% with chemical parameters 95% for E. coli 65% for Total Coliforms
Typical residential water bill (2005/06)	$896 per assessment	
Operating Cost (2004/05)	$315 per property	
Quality Complaints (2004/05)	1 per 1000 properties (NSW State average 5)	
Service Complaints (2004/05)	16 per 1000 properties (NSW State average 13)	
Water loss		
YVC Customer Database	26%	
DWE Performance Report (2004/05)	21%	

Source: DEUS (2004/05), YVC (2006)

3 Data Collection and Review

Data available for undertaking this demand analysis, including data sources and limitations, is set out in Table 4.

Table 4: Water demand analysis input data.

Data	Source	Description (including limitations)
Production records	YVC	Historical daily metered records of water pumped between January 1990 and December 2005 for the Yass, Bowning and Binalong water supply system. Only monthly production data was made available for the Murrumbateman scheme between 2003 and 2005. Limited records of maintenance or calibration of this meter exist.
Climate records	Silo Data Drill	Daily rainfall, evaporation and temperature records for Lat: -34.80, Long: 148.90 (Yass). Records prior to 1970 are of poor quality and have not been used.
Population data	YVC	Historical population and projections were based from the YVC Management Plan (2005), YVC Growth Profile (2004), Yass Water Supply Emergency Drought Relief Strategy (2004) and the YVC Developer Services Plan (2004).
	YVC	Finalised population projection calculated based on an average annual growth rate of 2.6% from YVC Growth Profile (2004).
	ABS Census	Census information from 1991, 1996 and 2001.
Consumption records.	YVC	Customer database of metered consumption containing tri-annual billing records (in kilolitres) for 2003, 2004 and 2005.
Meter losses	YVC	No data available on specific losses related to aged/inaccurate customer meters.
Water restrictions	YVC	Records of the date and level of restrictions imposed from January 1998 to March 2006 were available. Due to the extensive list of restrictions, the implementation periods are highlighted on page 9.
Efficiency programs	YVC	YVC has implemented a number of water conservation measures, including rainwater tanks, shower head replacement, education and pricing.

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4 Water Demand Analysis

The purpose of the water demand analysis is to establish how water has historically been used in the YVC service area. From a detailed understanding of historical use it is possible to predict (or forecast) expected future water demands.

The water demand analysis presented here considers both the volume of water produced and water consumed. The analysis also considers the difference between these two amounts (the produced and the consumed), to quantify the volume of unaccounted for water (UFW) within YVC water supply schemes. Similarly, the seasonal (external) and fixed (internal) end-use components of water demand are also identified.

The analysis was undertaken in the following steps:

- Correction of YVC's historical water production records for the impact of climate in order to establish an appropriate peak to average day demand ratio;
- Determination of total annual water consumption;
- Estimation and categorisation of UFW; and
- Determination of the breakdown of total consumption by customer category and within customer categories.

Details of each of these steps are set out in the following sections.

4.1 Water Production Analysis

YVC provided daily water production data for each of YVC's water supplies for this analysis. Production data for the Yass water supply scheme extended from 1990 until 2005 and was of good quality. However, only monthly production data was provided by YVC for the Murrumbateman scheme.

This daily water production data for Yass was used to calculate the long-term average production using the NSW Department of Water and Energy (formerly the Department of Energy, Utilities and Sustainability, DEUS) Climate Correction Model. The following sections describe the process of and the results of the climate correction.

4.1.1 DWE Climate Correction Model Overview

DWE has developed climate-correction software suitable for use by LWUs in analysing water production and effluent generation data. The DWE Water Demand Trend Tracking and Climate Correction Model and Manual (Version 10) were utilised for the purpose of climate-correcting the water production records available for the Yass water supply scheme. No climate correction was undertaken for the Murrumbateman scheme as the production records for this scheme were insufficient for the purposes of running the model.

The model analysis is undertaken in four main steps:

- Model calibration – development of a baseline production volume from a short-time series of daily recorded production data;
- Hindcasting – the projection of the calibrated model through comparison of daily production volumes against daily historical climate data to determine which climatic variables and to what extent they impact on water production and hence consumption within YVC; and
- Trend-tracking – comparison of observed water production records and predicted production data based on the results of the hindcasting to determine the long-term trends in production;

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- Peak day and average day demands and ratio– calculation of the peak day and average day demands, as well as the peak day to average day ratio (PDD:ADD) for each water supply scheme based on the results of the trend tracking process.

4.1.2 Model Calibration

The purpose of this task is to develop a model based on historical daily production data to determine trends in the baseline production volumes for the Yass WTP. The following flowchart illustrates the calibration process and input data used.

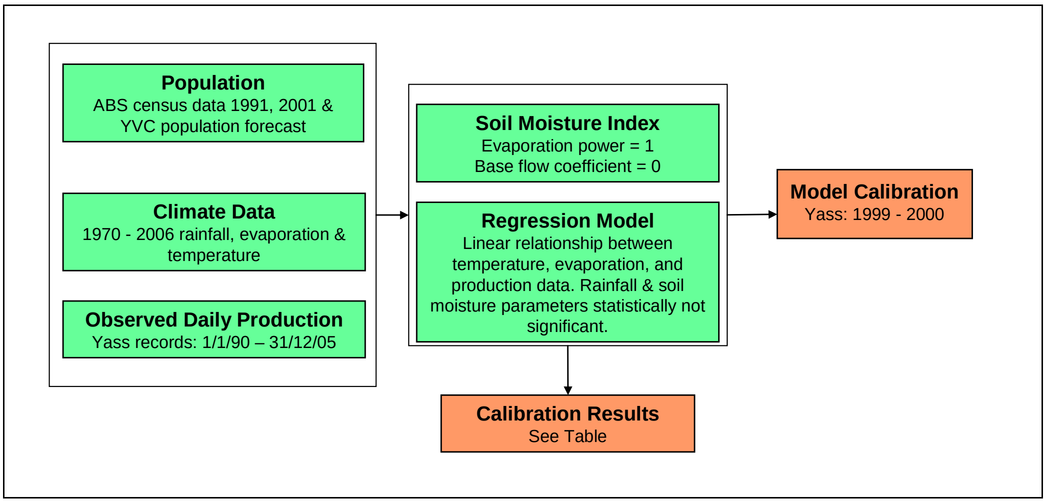


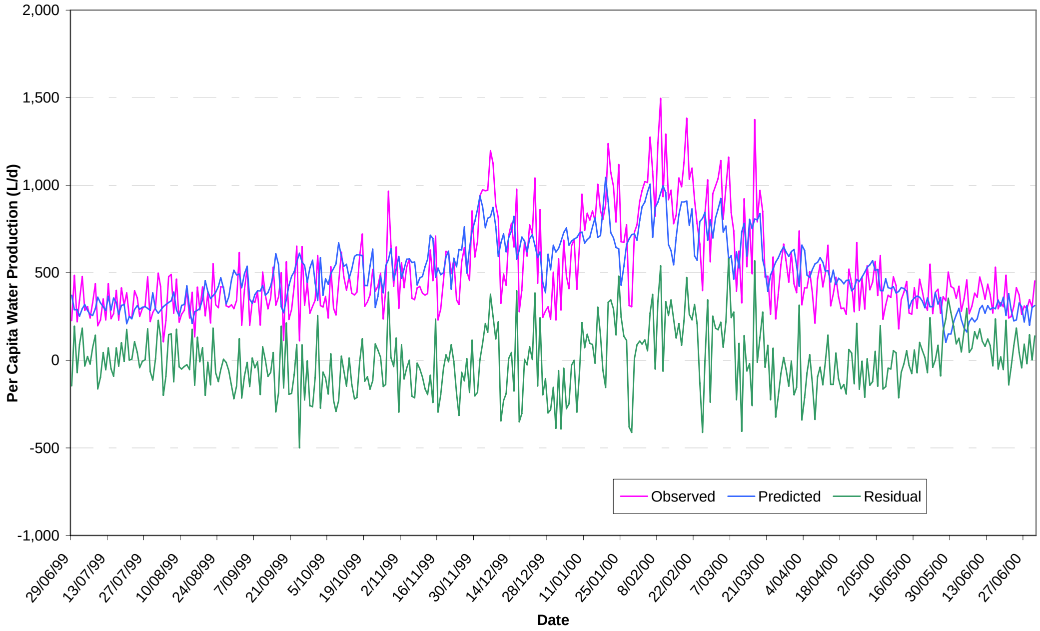
Table 5 lists the results of from the calibration of the model.

Table 5: Model Calibration Results.

Parameter	Yass	Discussion
Soil moisture model correlation coefficient		
Soil moisture model correlation coefficient	0.6606	Represents correlation of soil moisture and climate data. Result of 1 represents a perfect correlation, while 0 represents no correlation.
Regression model calibration		
R^2	0.5307	Model is statistically significant, with a moderate relationship between climatic parameters and historical daily production records.
Standard error of y estimate	182.21	
Model F Statistic	205.25	
Degrees of freedom	363	
Durban Watson statistic	1.557	Durban Watson statistic determines whether residuals are randomly distributed or not. Durban Watson < 2.0 suggests that residuals are not random and that some serial auto correlation exists within the model.
T statistic – maximum temperature	7.95112	Statistically significant climatic parameter. T => 1.6
T statistic – evaporation	3.81664	Statistically significant climatic parameter. T => 1.6

The resulting calibration for the Yass scheme production data is set out in Figure 2.

Figure 2: Yass Production Regression Model Calibration.



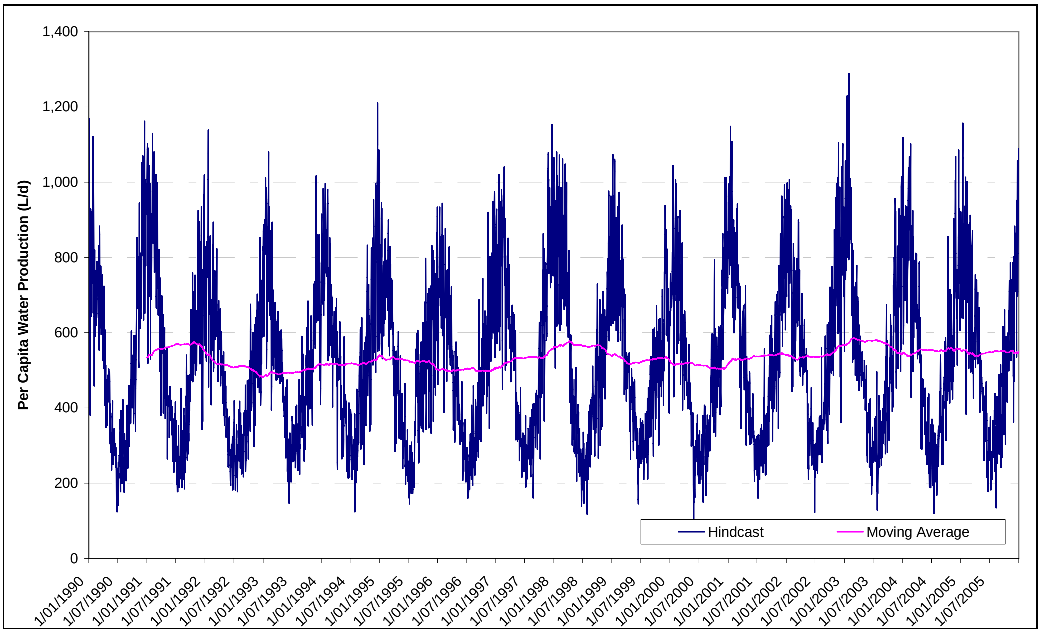
The predicted water production volumes (per capita), for the Yass model provides a reasonable correlation to the observed production data, with the residual being within +/- 582 L/d/capita.

4.1.3 Hindcast

The hindcast set out in Figure 3 was developed by projecting the historical climate record available through the calibrated regression model, as developed in Section 4.1.2. In so doing, the hindcast represents the demand that would have been expected to have occurred over this period. In this sense, the hindcast extends the production data record to match the available climatic record. Also shown on the figure is a 365-day trend in the predicted production levels.

The hindcast demonstrated that the long-term mean production per capita for Yass is 533 litres per day.

Figure 3: Yass Regression Model Hindcast.



4.1.4 Climate Correction of Water Production Records

The calculated percentage change in seasonal demand is illustrated in Figure 4. Also included in the graph are all the water restrictions enforced by YVC between 1998 and 2006. From this, it can be seen that water restrictions have been constantly in place over this time period.

Figure 4: Percentage in fixed, seasonal and total demand relative to the baseline year for Yass.

The climate-corrected production volumes for the Yass scheme were found to be 801ML/annum.

4.1.5 Peak to Climate Corrected Average Day Demand Ratio

Climate-corrected demand was used to estimate the peak to average day demand ratio (PDD:ADD ratio). The climate corrected PDD: ADD ratio for the Yass water supply scheme was found to be 2.6.

4.2 Water Consumption Analysis

YVC provided three years of half yearly consumption data for each customer account from their consumption database from 2003, 2004 and 2005 for Yass, Bowning, Binalong and Murrumbateman. The datasets for divided each customer account into one of following categories:

Yass, Bowning and Binalong

- Residential;
- Residential – non urban;
- Business;
- Farmland;
- Non rateable+;
- Mixed development*; and
- Cancelled assessments

Murrumbateman

- Residential;
- Residential – non urban;
- Business; and
- Non rateable.

+ Non rateable included a number of sub categories identified as having water, sewerage and garbage service charges.

*Mixed development refers to commercial shop fronts which also have a residential portion on the same meter.

The dataset also contained the following data for each customer account:

- Meter number,
- Assessment number,
- Consumption in kL.

4.2.1 Identification of Customer Categories and their Water Use

For the purposes of undertaking an end-use based forecast of water demands, it can be useful to roll up accounts that do not make up a significant proportion of the overall customer database into a common customer category which have similar water use characteristics to simplify the model. For both the Yass and Murrumbateman models only “residential” and “other (commercial)” customer categories were run. This was due to the small consumption volumes spread out across six different categories.

The “mixed development” category was split between the “residential” (40% of consumption) and other (commercial)” (60% of consumption), to match YVC billing methods for this assessment type.

Of the assessments listed within the YVC customer database, Table 6 indicates the breakdown of assessment numbers across customer categories as indicated within the customer database. The breakdown of consumption into these final customer categories for input into the demand models for both the Yass and Murrumbateman schemes are also presented in the following table.

Table 6: Summary of Consumption Database (2004/05).

Customer Category	Yass		Murrumbateman	
	Number of Assessments	Consumption (%)	Number of Assessments	Consumption (%)
Residential	2,448	72	142	80
Other (commercial)	327	28	19	20
Total	2,775	100	161	100

*These assessment numbers have been increased by 3% to provide a better match with the reported number of assessments within the DWE performance reports.

4.2.2 Breakdown of Customer Category Water Use

Within each customer category the total water consumption can be separated into water consumed internally (i.e. toilets, baths, showers, taps, sinks, dishwashers, laundry) and water consumed externally or in relation to climate (outdoor irrigation, pools, fountains, wash-downs, car washing, evaporative air conditioning). External water use tends to vary seasonally and may also be more responsive to water prices and water efficiency education programs. Internal water use tends to be more constant throughout the year and is generally less sensitive to demand management techniques.

However, as meter readings for YVC were not taken quarterly, it was not possible to determine the difference in seasonal demands, which would provide a best-guess indication of the external and internal water use split. Therefore the following consumption splits have been used.

Table 7: Assumed breakdown of internal and external use by customer category.

Yass Customer categories	Internal (%)	External (%)
Residential	50	50
Other (commercial)	80	20
Murrumbateman Customer Categories	**Internal (%)**	**External (%)**
Residential	50	50
Other (commercial)	80	20

No internal end-use data is available for YVC. Therefore the following assumptions have been made regarding the split of internal water use within residential assessments, based on the Australian Bureau of Statistics end-use study (ABS, 2005).

Table 8: Assumed breakdown of residential internal water use.

Internal Use	% of Internal Consumption
Shower	31
Toilet	28
Laundry	19
Kitchen	12
Internal Leakage	10

4.3 Unaccounted for Water Estimates

Unaccounted for water (UFW) is the difference between metered water production and metered water consumption. The current total water production in the YVC service area (including the impact of climate correction for the Yass water supply scheme) is 848 ML/annum and the consumption from YVC water supplies in 2004/05 is 619 ML/annum. Details of the water production and consumption for both water supply schemes are listed in Table 9 and Table 10.

The results of this analysis show UFW of 26% for the Yass water supply scheme. This represents actual water loss and leakage, filter backwash, fire fighting, mains flushing, unauthorised consumption, under-registration of customer meters, unbilled meters and may also include inaccurate and/or incomplete metering of production and consumption volumes. It is considered that around half of the UFW is due to leakage and the other half is non-revenue water. The non-revenue may be particularly significant for the Murrumbateman scheme, where 40% UFW was calculated. As a result, 26% UFW was also assumed for the Murrumbateman scheme for the DSS model as a baseline.

Table 9: Unaccounted for water analysis for the Yass scheme.

Year	Production (ML/a)	Consumption (ML/a)	UFW (ML/a)
2003	719	336	383 (53%)
2004	824	607	217 (26%)
2005	824	575	249 (30%)
2004/05	824	591	233 (28%)
Climate Corrected*	801	591	210 (26%)

*Long term average production volume and this consumption used in the DSS as a baseline.

Table 10: Unaccounted for water analysis for the Murrumbateman scheme.

Year	Production (ML/a)	Consumption (ML/a)	UFW (ML/a)
2003	39	13	29 (67%)
2004	46	26	20 (44%)
2005	48	30	18 (38%)
2004/05	47	28	19 (40%)

yass valley
the country the people

5 Water Demand and Effluent Forecasts

The purpose of developing forecasts of water demand (and the subsequent effluent expected to be generated in a service area) for the future is primarily to understand the likely water resource and water supply infrastructure that will need to be provided by YVC to meet future requirements.

The production of a baseline water demand and effluent forecast was undertaken in the following steps:

- An analysis of historical and expected future demand drivers; and
- An application of these drivers to the current level of consumption of each of the customer categories expected to be impacted by these drivers.

5.1 Demand Drivers

Before forecasts of the water demands can be developed, it is important to have a good understanding of the drivers influencing water demands.

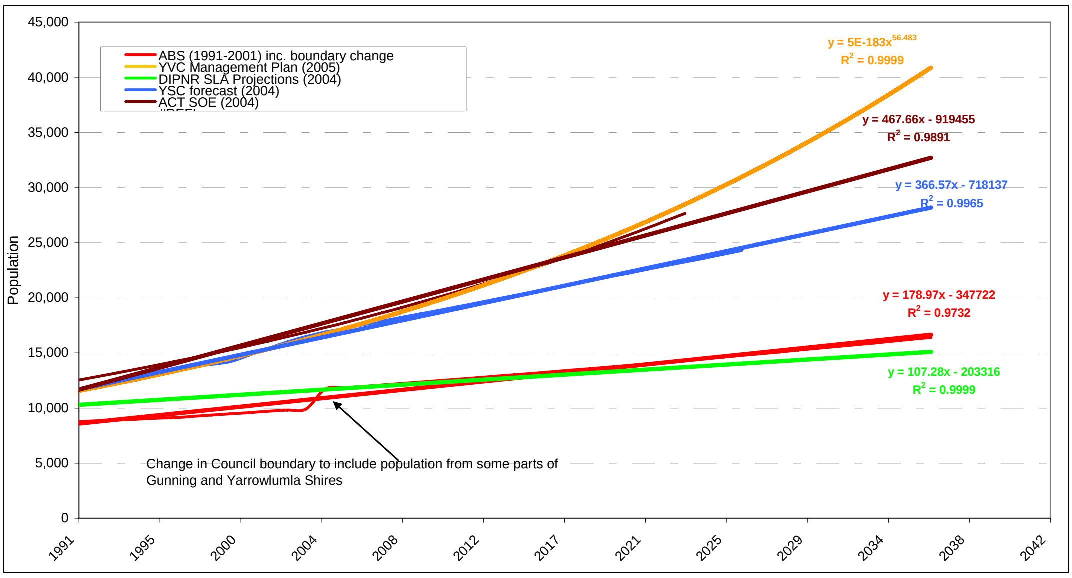
There are several key demand drivers that may influence trends in water demand in the YVC service areas. These include population growth, land release and development, household size, occupancy rate, dwelling mix, and water efficient appliance uptake. Each of these drivers is discussed in more detail in the following sections.

5.1.1 Population

Changes in population growth, either increases or decrease, can significantly impact on the level of water demand in a service area. Historical population information and existing population forecasts are one way of assessing the likely influence of population as a demand driver.

Figure 5 illustrates historical population data and a series of population forecasts for the Yass LGA. Historical data for the years 1991, 1996 and 2001 were taken from ABS Census data. Predicted population data was sourced and/or adapted from a number of different sources as shown in the figure.

Figure 5: Historical population data and existing population forecasts for Yass LGA.



The figure illustrates that the YVC LGA population has been on a steady rise since 1991. The population of YVC jumped in 2004 with boundary changes which meant that some parts of the former Gunning and Yarrowlumla Councils became part of the YVC LGA. Forecasts of population from 2002 onwards have ranged from projecting moderate to high growth. The projected growth rate ranges from 0.9% to 2.8% per annum across the LGA until 2036.

The highest population prediction developed as part of the YVC Management Plan. However, this projection has been superseded by a more recent projection developed for the YVC which suggests high growth until 2015 at approximately 2.9% per annum and then continuing, but slower growth of 1.7% per annum thereafter. These forecasts have also been developed for the Yass and Murrumbateman water supply service areas and hence have been adopted for this demand analysis.

The following figures illustrate the historical and predicted populations for the towns of Yass and Murrumbateman.

Figure 6: Historical population data and existing population forecasts for Yass Water Supply

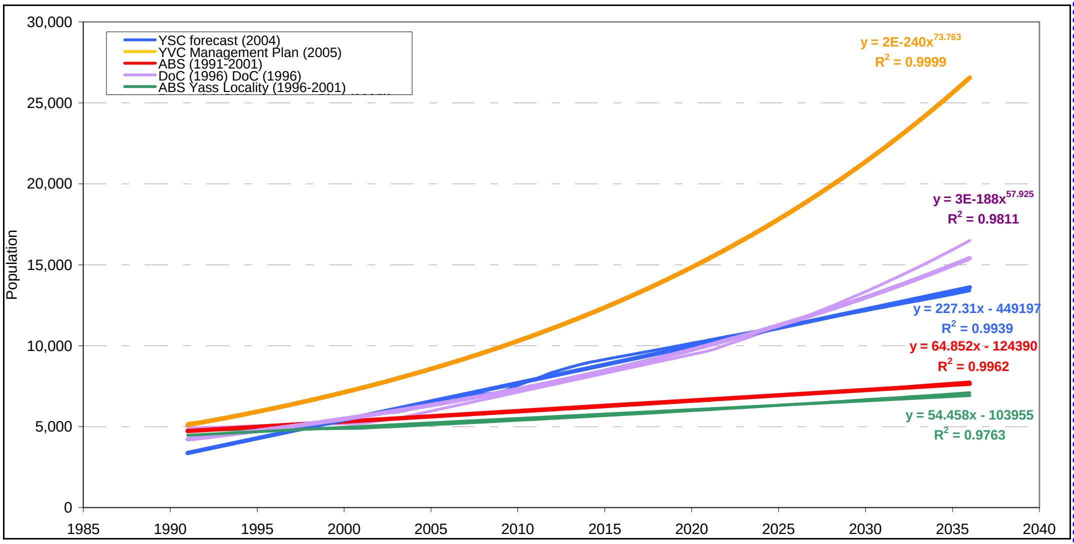
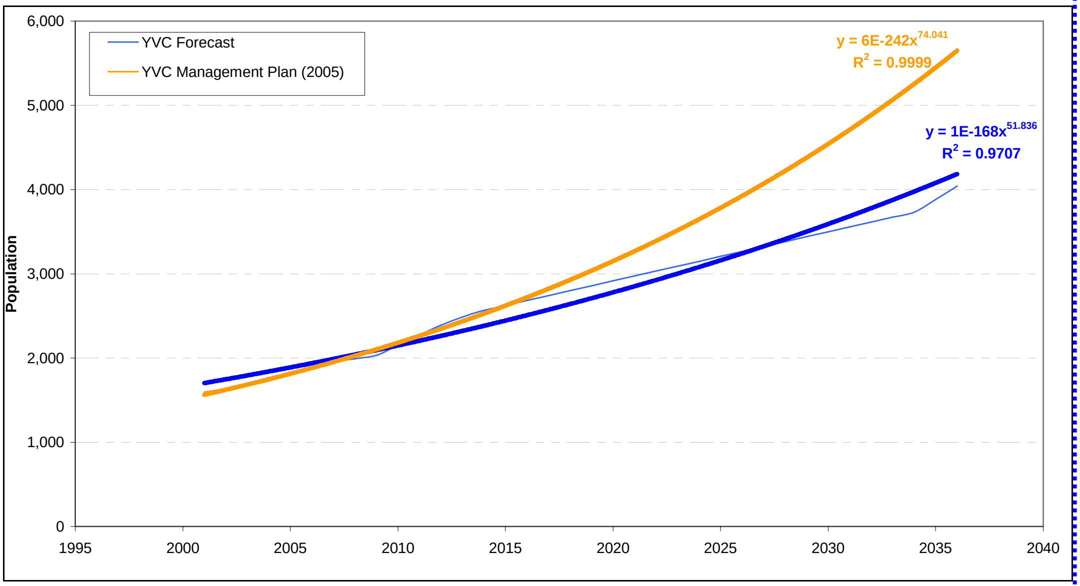


Figure 7: Historical population data and existing population forecasts for Murrumbateman Water Supply



5.1.2 Dwelling Characteristics

As the number of individuals in an average household decreases (which is a common trend in Australia), so may the internal water use of individual households. However, if residential development occurs at a higher rate than population growth, particularly single residential dwellings, then the total volume of water used for external purposes may increase as the number of gardens increase.

The average occupancy rates for Yass and Murrumbateman are 2.7 and 2.4 respectively, have been assumed based on ABS census data. These are expected to decline slightly over the next 30 years, due to current NSW state wide trends.

Single residential dwellings are more likely to have a higher water use per capita than multi-residential dwellings. This is a result of lower external water use, due to either smaller or no gardens in multi-residential dwellings.

Between the 1996 and 2001 census, the type of residential dwellings within YVC has remained constant with approximately 81% of all residential dwellings being single residential dwellings. This dwelling type split is not expected to change significantly over the next 30 years.

5.1.3 Water Efficient Appliance Uptake

Over time, the number of water using appliances in homes has increased. In addition, ownership levels for such appliances, including fixed and automatic reticulation of domestic gardens, dishwashers and washing machines have also increased (Loh 2003). At the same time, there has been a general shift towards the production of more water and energy efficient appliances in general.

Despite these impacts, Australian end-use studies have previously concluded that the only significant influence on in-house usage is the number of people living in a household (Loh, 2003). Although the distribution of water use between internal water uses such as showers, baths, toilets and washing machines has changed over time (e.g. showers usage has increased as bath usage has decreased) the overall level of consumption per person has remained fairly constant. Hence the impact of water efficient appliances and the tendency to use more water using appliances in the home are likely to cancel each other out. Hence, the overall internal water use per capita in the baseline estimate has been held constant.

However, external water use is more highly correlated to changes in technology, and can be considered to be comprised largely of discretionary water use (i.e. the consumer has a significant degree of choice in the level of consumption). Historically, as incomes have risen, the amount of water consumed in discretionary water uses has increased.

5.2 A Baseline Water Demand & Effluent Forecast

The DSS provides a detailed least cost planning evaluation framework for water demand management programs. Two separate models were created, based on each sewerage subcatchment:

- Yass; and
- Murrumbateman.

The purpose of developing the models based on sewerage catchments is to enable effluent forecasts to be generated at the same time.

The baseline forecast of future water production, compared to the existing WTP capacity for each schemes are presented in the following figures. These baseline results consider the climate correction production volumes, the breakdown of water consumption and customer categories and the demand drivers as discussed in the previous sections of this report.

Figure 8: Baseline average day demand forecast (ML/d) – Yass

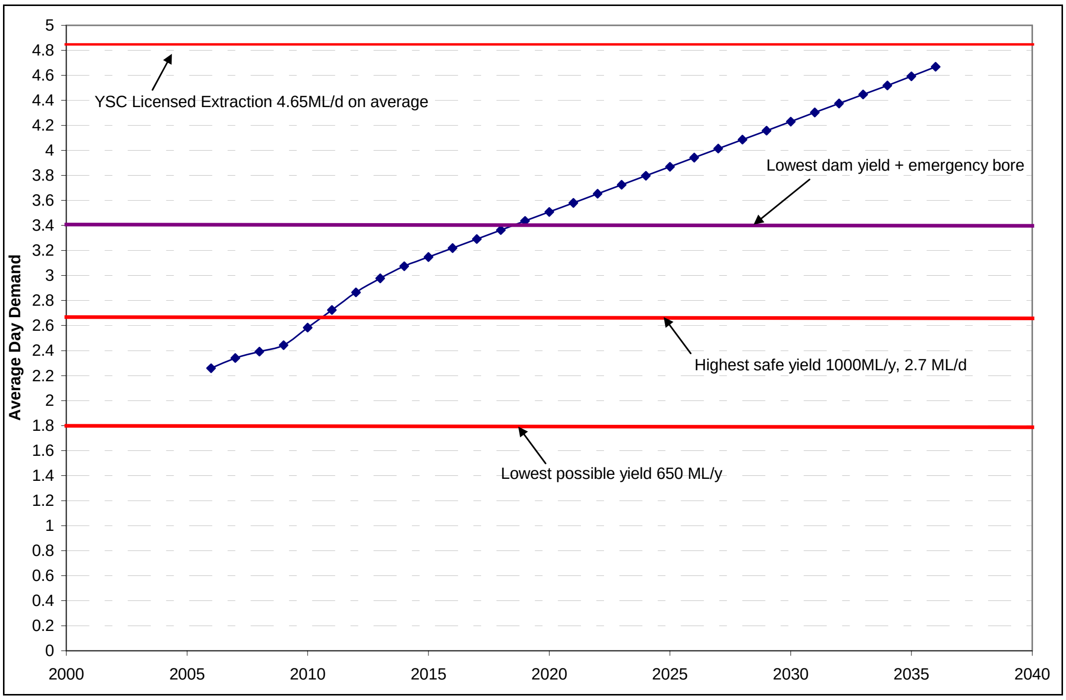
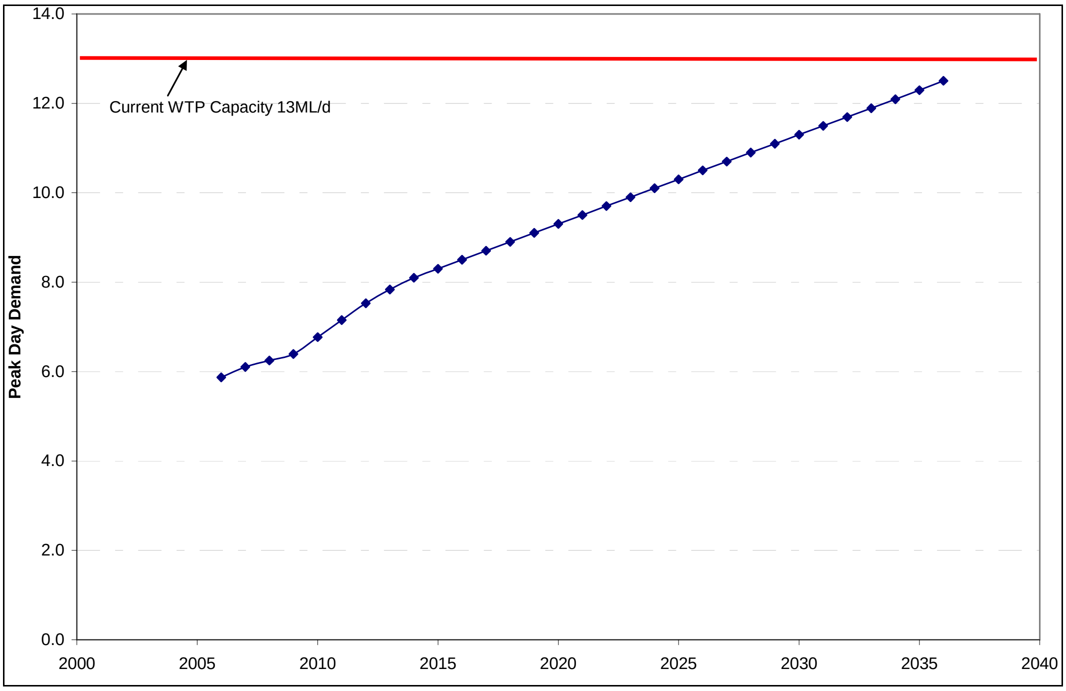


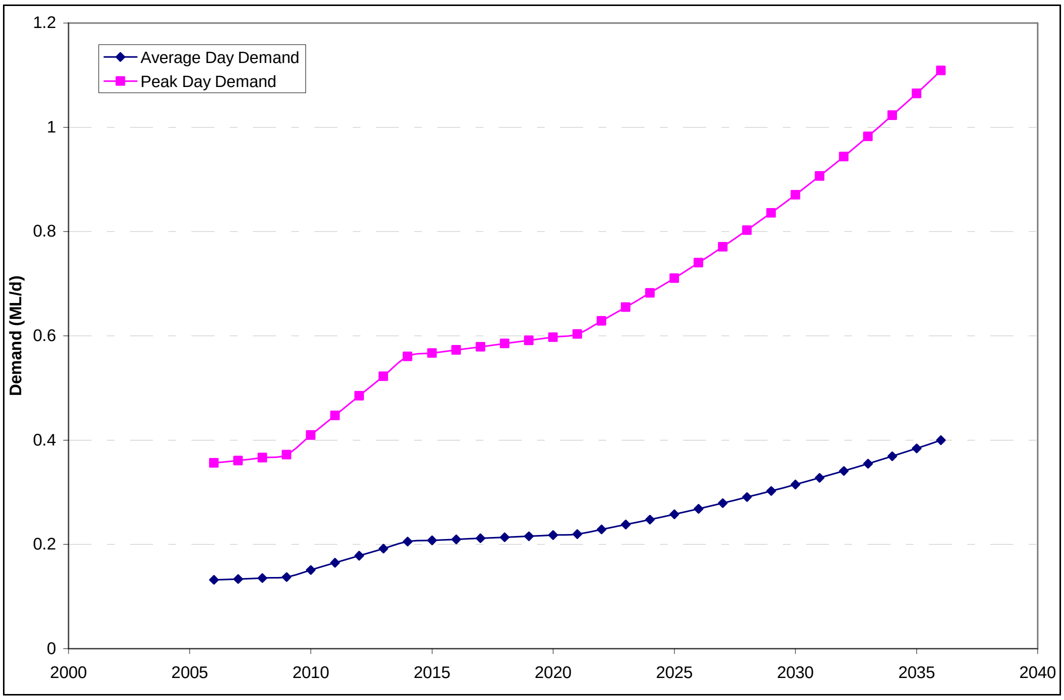
Figure 9: Baseline peak day demand forecast (ML/d) – Yass



From the baseline average demand forecast, it is understood that though the average demand at the end of 2036 planning horizon is below the extraction license, the important issue is the availability of water. The demand will exceed the safe yield in around 2010. Council is now installing an emergency bore as an emergency drought measure. However, that measure also can not satisfy increasing demand. It can be concluded that a source augmentation is absolutely necessary.

Based on current water demand trends, the current treatment capacity of the Yass WFP is sufficient to meet future demands past the 2036 planning horizon.

Figure 10: Baseline average and peak day demand forecasts (ML/d) – Murrumbateman



6 Water Efficiency Analysis

The purpose of the water efficiency analysis is to determine the impact of water efficiency programs on the baseline level of forecast water demand.

The DSS is designed to undertake a cost-benefit analysis of potential demand management measures and possible program combinations to determine which combination of options will provide the greatest water and energy savings per dollar spent by YVC and their customers.

6.1 Water Efficiency Measures

A series of individual water efficiency measures were considered as part of this analysis. The details of these measures are set out in Table 11.

Table 11: Individual water efficiency measures.

Measure	Description
Pricing Measure Model	YVC has already adopted user pays pricing. However, currently only 45% of revenue comes from usage charges (2005/06). In order to be fully compliant with DWE requirements, 75% of revenue is required to come from usage. In order to achieve this, usage charges must increase by 30%. The pricing model assumes that YVC will increase their usage charge in the next financial year to meet the DWE Pricing Guidelines. The impact of this measure is expected to reduce outdoor use only.
BASIX	Adoption and promotion of the NSW Government BASIX Program. The model developed focused on rainwater tanks for all new single and multi-residential dwellings. It is however, assumed that if other alternative sources of water were used, similar costs and savings would occur.
Education Program internal and external uses.	YVC commenced a water education program in 2003. It is assumed that this program will continue and expand further over the next 30 years and will focus on providing reductions in external use of between 10 and 15%. This education program will also support the other water efficiency measures through increasing community awareness and allowing the community to access information.
Showerhead Retrofit	YVC have previously promoted a showerhead retrofit program. This model assumes this voluntary program will expand with the implementation of a retrofit rebate for existing dwellings, but also recognise the fact that BASIX will over-ride the need for this program in relation to new development.
Rainwater Tank Rebate	This program assumes that YVC will provide a $500 rebate for customers willing to install a rainwater tank. This program builds on YVC's rainwater tank program adopted in 2003, which offered a $200 rebate for existing dwellings. This program is also separate from the BASIX program which focuses on both new single and multi-residential developments.
Residential Household Tune-Up	Local residents would be offered the opportunity to have an analysis of their household water using devices and activities focussing on ways to improve water use efficiency.
Dual Flush Toilet Retrofit	YVC has had no previous rebate for the installation of dual flush cisterns in either residential or commercial premises. This measure aims to replace high flow and 9/4.5 dual flush with 6/3 dual flush toilets. This is likely to only impact older homes.

Measure	Description
Unaccounted for Water	In 2005, YVC undertook a meter survey to identify defective water meters. However, YVC has not done any active leak detection in their water supply networks. This program models the likely impact of undertaking such an investigation to reduce UFW. However, as explained in Section 4.3, it is assumed that half of the UFW is non-revenue water use such as fire fighting, mains flushing and filter backwash. It is not possible to reduce non-revenue water apart from unbilled metered use or under registration of consumer meters. This program also models the impact of the likely reduction of non-revenue water. The target UFW is 20% (10% from leakage and 10% non revenue use).

The results of the cost-benefit analysis of each of these individual demand management measures for the Yass water supply scheme are set out in **Table 12**.

The assessment is made from both a utility perspective as well as a customer perspective. The difference is best illustrated by example. The costs of the business audit are borne by the utility, which also sees a subsequent reduction in the amount of water it is required to pump and treat. In addition to these benefits, the recommendation of the audit may result in hot water savings and hence energy, but also come with expenditure from implementing the audit findings. These additional benefits mean that the overall effectiveness of this measure is different from the community perspective, than from the utility perspective alone.

Table 12: Preliminary cost-benefit analysis of individual water efficiency measures.

Option	Benefit:Cost analysis		
	LWU	**Customer**	**Overall**
Pricing Measure Model	High	Very High	Very High, mandatory
Rainwater Tanks under BASIX	Very High	Very Low	Medium, mandatory
Education Program (external uses)	Very Low	Very Low	Very Low, complementary
Unaccounted for Water (UFW)	Low	Medium	Medium, complementary
Shower Retrofit	Low	Very High	High
Rainwater Tanks Rebate	Medium	Medium	Medium
Residential Audit Program*	Medium	Low	Medium
Dual Flush Toilet Retrofit	Low	Medium	Medium

As the Yass water supply scheme serves a significant proportion of YVC customers, these results are most representative of the most cost-effective demand management measures for the entire YVC service area. Adopting these results will also assist YVC in implementing uniform demand management methods across the entire LGA inline with the DWE Guidelines. In addition to this, it is expected similar trends would be experienced at Murrumbateman.

6.2 Water Saving Programs

Initial analysis of water efficiency measures indicated that BASIX has medium overall benefit:cost ratio across the utility and community sectors and that education shows a very poor benefit:cost ratio. However, these measures are included in the WSPs as BASIX is a mandatory measure as of 2005/06 and education will assist in maximising the water savings from all other demand management measures implemented through increased community awareness of the benefits of efficient water use and the potential ways that savings can be achieved.

Initial analysis of these water efficiency measures indicated that residential audit, UFW reduction, dual flush toilets and the rainwater tank rebates provide a medium level benefit:cost ratio. Hence, these measures should be included only in the last water savings program (WSP).

As UFW is one of the main target areas of DWE's demand management guidelines, reducing UFW has been highlighted as a priority measure, and included in WSP 2.

Utilising the preliminary cost-benefit analysis presented above, three water saving programs (WSP) were developed. The details of each of these programs are set out in **Table 13**.

Table 13: Potential water saving programs for YVC

Program	Pricing	BASIX	Education	UFW	Showerhead Retrofit	RWT Rebate	Residential Audit	Toilet Retrofit
WSP 1	✓	✓	✓					
WSP 2	✓	✓	✓	✓	✓			
WSP 3	✓	✓	✓	✓	✓	✓	✓	✓

The estimated impact of each of these programs on the average day water demand, the peak day water demand and dry weather effluent flows for the Yass system are set out in the following figures. WSP 2 was considered as having the greatest benefit for the level of investment.

Figure 11: WSP influenced average day demand forecast (ML/d) – Yass.

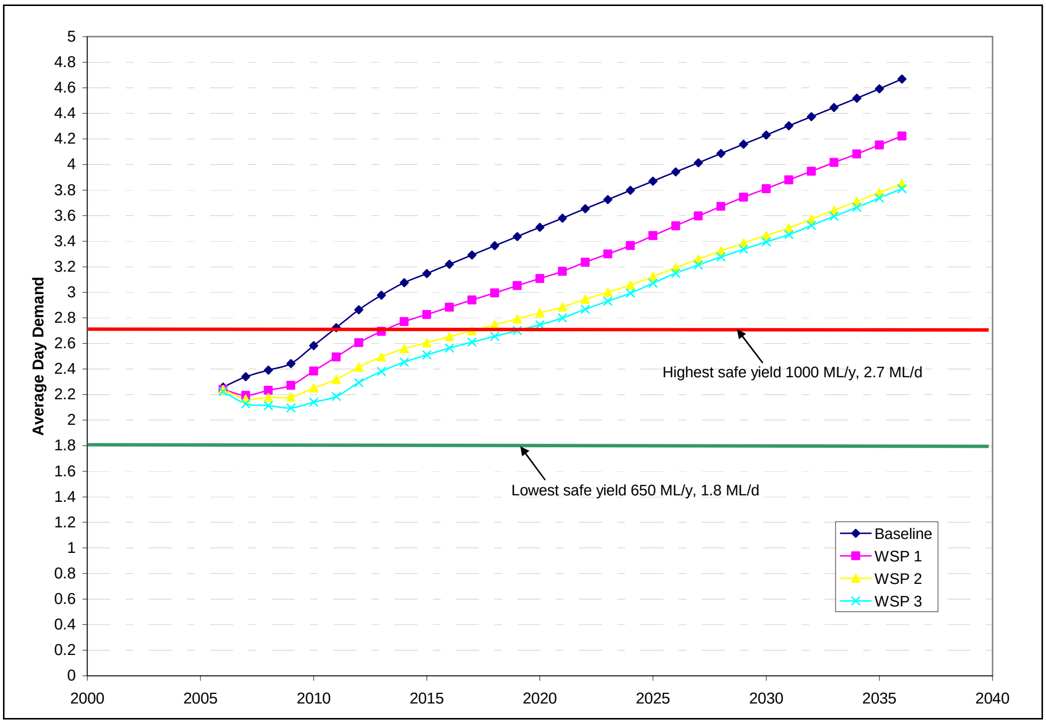


Figure 12: WSP influenced peak day demand forecast (ML/d) – Yass.

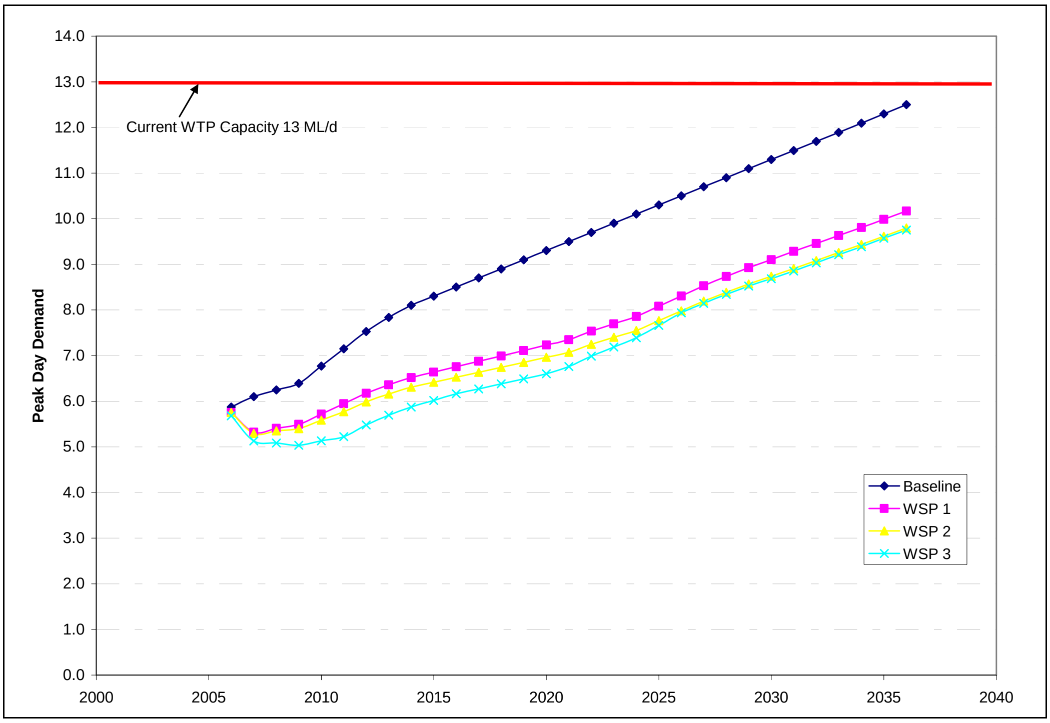
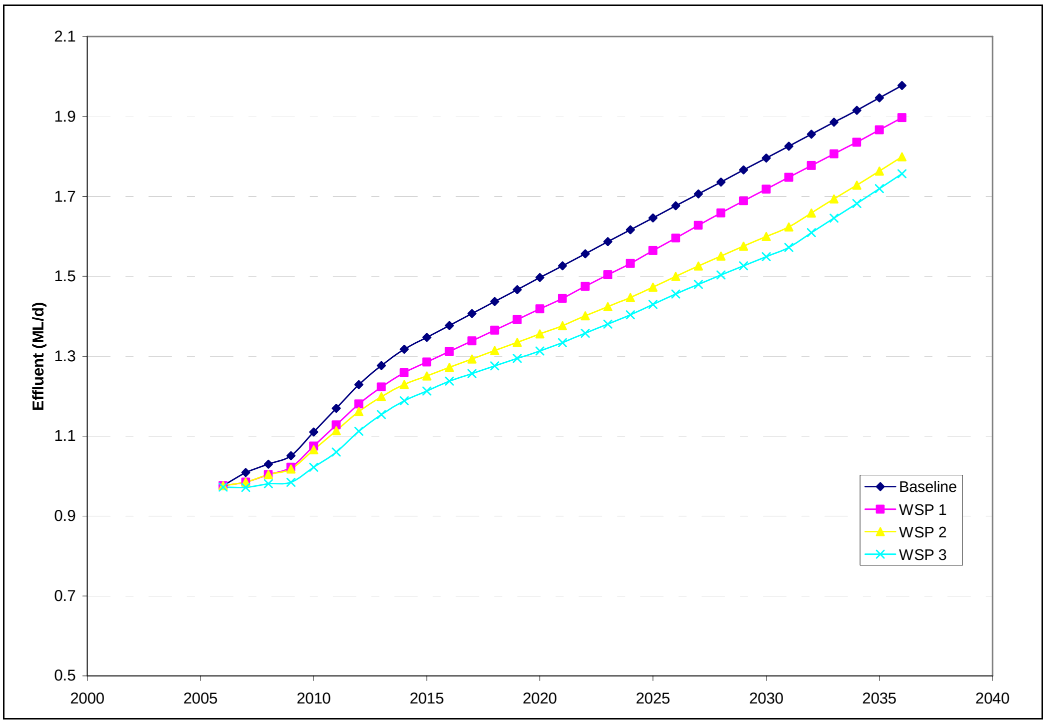


Figure 13: WSP influenced dry weather effluent forecast (ML/d) – Yass.



7 Conclusions

The key outcomes and recommendations of each of the aspects of this water demand and effluent forecasting analysis are set out in the table below.

Table 14: Key outcomes and recommendations of the analysis.

Element	Key outcomes and recommendations
Data collection and review	Review the customer consumption database customer categories and confirm the number of dwellings on multi-residential assessments.
Water demand analysis	The climate corrected potable water production within YVC's service area was 848 ML/a in 2004/05 with: • Yass 801 ML/a; and • Murrumbateman 47 ML/a. Average UFW in the Yass scheme was found to be 26% of the total production volume for the baseline. In the absence of better data for Murrumbateman at the time of analysis an UFW of 26% was also assumed, despite 40% UFW being calculated using the available production and consumption records. Around half of the UFW is non-revenue water use such as fire fighting, mains flushing and filter backwash and it is not possible to reduce these uses except non-revenue water such as unbilled metered use or under registration of consumer meters. The other half of the UFW is physical losses due to leakage. The target UFW is 20% (10% from leakage and 10% non revenue use). Residential demand accounts for 72% of consumption in Yass and 80% in Murrumbateman.
Water demand and effluent forecasts	Population growth in Yass and Murrumbateman is expected to follow similar trends and will be the most important driver of town water demand and effluent forecasts in YVC. Baseline water forecasts predict that annual average production rise by approximately 53% in Yass and 50% in Murrumbateman by 2036.
Water efficiency analysis	By applying a number of individual demand management measures to the baseline forecast and examining the costs and benefits, the relative merit of each measure was determined. The best performing individual measures were progressively bundled together as a number of efficiency programs. A review of YVC's best-practice pricing is expected to be the most cost-effective measure for reducing water demand over the planning horizon, combined with the impact of BASIX, and a community education program. The adopted WSP is expected to reduce the total baseline annual average demand by up to 17% by 2036 based on current demand trends. However, further review of costing for each water efficiency measure is required to finalise the cost benefit analysis used to develop these water efficiency programs. This is expected to be undertaken during the review and updating of the YVC Demand Management Plan.

8 References

Australian Bureau of Meteorology (BOM) 2006 *Silo Data Drill for Yass township* http://www.nrm.gld.gov.au/silo

Australian Bureau of Statistics 1991, 1996, and 2001 Census Data Yass *LGA and Yass Urban Centre*

Australian Bureau of Statistics (ABS) 2005 *Water Facts*.

Department of Energy, Utilities and Sustainability (DEUS), *Water Demand Trend Tracking and Climate Correction Model and Manual– Version 10 Model and User Manual*.

Department of Energy, Utilities and Sustainability (DEUS), *Demand Side Management Least Cost Planning Decision Support System – Version 12 Model and User Manual*.

DEUS, 2006; NSW Benchmarking Report – water supply and sewerage – 2004/05.

JWP 2006 *YVC Integrated Water Cycle Management Plan – Concept Study*.

Loh, M. and Coghlan, P. 2003. *Domestic water use study: in Perth, Western Australia 1998-2001.*

Yass Valley Council (YVC) 2005/06 *Strategic Business Plan for Water Supply.*

Yass Valley Council (YVC) 2006 *Water Consumption and Production Database Records*.

Yass Valley Council (YVC) 2005/06 *Special Schedules for Water Business*.

Turner, A. & White, S, 2006: *Does demand management work over the long term? What are the critical success factors?*, Sustainable Water in Urban Environment II Conference.

Turner, A., et. al. 2005: *Results of the largest residential demand management program in Australia, Turner*, A., White, S., Beatty, K. and Gregory, A., International Conference on the Efficient Use and Management of Urban Water; Santiago, Chile, March, 2005.

Turner, A., et. al. 2004: *Methods used to develop an end use model & demand management program for an arid zone*; Turner, A., Campbell, S. and White, S.; Biennial World Water Congress, Marrakech, Morocco, September, 2004.

Appendix E

Murrumbateman Rainwater Tank Analysis

Technical Note No.: 2
Title: **Murrumbateman Rain Water Tank Model**
Status: Draft

Purpose

This technical note provides preliminary results of the Murrumbateman rain water tank model.

Background

Yass Valley Council (YVC) commissioned JWP to prepare its IWCM Concept Study and Strategy Planning in accordance with the NSW Department of Energy, Utilities and Sustainability (DEUS) 2004 *Integrated Water Cycle Management guidelines for NSW Local Water Utilities*.

As a variation to the original scope of work, YVC commissioned JWP on 14/12/06 to assess the feasibility of rainwater tanks as a water supply source for Murrumbateman.

Scope

The aim of this additional scope of works was to assist Council in:

- Determining if rainwater tanks could fulfil the internal water consumption needs of an average residential dwelling in Murrumbateman; and

- Determining the most appropriate rainwater tank size for Murrumbateman's average residential dwelling based on the historical rainfall regime in the region.

JWP sized the most appropriate RWT tanks for Murrumbateman taking into account different roof areas and climate corrected rainfall data. Roof sizes used were 150, 200, 250, 300, and 350 m^2.

The scenarios requested by Council were:

1. Rainwater providing all internal use; and

2. Rainwater providing all internal uses except for toilets and washing machines which can be supplied by existing town water.

Council has suggested a total internal water requirement of 500 litres/house/day.

The scope of work was detailed in JWP's variation proposal of 1/12/06.

Assessment

JWP determined whether part internal water use needs in Murrumbateman residential dwellings can be fulfilled by using rainwater tanks as a sole water source (scenario 2). This was achieved through the development of a desktop spreadsheet model using the DEUS rainwater tank model as a basis. Historical climate records for Murrumbateman including rainfall and evaporation was obtained through the Bureau of Meteorology's SILO Data Drill.

Internal water consumption volumes for different end users were obtained from the simplified DEUS Decision Support System (DSS) model already developed for

Murrumbateman as part of the IWCM strategy study. The DSS model assumed bathroom (except toilet) and kitchen use as 31% and 12% of internal use, respectively. Adding a 5% leakage to those, the requirement under scenario 2 is 48% of the total internal demand (240 L/house/day).

The preliminary assessment shows that for an internal use of 240L/house/day supplied by rainwater (with remainder provided by town water), the minimum roof size which can provide the water requirement is 300 m^2, with a tank size of 35,000L.

As part usage (240 L/house/day) could not be satisfied by RWT for a roof size of less than 300 m^2, scenario 1 was not undertaken which is to satisfy a total internal water requirement of 500 litres/house/day. Instead part usage of 132 L/house/day was used to simulate another scenario. This is 48% of total internal demand of 275 L/house/day based on meter reading provided by YVC. Under this scenario, the minimum roof size which can provide the water requirement is 200 m^2, with a tank size of 16,000L.

An additional scenario was modelled using an average value of above two cases, resulting a total internal water demand of 390 L/house/day and a part usage requirement of 190 L/house/day. Under this scenario, the minimum roof size which can provide the water requirement is 300 m^2, with a tank size of 20,000L.

Results are attached in the appendix.

Conclusion

To meet part of the internal demand (190 L/house/day) through rainwater tanks in Murrumbateman, a roof size of 300 m^2 and a tank size of 20,000 litres is likely to be required.

Required Action

Comments on this technical note by YVC are expected within 3 working days for timely incorporation in the draft scenarios.

Author: Nurul Islam
Date: 18/01/07
Checked by: Robyn Campbell
Date: 18/01/07

JWP Authorisation	**Client Acceptance**
Name: Nurul Islam	Name
Date: 18/01/07	Date

Appendix

Scenario 1

Assuming 500L/house/day total internal usage (Council request)

Part internal usage = 240 litres/house/day

Roof Size	Annual Topup (%)	Minimum tank size (L)	Annual Topup (L)	Comment
150	4	49500	3941	No tank can satisfy this requirement
200	3	27000	2534	No tank can satisfy this requirement
250	1	24500	1314	No tank can satisfy this requirement
300	0	34500	423	Requirement is satisfied
350	0	30000	419	Requirement is satisfied

Scenario 2

Assuming 275L/house/day internal usage (based on actual meter readings)

Part internal usage = 132 litres/house/day

Roof Size	Annual Topup (%)	Minimum tank size (L)	Annual Topup (L)	Comment
150	1	12000	705	No tank can satisfy this requirement
200	0	16000	221	Requirement is satisfied
250	0	11500	239	Requirement is satisfied
300	0	10000	232	Requirement is satisfied
350	0	9000	230	Requirement is satisfied

Scenario 3

Assuming 388L/house/day internal usage (optimum case)

Part internal usage = 186 litres/house/day

Roof Size	Annual Topup (%)	Minimum tank size (L)	Annual Topup (L)	Comment
150	3	17500	2377	No tank can satisfy this requirement
200	1	18000	974	No tank can satisfy this requirement
250	1	14000	1002	No tank can satisfy this requirement
300	0	20000	335	Requirement is satisfied
350	0	16000	330	Requirement is satisfied

Appendix F

Yass STP Water Quality Assessment

Success through Partnership

JWP

Yass Valley Council

Water Quality Assessment – Yass Sewage Treatment Plant Upgrade

November 2006

Yass Valley Council

Water Quality Assessment – Yass Sewage Treatment Plant Upgrade

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Executive Summary

This report documents an assessment of the impact of the existing Yass Sewage Treatment Plant (STP) against the specified environmental values for the Yass River. This assessment has been used to develop appropriate water quality goals and objectives for the planned upgrade of the STP. In addition, some consideration is also given to minimising the impact of the planned upgrade on the Yass River flow objectives.

Water quality data for the Yass River is limited and not all of the parameters required for assessment are available.

In general, the assessment of the ambient water quality in the Yass River found that the environmental values and uses were poorly protected. This was primarily a result of high turbidity and nutrient levels in the waterway associated with a variety of land use practices.

The river flow assessment found that the natural flow regime of the Yass River has been significantly altered as a result of irrigation extractions, diversions to farm dams and the operation of Yass Dam. Below the dam, the low flow regime is significantly altered. The discharge of the existing Yass STP constitutes a significant part of the low flow regime.

The mixing zone for the existing STP discharge may extend to the junction of the Yass River with Burrinjuck Dam storage.

Based on the assessment of the ambient water quality, river flow objectives and existing mixing zone, the following conclusions are made in relation to the Yass STP:

- As a result of land-use activities in the Yass River catchment, the environmental values and uses for this waterway are generally poorly protected.
- Management of treated effluent quality, particularly total phosphorus loads, is required to protect environmental values and uses.
- Although the monitoring data was unclear on whether the STP specifically was affecting aquatic ecosystems indicators, if the effluent is not discharged to waterways, the STP will not be contributing to nutrient levels in the river.
- However, the flow provided by discharges from the STP is a significant contributor to the low flow regime, which has been significantly altered as a result of irrigation extraction, farm dam diversions and Yass Dam.

As a result, the following are recommended as goals for the upgrade of the STP:

- Inclusion of treatment facilities at the STP to reduce phosphorus concentrations and to achieve treated effluent quality that meets the DEC Accepted Modern Technology criteria.
- Although there are limited opportunities for effluent reuse, YVC should continue to explore and identify reuse opportunities that may reduce the volume of effluent discharged to the Yass River, particularly during high flows.

- Sustainable and high value effluent reuse opportunities should consider the use of treated effluent as a valuable component of the low flow regime.
- This should however, also be balanced with opportunities to provide environmental flows from Yass Dam and the on-going improvement of the ability to protect the environmental values and uses of the waterway in relation to ambient water quality.
- Continue to implement a trade waste policy to ensure the influent does not impact on the appropriate functioning of the STP.
- Internal water use efficiency programs targeting residential toilets and showerheads will contribute to the reduction in effluent requiring treatment. Implementation of a general demand management plan.
- Preparation and implementation of maintenance procedures that would prevent, control or minimise incidents.
- Establish incident procedures to ensure that employees and contractors understand their responsibilities.
- Monitoring protocols for the STP and discharge location should include faecal coliforms, algae and blue-green algae.
- The implementation of an operational monitoring program to establish the extent of the mixing zone may identify further improvements to the effluent discharge regime and potentially contribute to the environmental values of the Yass River.
- Develop chemical, physical and biological monitoring in the mixing zone to ensure the release does not further erode the protection of environmental values and uses.

Contents

1 Introduction

This report documents an assessment of the impact of the existing Yass Sewage Treatment Plant (STP) against the specified environmental values for the Yass River. This assessment has been used to develop appropriate water quality goals and objectives for the planned upgrade of the STP. In addition, some consideration is also given to minimising the impact of the planned upgrade on the Yass River flow objectives.

1.1 Background

Yass Valley Council (YVC) is currently in the process of upgrading the existing Yass STP (see **Figure 1**) to provide residents and the environment with a higher level of service. The STP upgrade is intended to improve the quality of the treated effluent while simultaneously catering for the expanding population of Yass (plant capacity to be designed for 6,800 EP with the potential to upgrade to 10,800 EP).

Figure 1: Existing Yass STP Site.

Source: YVC, 2005.

Treated effluent is presently used to irrigate agricultural land adjacent to the STP during the summer months (November to May). Due to winter rainfall, irrigation is generally not sustainable during June to October. The remaining effluent from the existing STP is discharged into Banjo Creek, a tributary of the Yass River.

As an input to the upgrade process, the NSW Department of Environment and Conservation (DEC) has requested that YSC complete an assessment of the impact of the existing plant on the ambient water quality goals for the Yass River. The outcome of this assessment is to provide the background for setting appropriate environmental goals and objectives for the planned STP upgrade.

The DEC has advised (correspondence to YVC dated 2 February 2006) that the assessment is to be undertaken utilising the ambient water quality goals set out in the *Murrumbidgee and Lake George Catchment Water Quality and River Flow Objectives* (WQRFO) (NSW Government 1999). A discussion of the NSW water quality assessment framework including these objectives is set out in **Section 2**.

Specifically, the DEC requires that the water quality objectives for the following stream categories are to be considered:

- Uncontrolled streams;
- Waterways affected by urban development; and
- Town water supply sub-catchments.

The DEC has also suggested the following considerations may also be relevant to the assessment:

- The river flow objectives set out for the Yass River in the Murrumbidgee Catchment WQRFOs; and
- Mixing zones.

1.2 Scope of Assessment

The scope of this assessment is limited to:

- A desktop determination of the protection afforded by the ambient water quality to the environmental values set out in the Murrumbidgee and Lake George WQRFO for the Yass River. The determination is based on the water quality data sets available with the NSW Department of Natural Resources (DNR) for the Yass River.
- A determination of the impact of the existing STP on the level of protection afforded to the environmental values.
- A desktop assessment of the natural flow regime in the Yass River against the river flow objectives of the Murrumbidgee and Lake George WQRFO for Yass River.
- A determination of the impact of the existing STP on the level of protection afforded to the natural flow regime in the Yass River. The natural flow regime was determined using data held by the NSW Department of Commerce which naturalised the DNR recorded flow in the Yass River for the impact of irrigation extractions.
- A desktop assessment of the impact of the existing mixing zone based on the water quality and river flow data cited above.
- Recommendation of a series of water quality and river flow goals which should be considered in the planning for the upgrade of the STP.

The assessment is based on the water quality assessment framework set by:

- The *Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000* (ANZECC/ARMCANZ 2000 – henceforth referred to as the ANZECC guidelines);
- The *Murrumbidgee and Lake George Catchment Water Quality and River Flow Objectives* (NSW Government 1999[1]);
- The guidelines, *Considering Environmental Values of Water when Issuing Prevention Notices* (DEC 2006a).
- The handbook *Local Planning for Health Waterways using NSW Water Quality Objectives* (DEC 2006b);
- The handbook *Using the ANZECC Guidelines and Water Quality Objectives in NSW* (DEC 2006c).

The ANZECC guidelines specifically state that they are not designed for direct application in activities such as discharge consents (see section 2.2.1.9), but rather, they have been derived to apply to the ambient waters that receive effluent discharges and protect the environmental values they support (ANZECC/ARMCANZ 2000). The guidelines have been used to establish the ambient water quality criteria.

The ANZECC guidelines are not designed to deal with mixing zones (specific areas around effluent discharges where the management goals of the ambient waters do not need to be achieved) (ANZECC/ARMCANZ 2000). However, the recommendations of this report consider effective discharge controls that ensure that the area of a mixing zone is limited and the values of the water body as a whole are not jeopardised.

The DEC recognise that the ANZECC guidelines should not be used directly to specify numerical conditions, limits or standards for a development for a number of reasons including (DEC 2006b):

- The fact that there are many (diffuse and point) sources in a catchment that contribute to ambient water quality and hence, should contribute to the protection of environmental values over time.
- Aspects such as siting, design and measures for recycling and reuse, not just treatment and discharge, determine whether water management will support environmental values in ambient waters.
- It is inequitable to require one activity alone to restore ambient water quality for environmental values unless it is clearly identified as the only activity significantly affecting water quality.

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[1] These objectives were published in hard form in 1999. However, sections of the documents were replaced in 2006 and the DEC did not publish the revised documents in hard form. Hence, the most current version of the guidelines is only available electronically (at www.environment.nsw.gov.au/ieo). The electronic versions of the objectives (as published on the cited website in June 2006) have been used for this assessment.

2 NSW Water Quality Objectives

In consultation with the community, during the late 1990s, the NSW government developed WQRFO for each of the major river catchments of the state. The objectives set out the agreed environmental values and long-term goals for NSW surface waters. The objectives for each river catchment define:

- The community's values and uses for waterways (i.e. healthy aquatic life, water suitable for recreational activities and drinking water); and
- A range of water quality and flow indicators to help assess whether the current condition of waterways supports those values and uses.

The objectives are consistent with the ANZECC guidelines, which are the agreed national framework for assessing water quality. The WQRFO for each river catchment document the environmental values and uses for that waterway whilst the ANZECC guidelines provide the technical guidance to assess the water quality needed to protect those values.

The river flow objectives are the agreed high-level goals for surface water flow management. They deal with how water moves down rivers and streams and identify the key elements of the flow regime that protect river health and water quality for ecosystems and human uses.

Further details about the use of water quality and river flow objectives to guide the assessment of development are set out in the following sections.

2.1 Ambient Water Quality Objectives

The uses and environmental values which the water quality objectives (WQO) for the Murrumbidgee River catchment are designed to protect are set out in **Table 1** (NSW Government 1999). For each use and value, a number of numerical indicators and associated trigger values have been determined. These are also set out in the table. The exact values and uses for a particular waterway within the Murrumbidgee River catchment are set depending on the stream classification of the waterway in question. The stream classification is defined by a map in the WQRFO document. Together, these form a framework for local planning for healthy waterways in the Murrumbidgee River catchment.

Table 1: Environmental Values and Uses for the Murrumbidgee.

Uses and Values	Numerical Indicators	Trigger Value
Aquatic Ecosystem Protection 	Total Phosphorous (TP)	<0.02 mg/L
	Total Nitrogen (TN)	0.1 – 0.75 mg/L
	Chlorophyll-a	2 – 10 µg/L
	Turbidity	<5 NTU
	Salinity	<1,500 µS/cm
	Dissolved Oxygen (DO)	>6mg/L
	pH	6.5-9.0

Uses and Values	Numerical Indicators	Trigger Value
Visual Amenity	No numerical indicators	
Primary Contact Recreation	Faecal Coliforms Enterococci Algae & Blue Green Algae Temperature pH Turbidity	<150 cfu/100mL <35 eu/100mL <15,000 cells/mL 15-35 °C 5.0-9.0 <6NTU
Secondary Contact Recreation	Faecal Coliform Algae & Blue Green Algae Enterococci	<1,000 cfu/100mL <15,000 cells/mL <230 eu/100mL
Aquatic Foods (Cooked)	Faecal Coliforms	< 14 cfu/100mL
Livestock Supply	Faecal Coliforms Algae & Blue Green Algae Salinity	<1,000 cfu/100mL <10,000 cells/mL <3,000-9,000 µS/cm
Irrigation Supply	Faecal Coliforms Salinity pH	<1,000 cfu/100mL <280 µS/cm 4.5-9.0
Drinking Water at Point of Supply	Blue-Green Algae Salinity Faecal Coliforms Total Coliforms Dissolved Oxygen (DO) pH	<2,000 cells/mL <1,500 µS/cm <0 cfu/100mL <0 cfu/100mL >6.5 mg/L 6.5-8.5
Homestead Supply	Turbidity Total Suspended Solids (TSS) Faecal Coliforms pH Blue-Green Algae	<5NTU <500 mg/L <0 cfu/100mL 6.5-8.5 <2,000 cells/mL

Source: NSW Government 1999.

The DEC requires that all activities and development contribute to realising the water quality objectives over time but recognises that the timeframe for this achievement will depend on the current condition of the waterway and the practical and economic feasibility of restoring the waterway or reducing impacts on it (DEC 2006b). The DEC requires that (DEC 2006c):

- Where the environmental values and uses are being achieved in a waterway, they should be protected, and
- Where the environmental values and uses are not being achieved in a waterway, all activities should work towards their achievement over time.

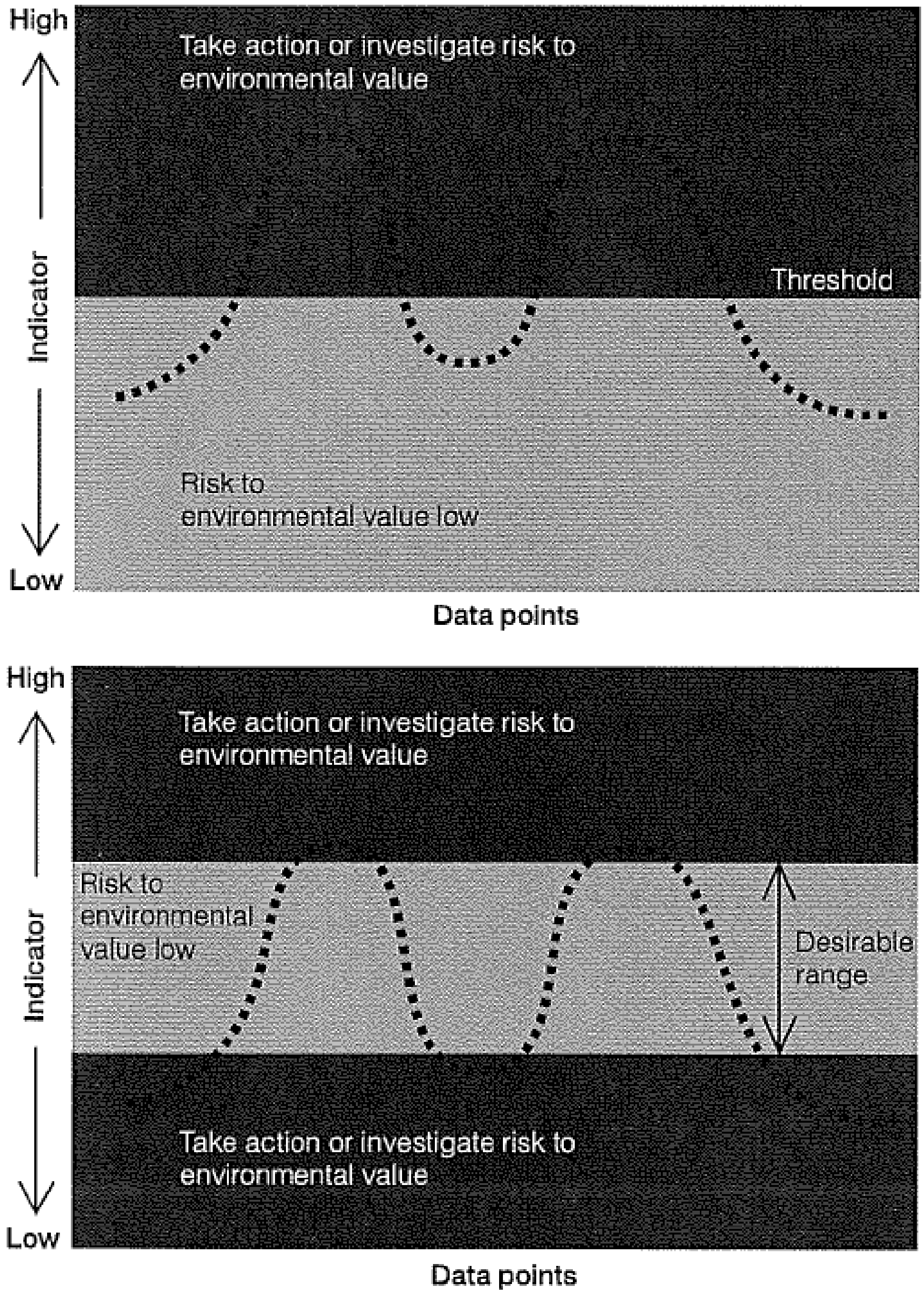
Different levels of protection may be appropriate for different water bodies The ANZECC guidelines specify ecosystem condition based (high conservation value, slight to moderate disturbance and highly disturbed) levels of protection (stringent to flexible). In NSW, the general level of protection applied is the one suggested for 'slightly to moderately disturbed' ecosystems (DEC 2006c).

In addition, the DEC promotes an 'issues-based' approach to assessing ambient water quality, rather than the strict application of numerical criteria without context (DEC 2006c). Hence, although triggers are provided for a wide range of indicators, only those relevant to the issue being faced need to be considered (DEC 2006c).

Once the appropriate triggers are defined, the trigger values (which may be a threshold value or a range of desirable values) can be used to determine the ambient water quality. However, the trigger values are conservative assessment levels, not pass/fail compliance criteria (DEC 2006c).

The application of the framework is risk based. As illustrated in **Figure 2**, although the trigger values are catchment wide, where the ambient water quality of a study area is well within triggers, it is generally considered that the risk of the WQOs not being achieved is low. However, where an indicator exceeds the threshold value or is outside the desired range, there may be a risk that the environmental values and uses will not be protected. In this circumstance, a precautionary approach would require action be taken to address the causes of the trigger exceedence, although in some cases, the result may indicate that a more localised trigger value is required (DEC 2006c).

Figure 2: Risk to Environmental Value against Indicator Trigger Values.



Source: DEC 2006c.

The DEC recognises that, based on case-by-case assessment, the level of environmental performance required of a proposed facility needs to be reasonable and viable for the type of activity being regulated (DEC 2006a). This means that practical measures that can be taken at a site to maintain or restore environmental values are to be identified and implemented (DEC

2006a). This recognises that the trigger values are not designed to be directly applied as regulatory discharge criteria, limits or conditions (DEC 2006a). Practical measures may include (DEC 2006a):

- Reducing the amount of wastewater generated.
- Carrying out maintenance procedures that would prevent, control or minimise incidents.
- Establish incident procedures to ensure that employees and contractors understand their responsibilities.
- Monitor to assess the effectiveness of action taken.

2.2 River Flow Objectives

The river flow objectives (RFO) for the Murrumbidgee River catchment are set out in **Table 2** (NSW Government 1999). For each objective, a number of measures to achieve it have been identified. These are also set out in the table.

Table 2: River Flow Objectives for the Murrumbidgee.

River Flow Objective	Measures to Achieve Objective
Protect Pools in Dry Times	There should be no water extraction from streams or wetlands in periods of no flow. If conditions on water licences do not provide for this objective to be met, priority should be given to implementing it by actions appropriate to local circumstances.
Protect Important Rises in Water Levels	Unless local information shows alternative targets, the following limits on extraction are recommended by River Management Committees (RMC's) : No extraction of more than 30-50% of moderate to high flows on a daily basis. No increase in extractions in high conservation streams. Where use exceeds the above limit, appropriate ways of limiting the volume or controlling the timing of extraction are needed.
Maintain Wetland and Floodplain Inundation	Water sharing plans (WSPs) and actions need to include strategies to maintain, restore or mimic natural inundation and drying patterns in natural and semi-natural wetlands and remaining native floodplain ecosystems and ensure adequate access for native fish to and from floodplain wetlands. Flooding patterns should not be altered without proper environmental assessment.
Maintain Natural Rates of Change in Water Levels	Identify locations where water levels often rise or fall faster than they would naturally. Identify the reasons and impacts. Remedial action requires case-by-case assessment. Identify potential problems and take early action.

River Flow Objective	Measures to Achieve Objective
Protect Natural Low Flows	Share low flows between the environment and water users and fully protect all very low natural flows. Very low flows: flows below the level naturally exceeded on 95% of all days with flow. Low flows: flows below the level naturally exceeded on 80% of all days with flow. Unless environmental, social and economic evaluations give an appropriate alternative, the following limits on water extraction apply: • Environmental share in high-conservation value streams: to be all very low flows and most of the low flows. There should be no increase in extraction of low flows. • Environmental share in other streams: all very low flows and 50-70% of daily low levels. New or transferred licences should not allow extraction during low flows below the 80th percentile. Review management of town water supplies to assess whether changes may help achieve the objective without significantly affecting reliability.
Mimic Natural Drying in Temporary Waterways	Identify any creeks or unregulated rivers where unnatural flows have greatly reduced drying periods. Assess potential short- and long-term environmental, economic and social effects of this change and of possible management alternatives. Decide what, if any, action is appropriate to implement this objective in streams and wetlands should be worked out on a case-by-case basis after giving due consideration to local views. Where relevant, agreements under land and water management plans should be respected, but this objective should take into account, along with WQOs, social objectives and economic objectives, in resolving outstanding or new management issues for drainage water.
Maintain Natural Flow Variability	Identify streams with unnatural flow variability and develop actions to mimic natural variability Identify streams with potential for flow variability problems and take early action.
Manage Groundwater for Ecosystems	Implement the State Groundwater Policy. Identify any streams or ecosystems that may depend on high groundwater levels and assess impacts of reduced recharge or excessive pumping. Identify where groundwaters may be rising and likely to threaten ecosystems or surface water quality. Determine appropriate action to keep groundwater levels within acceptable bounds.
Minimise Effects of Weirs and Other Structure	Implement the NSW Weirs Policy. Identify and take action to improve fish passage on other structures that impede the two-way movement of native fish along streams or natural high-flow channels.
Minimise Effects of Dams on Water Quality	Determine whether water quality from dam releases limits achieving WQOs in unregulated streams and develop appropriate actions.
Make Water Available for Unforseen	Current water licence conditions enable pumping to be suspended in the rare event that this may be necessary. WSPs should identify potential situations when action may be warranted and the steps that should be taken to manage flows at these times.

Source: NSW Government 1999.

These RFOs do not apply to the regulated rivers of the Murrumbidgee River Catchment including the Murrumbidgee, Tumut or Goodradigbee Rivers, the regulated part of Mirrool Creek or streams affected by the Snowy Scheme.

The RFO are based on achieving improved environmental results from managing the riverine system. It should be noted however that the RFOs are not necessarily quantifiable, but rather they offer guidelines to help improve or stabilise river flow. The framework recognises that flow patterns in many rivers have been significantly altered and will not return to natural flow regimes. The intention of the framework is not to attempt to restore completely natural flow patterns where the community significantly benefits from altered flow patterns. However, where adjustments may be sought to maintain or improve river health while continuing to benefit from water use (NSW Government 1999).

2.3 Mixing Zones

The practice of applying the concept of the *mixing zone* (sometimes termed an *exclusion zone*), an explicitly defined area where environmental values and uses are not protected around an effluent discharge point, is an accepted practice to recognise that despite the adoption of rigorous sewage limits and strict waste minimisation targets, effluent may still be of a poorer quality than the receiving water (ANZECC/ARMCANZ 2000).

An assessment of a mixing zone should consider both the concentration and the total mass of contaminants. Effective controls should also consider these, and when combined with in situ dilution and waste treatment, should ensure that the area of a mixing zone is limited and the values of the water body as a whole are not jeopardised (ANZECC/ARMCANZ 2000). The size and environmental conditions within the mixing zone are important. The size should be limited and the environmental impacts effectively contained (ANZECC/ARMCANZ 2000).

As stated in Section 2.2.1.9 of the ANZECC guidelines, the guidelines have not been designed to deal with *mixing zones*. However, managing mixing zones is important for the protection of water quality. The limited guidance provided is in relation to establishing and managing a new mixing zone primarily in relation to the protection of aquatic ecosystems and with some consideration of human health. Depending on the stringency of the environmental requirements being suspended, some or all of the restrictions set out in **Table 3** may be applied to achieve best practice in mixing zone management (ANZECC/ARMCANZ 2000).

Table 3: Best Practice Management of Mixing Zones.

Restrictions	Description
Treatment and Toxicity Testing	Pre-release effluent treatment may be required, or only permits for effluent known to be benign may be issued. These stipulations may be accompanied by a requirement for pre-release toxicity testing.

Restrictions	Description
Temporal Restrictions	Release may only be permitted under specified hydrological conditions. For fluvial systems, threshold streamflow discharge may be required for release. A requirement may be made for the effluent release to be pulsed, with extended periods of no release to maximise the possibility of ecological recovery between episodes.
Mixing Zone Size	The mixing zone must be as small as practical in accordance with the waste management hierarchy, and either alone, or in combination with other mixing zones, should not occupy a significant proportion of the receiving waters. The overall integrity of the ecosystem should not be compromised; for example, the entire width of a stream should not be occluded by the zone. This may allow migrating species to avoid the contaminated zone.
Mixing Zones Not Applicable to Certain Waters	Mixing zones should not generally be designated in waters which have values or characteristics which are not compatible with the existence of a plume of water which does not meet ambient management goals. Examples include waters which either: (a) receive significant and regular use for primary contact recreation; (b) are recognised as of significant value as spawning or nursery areas; (c) are close to areas used for aquaculture; (d) are close to potable water supply intakes; (e) are of outstanding ecological or scientific importance; (f) have high conservation ecosystem values; or (g) where the mixing zone plume is likely to hug the shoreline.
Emission Limits	Emission discharge limits should be set such that, within the mixing zone, the emission does not cause either: (a) objectionable odours which would adversely affect the use of the surrounding environment; (b) objectionable discoloration at the surface of the mixing zone which could adversely affect the use of the surrounding environment; (c) visible floating foam, oils, grease, scum, litter or other objectionable matter; (d) acute toxicity to fish or other aquatic vertebrates; (e) significant irreversible harm within the mixing zone, including objectionable bottom deposits; (f) at levels which, when the size of the mixing zone is considered, may constitute a barrier to the migration of aquatic organisms; or (g) the growth of undesirable aquatic life or dominance of nuisance species.
Prohibition of Certain Substances	Mixing zones should not be used for chemicals which bioaccumulate, unless it can be demonstrated that the discharge of these substances into the environment will not result in long-term adverse effects to biota.
Monitoring Programs	Monitoring may be mandatory. Apart from chemical, physical and biological monitoring in the affected area, the rate of dispersal of the mixing zone after suspension of release may need to be evaluated, particularly in low-energy water bodies such as lakes. Ecotoxicity testing should be evaluated and conducted where necessary (for example, to assess the toxicity of effluent containing mixtures of pollutants).

Source: ANZECC/ARMCANZ 2000.

3 Yass STP Upgrade

This section sets out an analysis of the impact of the existing Yass STP on the WQRFO for the Yass River to provide the background for the setting of appropriate environmental goals and objectives for the planned upgrade of this facility.

3.1 Ambient Water Quality Assessment

The purpose of this section is to determine the level of protection the ambient water quality of the Yass River is affording to the identified environmental values and uses of that waterway.

The DEC publication, *Local Planning for Health Waterways using NSW Water Quality Objectives* (WQO) recommends the following approach to undertaking an assessment for a particular proposal (DEC 2006b, 2006c):

- Determine community values for waterways;
- Determine appropriate level of protection;
- Identify waterway issues and significant risks to water quality;
- Identify and apply indicators and trigger values;
- Set benchmarks for design.

As relevant to the Yass STP and planned upgrade, each of these steps is set out in the following sections.

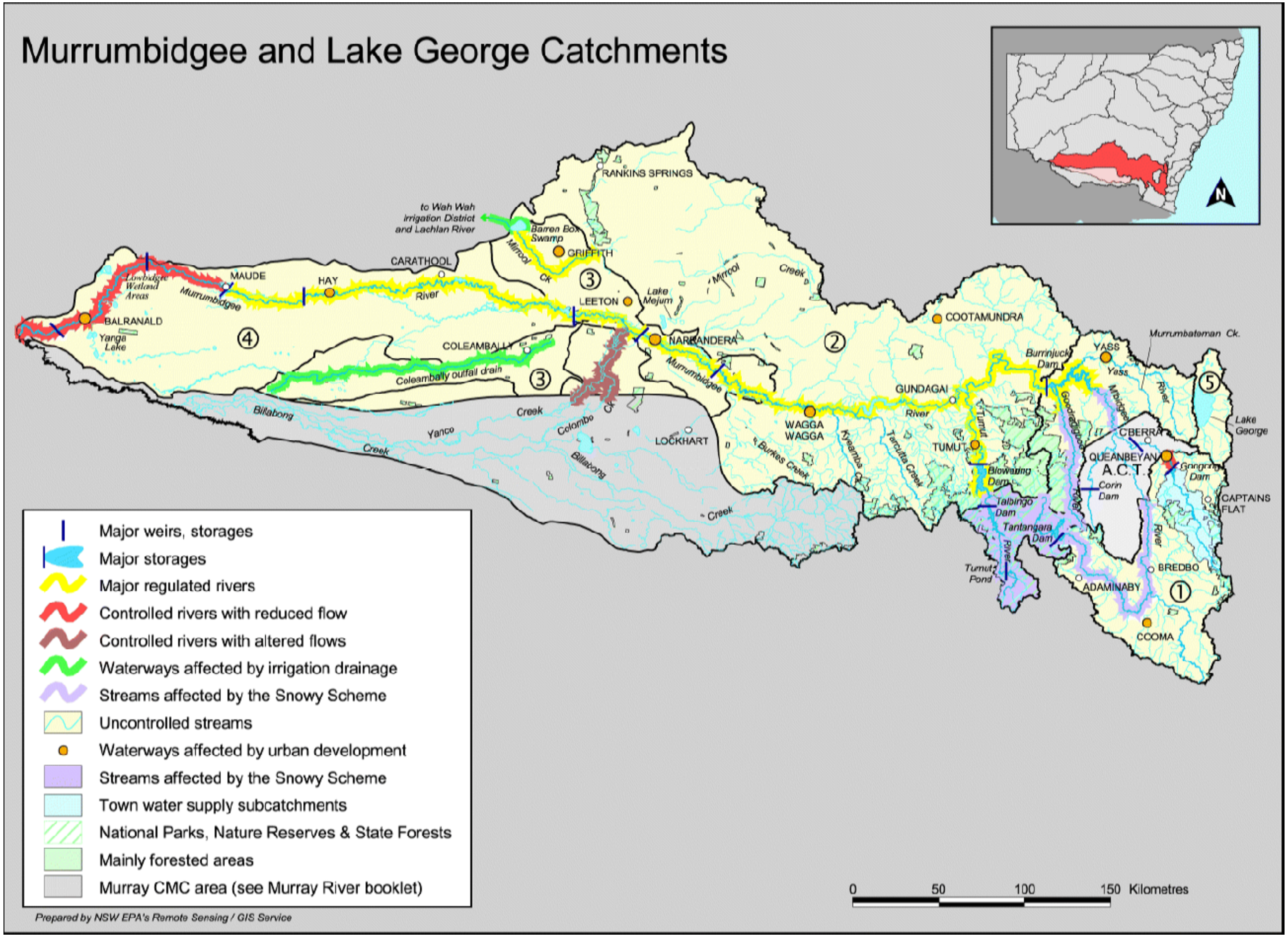
3.1.1 Community Values for the Yass River

The Yass River is a tributary of the Murrumbidgee River located in the headwaters of the Murrumbidgee River catchment. As illustrated in **Figure 3**, the Yass River is classified in the *Murrumbidgee and Lake George Catchment Water Quality and River Flow Objectives* as an 'Uncontrolled stream'.

Based on this classification, all of the environmental values and uses in **Table 1** are relevant for the purposes of this assessment.

Although not relevant based on the classification of the Yass River, the DEC has requested that the WQOs associated with the stream classifications 'Waterways affected by urban development' and 'Town water supply sub-catchments' be considered. These objectives are however, a sub-set of those already required to be considered under the Uncontrolled stream classification.

Figure 3: Stream Flow Classifications of the Murrumbidgee and Lake George Catchments.



Source: NSW Government 1999.

3.1.2 Level of Protection

Consistent with the NSW policy discussed in **Section 2.1**, the Yass River is a slightly to moderately disturbed ecosystem. Therefore, maintenance of the existing ecosystem condition is a baseline and improvement is a key management goal.

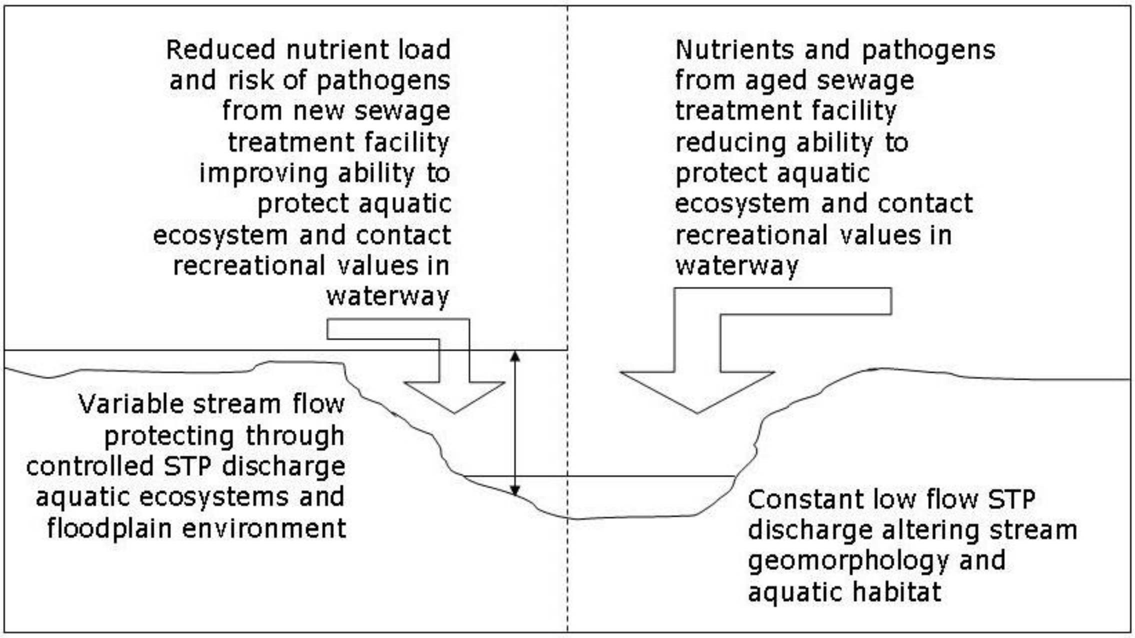
3.1.3 Waterway Issues and Significant Risks to Water Quality

As discussed in **Section 2.1**, the use of the WQOs in guiding planning is based on identifying the risk to water quality, and hence risk to the protection of the various environmental values and uses for a waterway.

The DEC promotes the use of conceptual models, such as the cross-section of a stream, to assist in identifying priority risks to water quality (DEC 2006b). These models identify and simplify the cause and effect relationships which can impact on river health. These models are suitable when there is little data (for further discussion see **Section 3.1.4**) and to set the context for quantitative assessments of the level of protection afforded by the ambient water quality.

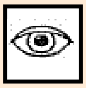
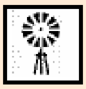
The main activity-specific risk to water quality associated with the existing and the proposed upgrade to the Yass STP is the generation of treated sewage effluent which may have unacceptable nutrient and pathogen loads. A conceptual model of this risk to water quality is provided in **Figure 4**.

Figure 4: Conceptual Model of Potential Impact of STP on Waterway.



A summary of activity-specific waterway issues associated with the existing and the proposed upgrade to the Yass STP is set out in **Table 4**.

Table 4: Activity-Specific Waterway Issues Against Uses and Values.

Uses and Values	Issue	Indicator
	Nuisance aquatic weeds (eutrophication).	TP, TN, chlorophyll a, dissolved oxygen.
	Scums and odours.	Algae and blue-green algae.
 	Human health.	Faecal coliforms, enterococci, protozoans, algae and blue-green algae.
	Human health.	Faecal coliforms, enterococci, protozoans.
	Livestock health.	Algae and blue-green algae.
	Human health.	Faecal coliforms, total coliforms, protozoans, blue-green algae.
	Human health.	Faecal coliforms, blue-green algae, total suspended solids.

3.1.4 Identify and Apply Indicators and Trigger Values

Based on Section 3.1.1 and Table 4, with the exception of the indictors and triggers for the irrigation supply use, indicators and triggers of Table 1 are the most appropriate to apply to assess the ambient water quality of the Yass River.

Table 5 sets out the water quality data available with the DNR relevant to the assessment of the Yass River (data is presented in the direction of flow in the waterway). The majority of the data has been sourced from water quality stations located on the Yass River. For comparison, data has also been sourced from four stations located on the Goodradigbee River and one located on the Murrumbidgee River at Burrinjuck Dam. Together, these locations represent the larger catchment area and provide a general assessment of water quality within the catchment.

The data available from the majority of stations is incomplete with respect to some of the numerical indicators (parameters) for the environmental values and uses. This is illustrated in **Table 5**.

Table 5: Water Quality Stations and Data Sets.

Station Number	Location	Data Set	Parameters	Number of Samples	Sample Mean[2]
41010093	Yass River @ Macs Reef Road Bridge	RWME0003 RWME0001	DO pH TP TSS Temperature Turbidity	5 12 15 15 12 12	9.64 mg/L 7.88 pH 0.02 mg/L 5.73 mg/L 12.3 °C 12.5 NTU
410851	Yass River @ Above Macs Reef Road	HIWQ0001	EC pH TP TSS Temperature Turbidity	70 77 33 1 70 63	625 µS/cm 7.52 pH 0.01 mg/L 0.31 mg/L 13.6 °C 13.7 NTU
410850	Yass River @ Macs Reef Road	HIWQ0001	EC pH TP Temperature Turbidity	47 22 1 25 2	628 µS/cm 7.78 pH 0.01 mg/L 15.8 °C 3.45 NTU
410090	Yass River @ Gundaroo	HIWQ0001	EC pH Temperature Turbidity	90 57 91 49	635 µS/cm 7.68 pH 16.1 °C 9.44 NTU

[2] It is important to note that the water quality assessment was prepared based on the range of results for a parameter at a location, not on the sample means.

Station Number	Location	Data Set	Parameters	Number of Samples	Sample Mean[2]
41010088	Yass River @ Elizabeth Field	RWME0015	EC	147	739 µS/cm
		RWME0003	DO	21	4.86 mg/L
		RWME0001	pH	193	7.39 pH
		HIME0001	TP	48	0.04 mg/L
			TSS	48	11.3 mg/L
			Temperature	46	13.3 °C
			Turbidity	50	20.8 NTU
410026	Yass River @ Yass	HIME0001	EC	142	680 µS/cm
		HIWQ0001	pH	125	7.82 pH
		RWME0003	TP	49	0.10 mg/L
			TSS	3	2.07 mg/L
			Temperature	145	15.4 °C
			Turbidity	102	8.06 NTU
41010089	Yass River @ Yass Weir	RWME0003	EC	2	377 µS/cm
		RWME0001	DO	28	6.29 mg/L
		SWME0001	pH	57	7.84 pH
			TP	48	0.04 mg/L
			TSS	48	17.5 mg/L
			Temperature	56	17.0 °C
			Turbidity	58	37.5 NTU
41010898	Yass River @ Riverview	RWME0001	EC	113	724 µS/cm
		SWME0001	DO	173	9.54 mg/L
			pH	186	8.37 pH
			TP	56	0.03 mg/L
			TSS	56	9.96 mg/L
			Temperature	190	16.2 °C
			Turbidity	186	8.06 NTU

Station Number	Location	Data Set	Parameters	Number of Samples	Sample Mean²
41010027	Yass River @ Burrinjuck Dam	SWME0001 HIWQ0001	Chlorophyll-a EC TN DO pH TP TSS Temperature Turbidity	88 88 2 10 114 114 36 63 117	6.33 µg/L 263 µS/cm 1.45 mg/L 9.58 mg/L 7.77 pH 0.08 mg/L 28.8 mg/L 19.1 °C 22.1 NTU
41010166	Goodradigbee River @ Swing Bridge Reserve	RWME0008 RWME0012	Chlorophyll-a TN DO pH TP TSS Temperature Turbidity	22 6 23 24 19 18 24 23	323 µg/L 0.12 mg/L 10.2 mg/L 7.52 pH 0.01 mg/L 7.56 mg/L 11.1 °C 5.3 NTU
410024	Goodradigbee River @ Wee Jasper	RWME0001 RWME0003 HIWQ0001 RWME0008	Chlorophyll-a EC DO pH TP TSS Temperature Turbidity	6 251 187 282 79 77 327 273	367 µg/L 86.8 µS/cm 9.31 mg/L 7.53 pH 0.10 mg/L 52.6 mg/L 13.1 °C 16.9 NTU

Station Number	Location	Data Set	Parameters	Number of Samples	Sample Mean²
410088	Goodradigbee River @ Brindabella No 2 and No 3 Cabbans	HIWQ0001	EC pH TP Temperature Turbidity	108 71 3 109 64	98.4 µS/cm 7.52 pH 0.03 mg/L 12.1 °C 1.3 NTU
41010086	Goodradigbee River @ Brindabella	RWME0003	DO pH TP TSS Temperature Turbidity	20 48 49 49 48 50	9.74 mg/L 7.78 pH 0.01 mg/L 4.39 mg/L 11.2 °C 2.7 NTU
410008	Murrumbidgee River @ Burrinjuck Dam	HIME0001 HIWQ0001 RWWQ0004	E Coli EC TN DO pH TP TSS Temperature Total Coli Turbidity	2 226 3 66 227 180 85 219 2 320	2 MPN/100mL 172 µS/cm 1.01 mg/L 9.82 mg/L 7.52 pH 0.03 mg/L 12.5 mg/L 14.2 °C 30 CFU/100Ml 14.6 NTU

As an environmental value or use is represented by a group of water quality indicators, all indicator criteria must be met for that environmental value to be considered protected. For the purposes of this assessment, the extent to which the value was considered protected was ranked from very poor to good, based on the percentage of samples where the indicator criteria were met (see **Table 6**).

Table 6: Ranking of Environmental Values.

Ranking	Lower Limit	Upper Limit	Icon Colour
Good	75%	100%	Green
Fair	50%	74%	Yellow
Poor	25%	49%	Orange

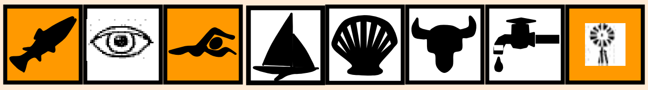
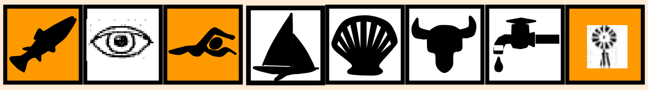
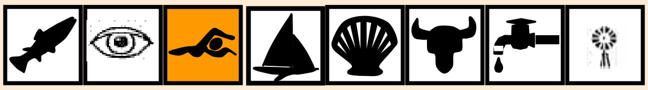
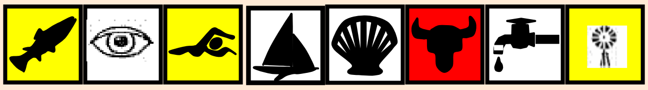
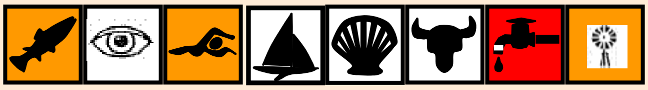
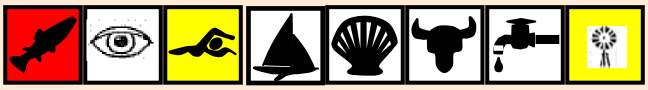
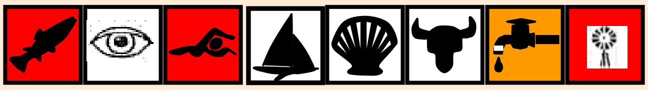
Ranking	Lower Limit	Upper Limit	Icon Colour
Very Poor	0%	24%	Red
Insufficient Data	NA	NA	Black and white

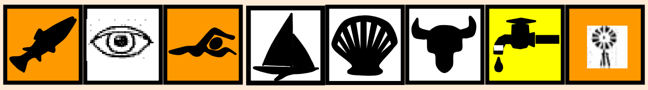
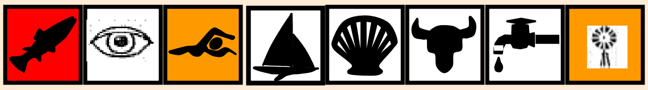
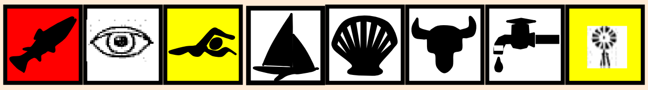
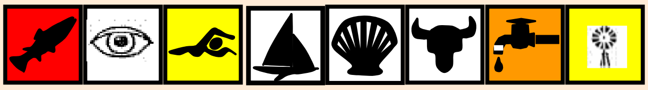
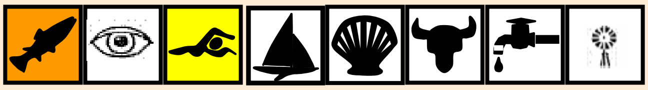
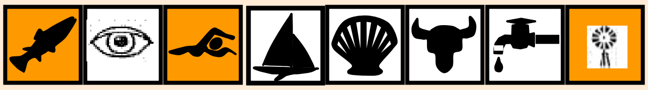
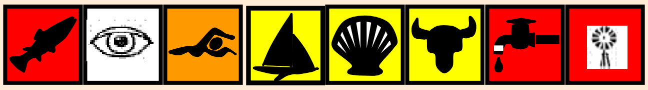
Due to the paucity of data, the assessment of the protection of the environmental values and uses is limited. Where sufficient information is currently unavailable to assess criteria, the icons are presented in black and white.

3.1.5 Ambient Water Quality of the Yass River

The ability of the ambient water quality of the Yass River to protect the environmental values and uses for this waterway is summarised in **Table 7**. The water quality stations are presented in the direction of flow.

Table 7: Ambient Water Quality Assessment of Yass River.

Station Number	Location	Results
41010093	Yass River @ Macs Reef Road Bridge	
410851	Yass River @ Above Macs Reef Road	
410850	Yass River @ Macs Reef Road	
410090	Yass River @ Gundaroo	
41010088	Yass River @ Elizabeth Field	
410026	Yass River @ Yass	
41010089	Yass River @ Yass Weir	

Station Number	Location	Results
41010898	Yass River @ Riverview	
41010027	Yass River @ Burrinjuck Dam	
41010166	Goodradigbee River @ Swing Bridge R.	
410024	Goodradigbee River @ Wee Jasper	
410088	Goodradigbee R @ Brindabella Cabbans	
41010086	Goodradigbee River @ Brindabella	
410008	Murrumbidgee River @ Burrinjuck Dam	

Yass River above Yass: Stations 41010093, 410851, 410850, 410090, 41010088

The protection of aquatic ecosystems above the town of Yass is generally poor, primarily due to turbidity and total phosphorus. Isolated issues with dissolved oxygen also contribute to the poor protection. The lack of chlorophyll-a and total nitrogen data and the limited amount of total phosphorus data limits the accuracy of the assessment.

There was insufficient data to determine the level of protection afforded to the environmental values and uses of visual amenity, secondary contact recreation and aquatic foods (cooked). This is primarily due to the lack of faecal coliform, enterococci and algae and blue-green algae data.

The protection of primary contact recreation use above the town of Yass is generally poor, primarily due to turbidity and temperature. The lack of faecal coliform, enterococci and algae and blue-green algae data limits the accuracy of the assessment.

The protection of homestead water supply use is generally poor, primarily due to turbidity. The lack of faecal coliform, and algae and blue-green algae data limits the accuracy of the assessment.

Yass River at Yass Town: Stations 41010089 and 410026

The protection of aquatic ecosystems at the town of Yass is very poor, primarily due to turbidity, total phosphorus and total nitrogen. Isolated issues with dissolved oxygen also contribute to the poor protection. The lack of chlorophyll-a and limited total nitrogen data limits the accuracy of the assessment.

The protection of primary contact recreation use at the town of Yass is very poor to fair, primarily due to turbidity and temperature. The lack of faecal coliform, enterococci and algae and blue-green algae data limits the accuracy of the assessment.

Yass River below Yass: Stations 41010898 and 41010027

The protection of aquatic ecosystems below Yass is poor to very poor, primarily due to turbidity, total phosphorus, total nitrogen and chlorophyll-a. The limited chlorophyll-a total nitrogen data limits the accuracy of the assessment.

The protection of primary contact recreation use below Yass is generally poor, primarily due to turbidity and temperature. The lack of faecal coliform, enterococci and algae and blue-green algae data limits the accuracy of the assessment.

Murrumbidgee River: Station 410008

The outcomes for this station are similar to those for the stations below the town of Yass. However, with the exception of enterococci and algae and blue-green algae data, data for the majority of parameters was available for this station.

Goodradigbee River: Stations 41010166, 410024, 410088, 41010086

The results for these stations along the Goodradigbee River are similar to those for the Yass River. However, more chlorophyll-a data is available for these stations, which allows the demonstration of the very poor outcomes for the protection of aquatic ecosystems.

General Water Quality Trends within the Assessment Area

- Turbidity entering waterways from land use practices in the Yass River catchment generally result in poor protection of aquatic ecosystems, primary contact recreation and homestead water supply.
- Nutrients (particularly phosphorus) entering waterways from land use practices in the catchment result in poor protection of aquatic ecosystems. Although nutrient levels are high in the full Yass River length examined, the town does appear to be a significant contributor as the level of protection afforded to aquatic ecosystems decreases close to the town. It is expected that the largely untreated stormwater from the urban area of the town as well as the discharge from the existing STP are the primary sources.

- The lack of chlorophyll-a and total nitrogen data significantly limits the assessment of the level of protection of aquatic ecosystems, which may be further degraded than this assessment suggests.
- The lack of faecal coliform, enterococci, algae and blue-green algae data significantly limits the assessment of the protection of primary and secondary contact recreation uses, which may also be further degraded than this assessment suggests.

3.1.6 Water Quality Goals for STP Upgrade

Based on the assessment of ambient water quality in the Yass River, the following goals for the STP upgrade are recommended:

- Inclusion of treatment facilities at the STP to reduce phosphorus concentrations and to achieve treated effluent quality that meets the DEC Accepted Modern Technology criteria.
- Monitoring protocols for the STP and discharge location should include faecal coliforms, algae and blue-green algae.

In addition, the following protocols should be implemented by YVC:

- Continue to implement a trade waste policy to ensure the influent does not impact on the appropriate functioning of the STP.
- Internal water use efficiency programs targeting residential toilets and showerheads will contribute to the reduction in effluent requiring treatment.
- Demand management in general.

3.2 Assessment of Yass STP on Yass River Flow

The purpose of this section is to determine the extent to which the river flow objectives for the Yass River are being protected.

3.2.1 Yass River Flow Regime

Limited data is available upon which to determine the natural and existing flow regime for the Yass River.

For the purposes of an assessment of the yield of Yass Dam, the Department of Commerce naturalised the recorded flow sequence at flow gauging station 410026 (Yass River at Yass). The purpose of the naturalisation process was to correct the flow sequence for the impact of extraction for irrigation and diversion for farm dams (Department of Commerce 2003). The synthetic series of river flows (1889 to 2003) generated represents a more natural sequence of streamflow in the Yass River at Yass.

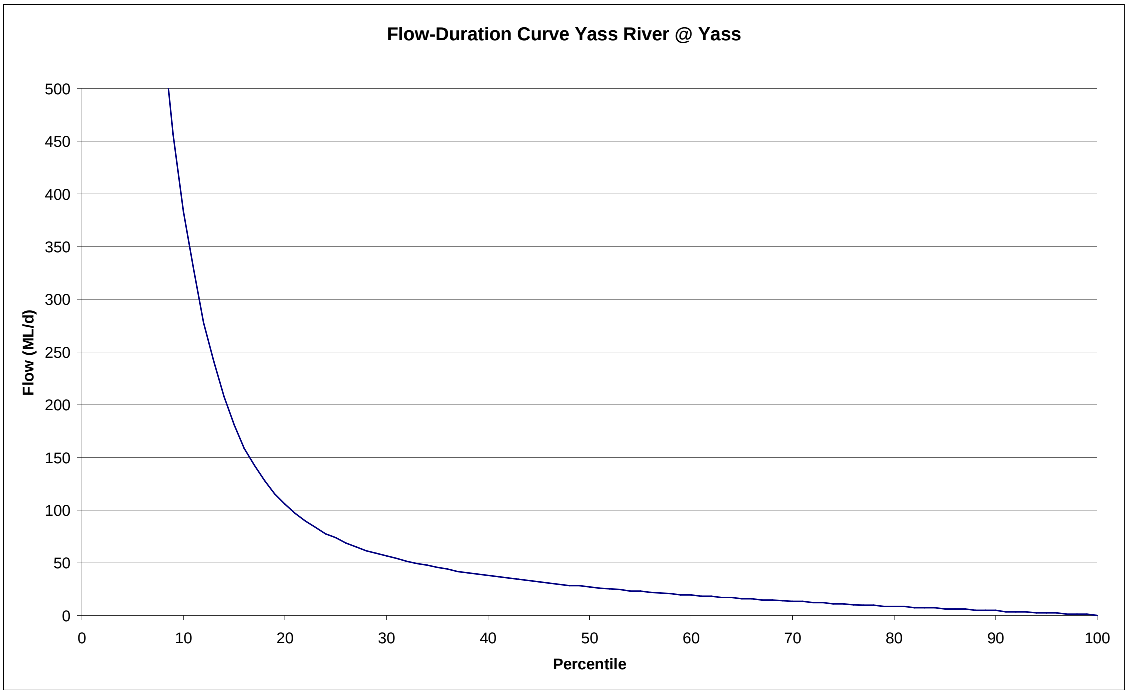
A flow-duration curve derived from the naturalised flow sequence is presented in **Figure 5**.

Very low flows (flows below the level naturally exceeded on 95% of all days with flow) in the Yass River are 2.4 ML/day. Low flows (flows below the level naturally exceeded on 80% of all days with flow) for the Yass River are 8.6 ML/day.

These flows enter the Yass Dam. The water licence for the dam does not specify an environmental flow, and therefore, the current guaranteed environmental flow is equal to zero (Department of Commerce 2003). The flows downstream of the dam, and hence in proximity to the STP discharge location, are significantly altered by the dam. The only active flow gauging station below the Yass Dam is the Yass River at Burrinjuck Dam (410176).

Recorded daily flows at the 410176 gauge station were used to derive the flow-duration curve shown in **Figure 6**. The accuracy of this curve is limited due to the short period of flow data upon which it is based.

Figure 5: Flow-Duration Curve for Yass River at Yass.



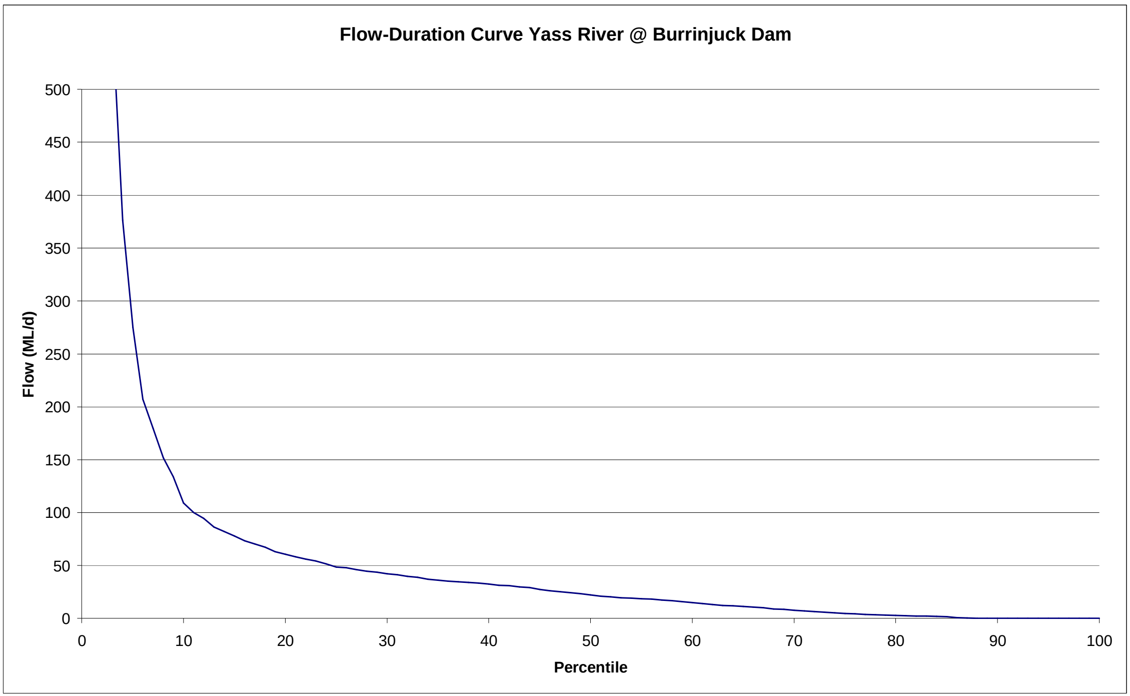
Source: Modified from Department of Commerce 2003.

Very low flows (95^{th}%ile flows) in the Yass River at Burrinjuck Dam are less than 0.1 ML/day. Low flows (80^{th}%ile flows) at this point in the Yass River are 2.9 ML/day.

It is apparent that the impact of the Yass Dam on flows in the Yass River below the dam is quite significant in terms of altering the natural flow regime.

Over the past three years, during the winter months when the existing STP discharges to the Yass River, the average daily discharge from the STP is in the order of 1 ML/day. This flow would constitute a significant part of the low flow regime as modified by Yass Dam. However, if the dam were not in place, or altered to provide environmental flows, it could be expected that the flow in the Yass River downstream of the dam would be significantly greater, even in low flow, as illustrated in **Figure 5**.

Figure 6: Flow-Duration Curve for Yass River at Burrinjuck Dam.



Source: Modified from www.waterinfo.nsw.gov.au

3.2.2 Yass River Flow Regime Against River Flow Objectives

To aid in assessment of appropriate river flow goals for the STP upgrade, **Table 8** sets out the key aspects of water use, regulation and discharge impacting on the RFOs for the Yass River.

Table 8: Impact of Water Use, Regulation and Discharge on Yass River Flow Objectives.

River Flow Objective	Measures to Achieve Objective
Protect Pools in Dry Times Protect Important Rises in Water Levels	The water licence for Yass Dam does not contain environmental flow requirements which is detrimental to achieving this objective. The natural low flow regime would be expected to be up to 3 times greater than the present altered (irrigation extraction, farm dam diversion and Yass Dam) flow regime. The STP discharges water and hence provides a significant part of the low flow below Yass Dam during dry times. The volumes discharged from the STP are not

River Flow Objective	Measures to Achieve Objective
Maintain Wetland and Floodplain Inundation	significant in relation to the overbank flows in the Yass River and hence the operation of the STP does not impact on this objective.
Maintain Natural Rates of Change in Water Levels	Irrigation extraction, farm dam diversion and Yass Dam impact on the natural rates of change in water levels. Discharge from the STP during the winter months averages approximately 1 ML/day ADWF for the existing population. During summer, the effluent discharge is much smaller as effluent is diverted for irrigation practices. The 95^{th}%ile river flow in June is 2.4 ML/day whilst the 80^{th}%ile in June is 9.8 ML/d. The discharges from the STP will not unduly alter the natural rates of change in water levels.
Protect Natural Low Flows	It could be expected that the natural very low flows (flows below the level naturally exceeded on 95% of all days with flow) in the Yass River at Yass are 2.4 ML/day. Similarly, low flows (flows below the level naturally exceeded on 80% of all days with flow) for the Yass River at Yass are 8.6 ML/day. Environmental share in the Yass River at Yass (and all streams other than those of high conservation value) should be 100% of the very low flows and 50-70% of daily low levels. In this case, whenever flow in less than the 80^{th}%ile, at least 2.6 ML of water should be allowed to pass Yass. Yass Dam significantly alters this regime. Very low flows in the Yass River at Burrinjuck Dam (see **Figure 6**) are less than 0.1 ML/day. Low flows at this point in the Yass River are 2.9 ML/day. Over the past three years, during the winter months when the existing STP discharges to the Yass River, the average daily discharge from the STP is in the order of 1 ML/day. This flow would constitute a significant part of the low flow regime as modified by Yass Dam. However, if the dam were not in place, or altered to provide environmental flows, it could be expected that the flow in the Yass River downstream of the dam would be significantly greater, even in low flow.
Mimic Natural Drying in Temporary Waterways	The Yass River is not a temporary waterway.
Maintain Natural Flow Variability	The flow variability in the Yass River is unnatural due to extractions for irrigation, farm dam diversions and Yass Dam. The discharge from the STP restores some of the low flow component that would be expected to occur naturally in the river below Yass Dam.
Manage Groundwater for Ecosystems	Interaction of surface and groundwater in Yass River is not known.
Minimise Effects of Weirs and Other Structure	Yass Dam does not currently have provision for fish passage.

River Flow Objective	Measures to Achieve Objective
Minimise Effects of Dams on Water Quality	See assessment in Section 3.1.5.
Make Water Available for Unforseen	Not applicable.

3.2.3 River Flow Goals for STP Upgrade

Based on the assessment of river flow in the Yass River, the following goals for the STP upgrade are recommended:

- Although there are limited opportunities for effluent reuse, YVC should continue to explore and identify reuse opportunities that may reduce the volume of effluent discharged to the Yass River, particularly during high flows.
- Sustainable and high value effluent reuse opportunities should consider the use of treated effluent as a valuable component of the low flow regime.
- This should however, also be balanced with opportunities to provide environmental flows from Yass Dam and the on-going improvement of the ability to protect the environmental values and uses of the waterway in relation to ambient water quality.

3.3 Yass STP Mixing Zone Assessment

The purpose of this section is to determine the extent of the existing mixing zone (a distinct area where environmental values and uses are not protected as a result of effluent discharge) around the existing Yass STP treated effluent discharge point.

3.3.1 Yass River STP Mixing Zone

In the absence of a detailed monitoring program for the mixing zone of the existing STP, the water quality assessment made in **Section 3.1.5** is the only source of information on the mixing zone. However, it is apparent from the assessment of the ambient water quality, that the environmental values and uses of the Yass River are generally poorly protected. Although there is some worsening of the nutrient levels associated with the town of Yass, the source of the contamination cannot be isolated. Hence, the definition of a distinct area where environmental values and uses are impacted upon as a result of the existing Yass STP is not possible with the data available.

Considering the discussion of the low flow regime in **Section 3.2.1**, it could be postulated that the existing mixing extends to Burrinjuck Dam. However, even without the discharge of treated effluent, it is expected that the ambient water quality would be unable to protect the environmental values and uses of the Yass River.

Further, the river flow assessment also illustrates that the discharge from the STP provides some of the flow that would be expected in the Yass River if it were not stored in Yass Dam. As such, although an extensive mixing zone may exist, it is assisting in achieving some of the RFO for the waterway.

3.3.2 Mixing Zone Goals for STP Upgrade

Based on the assessment of the existing mixing zone in the Yass River, the following goals for the STP upgrade are recommended:

- Inclusion of treatment facilities at the STP to reduce phosphorus concentrations and to achieve treated effluent quality that meets the DEC Accepted Modern Technology criteria.
- The implementation of an operational monitoring program to establish the extent of the mixing zone may identify further improvements to the effluent discharge regime and potentially contribute to the environmental values of the Yass River.
- Chemical, physical and biological monitoring in the affected area to ensure the release does not further erode the protection of environmental values and uses.

In addition, the following protocols should be implemented by YVC:

- Continue to implement a trade waste policy to ensure the influent does not impact on the appropriate functioning of the STP.

4 Conclusions

Based on the assessment of the ambient water quality, RFO and existing mixing zone, the following conclusions are made in relation to the Yass STP:

- As a result of land-use activities in the Yass River catchment, the environmental values and uses for this waterway are generally poorly protected.
- Management of treated effluent quality, particularly total phosphorus loads, is required to protect environmental values and uses.
- Although the monitoring data was unclear on whether the STP specifically was affecting aquatic ecosystems indicators, if the effluent is not discharged to waterways, the STP will not be contributing to nutrient levels in the river.
- However, the flow provided by discharges from the STP is a significant contributor to the low flow regime, which has been significantly altered as a result of irrigation extraction, farm dam diversions and Yass Dam.

As a result, the following are recommended as goals for the upgrade of the STP:

- Inclusion of treatment facilities at the STP to reduce phosphorus concentrations and to achieve treated effluent quality that meets the DEC Accepted Modern Technology criteria.
- Although there are limited opportunities for effluent reuse, YVC should continue to explore and identify reuse opportunities that may reduce the volume of effluent discharged to the Yass River, particularly during high flows.
- Sustainable and high value effluent reuse opportunities should consider the use of treated effluent as a valuable component of the low flow regime.
- This should however, also be balanced with opportunities to provide environmental flows from Yass Dam and the on-going improvement of the ability to protect the environmental values and uses of the waterway in relation to ambient water quality.
- Continue to implement a trade waste policy to ensure the influent does not impact on the appropriate functioning of the STP.
- Internal water use efficiency programs targeting residential toilets and showerheads will contribute to the reduction in effluent requiring treatment. Implementation of a general demand management plan.
- Preparation and implementation of maintenance procedures that would prevent, control or minimise incidents.

- Establish incident procedures to ensure that employees and contractors understand their responsibilities.
- Monitoring protocols for the STP and discharge location should include faecal coliforms, algae and blue-green algae.
- The implementation of an operational monitoring program to establish the extent of the mixing zone may identify further improvements to the effluent discharge regime and potentially contribute to the environmental values of the Yass River.
- Develop chemical, physical and biological monitoring in the mixing zone to ensure the release does not further erode the protection of environmental values and uses.

5 References

ANZECC/ARMCANZ 2000, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, Department of Environment and Heritage, Canberra. Available at www.deh.gov.au/water /quality/nwqms

Department of Commerce, 2003, *Yass Water Supply, Yass Dam Yield Study, prepared for Yass Shire Council*, Report No. 03083, Department of Commerce, Sydney.

Department of Environment and Conservation NSW (DEC) 2006a*, Considering Environmental Values of Water when Issuing Prevention Notices*, Guidelines issued by the Environment Protection Authority to appropriate regulatory authorities under s96(3A) of the *Protection of the Environment Operations Act* 1997, DEC, Sydney. Available at www.environment.nsw.gov.au

DEC 2006b, Local Planning for Health Waterways using NSW Water Quality Objectives, DEC, Sydney. Available at www.environment.nsw.gov.au

DEC 2006c, *Using the ANZECC Guidelines and Water Quality Objectives in NSW*, DEC, Sydney. Available at www.environment.nsw.gov.au

NSW Government 1999, *Murrumbidgee and Lake George catchment Interim Water Quality Objectives*, Environment Protection Authority, Sydney. Available at www.environment.nsw.gov.au/ieo

YVC 2005, Development Servicing Plan for Water Supply and Sewerage, YVC, Yass.

Appendix G

Capital Works Programs and OMA Schedules for Draft Scenarios

050626 Yass Valley Council IWCM
Capital Works Program Water - Base Case
2005
All values are in year 2005 $'000

Asset	Type of works				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Improved LOS	New System Assets	Renewals	30 year total	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
					2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
YASS																																		
Yass Dam																																		
Dredging investigation		100%		100	100																													
Earthquake study		100%		60	60																													
Movement study		100%		15		15																												
Dam storage survey		100%		30	30																													
Raising dam wall engineering studies		100%		250	75	100	75																											
Raising dam wall design/construction		100%		11,000				3000	4000	4000																								
Off-creek dam investigations (500ML)		100%																																
Off-creek dam design/construction (500 ML)		100%																																
Yass River flow gauging (2 locations)		100%		60	25	35																												
Treatment																																		
Water Softening (provisional)	100%			3,000						1500	1500																							
Filtration plant augmentation		100%		8,000																1600	6400													
Install walkway over WTP filters		100%		35		35																												
Distribution																																		
Trunk mains under Yass River		100%		200					200																									
Mount St WPS - raw water pumps		100%		120					60	60																								
Chlorine dosing facility to Morton reservoir		100%		20		20																												
Provide standpipe to supply at O'Connor Parr		100%		20				20																										
Renewals																																		
Pipe replacement			100%	3,750	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125
Pump replacement			100%	120				20					20					20						20					20					20
Domestic water service renewals			100%	852	50	50	50	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
IWCM			100%	26	26																													
Refubrish dam' scour valve			100%	45		45																												
Augmentation																																		
Emergency bore connections (50% subsidy ov	100%			1,780	356	712	712																											
New water supply (incl. main, pump st, retic fo	100%			20,000											7000	13000																		
Good Hope - field investigation for bores		100%		20		20																												
Demand Management																																		
MURRUMBATEMAN																																		
Treatment																																		
Distribution																																		
Renewals																																		
Augmentation																																		
Water supply upgrade (35% subsidy over cont	100%			800			160	640																										
Demand Management																																		
Stormwater Harvesting																																		
GUNDAROO																																		
Treatment																																		
Distribution																																		
Renewals																																		
Augmentation																																		
Groundwater study	100%			130					130																									
	100%			2,770						520	250	1500	500																					
Demand Management																																		
Stormwater Harvesting																																		
BOWNING/BINALONG																																		
Treatment																																		
Distribution																																		
150mm pipeline duplication to Bowning/Binalong		100%		2,500							2500																							
Renewals																																		
Augmentation																																		
Demand Management																																		
Villages																																		
Treatment																																		
Distribution																																		
Villages water main extensions		100%		80		20		20			20		20																					
Renewals																																		
Augmentation																																		
Demand Management																																		
Stormwater Harvesting																																		
Total				55,783	847	1,177	1,122	3,851	4,541	6,231	4,421	1,651	691	151	7,151	13,151	151	171	151	1,751	6,551	151	151	171	151	151	151	151	171	151	151	151	151	171
Improved LOS				28,480	356	712	872	640	130	2,020	1,750	1,500	500		7,000	13,000																		
Other New System Assets (growth w				22,510	290	245	75	3,040	4,260	4,060	2,520		20							1,600	6,400													
Renewals				4,793	201	220	175	171	151	151	151	151	171	151	151	151	151	171	151	151	151	151	151	171	151	151	151	151	171	151	151	151	151	171
Other Grants (Yass borehole & Murru				1,134	150	300	300	384																										

Water Base Case - OMA and Revenue Overrides (increases in current expenditure) (2005/06$)

Source: Figure 15, Page 80 of YVC SBP

Notes:

1. Yass dam raise OMA is zero as it is assumed to be covered by the existing falilities.

	30 Year TOTAL	03/04	04/05	1 2005/06 2005	2 2006/07 2006	3 2007/08 2007	4 2008/09 2008	5 2009/10 2009	6 2010/11 2010	7 2011/12 2011	8 2012/13 2012	9 2013/14 2013	10 2014/15 2014	11 2015/16 2015	12 2016/17 2016	13 2017/18 2017	14 2018/19 2018	15 2019/20 2019	16 2020/21 2020	17 2021/22 2021	18 2022/23 2022	19 2023/24 2023	20 2024/25 2024	21 2025/26 2025	22 2026/27 2026	23 2027/28 2027	24 2028/29 2028	25 2029/30 2029	26 2030/31 2030	27 2031/32 2031	28 2032/33 2032	29 2033/34 2033	30 2034/35 2034
Administration																																	
Demand management plan	30				30																												
Water efficient appliances subsidy	600			20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Cusomer education	60			2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Recycle options study	40					40																											
DSP review	60							10					10					10					10					10					10
Community consultation IWCM, water options	8				8																												
Drought management plan	25			25																													
IWCM plan	75			75																													
SBP review	100								20					20					20					20					20				
Update pricing tariff (DEUS model)	48			8					8					8					8					8					8				
Apply for water smart funding from NCC (effluent reuse)	3			3																													
Total adjustment	1049			133	60	62	22	32	50	22	22	22	32	50	22	22	22	32	50	22	22	22	32	50	22	22	22	32	50	22	22	22	32
Override (Inflated to 03/04$ and pro-rata adjustment for…)	**11900**	250	267	413	344	351	314	329	353	327	334	340	359	387	360	367	373	393	423	394	400	407	426	456	423	428	434	454	484	447	452	457	477
Engineering & Supervision																																	
W&S coordinator	1110			37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37
Graduated engineers	900			30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Operator training courses	12			2					2					2					2					2					2				
Total adjustment	2022			69	67	67	67	67	69	67	67	67	67	69	67	67	67	67	69	67	67	67	67	69	67	67	67	67	69	67	67	67	67
Override (Inflated to 03/04$ and pro-rata adjustment for…)	**4354**	45	44	116	116	117	119	121	125	124	127	129	131	136	137	139	142	144	149	149	152	154	156	161	160	162	165	167	170	169	171	173	175
Operations Expenses																																	
Leak reduction	30							30																									
Catchment management - Willow trees removal	750			25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Illalong feasibility of pearpoint bore field	45						20	25																									
Yass dam silt depth survey	120			30									30										30										30
Hartton's Corner-water quality monitoring	30			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Yass town - prepare due diligence plan	10			10																													
Linking GIS to asset register	30					20	10																										
Total adjustment	1015			66	26	46	56	81	26	26	26	26	56	26	26	26	26	26	26	26	26	26	56	26	26	26	26	26	26	26	26	26	56
Override (Inflated to 03/04$ and pro-rata adjustment for…)	**10368**	217	229	305	269	294	308	340	285	289	294	300	341	312	318	324	329	335	341	347	353	359	405	367	373	377	383	387	390	394	398	403	454
Maintenace Expenses																																	
Total adjustment	0																																
Override (Inflated to 03/04$ and pro-rata adjustment for…)	10602	228	233	251	258	263	268	279	290	301	310	318	324	330	336	342	348	354	360	366	372	378	384	390	396	402	408	414	420	426	432	438	444
Energy Cost																																	
Total adjustment	0																																
Override (Inflated to 03/04$ and pro-rata adjustment for…)	1335	23	28	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
Chemical Cost																																	
Total adjustment	0																																
Override (Inflated to 03/04$ and pro-rata adjustment for…)	1335	57	54	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
Purchase of Water																																	
Total adjustment	0																																
Override (Inflated to 03/04$ and pro-rata adjustment for…)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Expenses																																	
Total adjustment	0																																
Override (Inflated to 03/04$ and pro-rata adjustment for…)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Revenue																																	
Total adjustment	0																																
Override (Inflated to 03/04$ and pro-rata adjustment for…)	900	30	33	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30

050626 Yass Valley Council IWCM

Capital Works Program Water - Traditional Case
2005
All values are in year 2005 $'000

Asset	Type of works				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Improved LOS	New System Assets	Renewals	30 year total	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
					2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
YASS																			
Yass Dam																			
Dredging investigation		100%		100	100														
Earthquake study		100%		60	60														
Movement study		100%		15		15													
Dam storage survey		100%		30	30														
Raising dam wall engineering studies		100%		250	75	100	75												
Raising dam wall design/construction		100%		11,000				3000	4000	4000									
Off-creek dam investigations		100%																	
Off-creek dam design/construction		100%																	
Yass River flow gauging (2 locations)		100%		60	25	35													
Treatment																			
Water Softening (provisional)	100%			3,000						1500	1500								
Filtration plant augmentation		100%		8,000															
Install walkway over WTP filters		100%		35		35													
Distribution																			
Trunk mains under Yass River		100%		200					200										
Mount St WPS - raw water pumps		100%		120					60	60									
Chlorine dosing facility to Morton reservoir		100%		20		20													
Provide standpipe to supply at O'Connor Parr		100%		20				20											
RENEWALS - ALL SYSTEMS																			
Yass Dam			100%	5,100	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170
Bores			100%	24	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
WTP			100%	995	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
Pump Stations			100%	200	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Reservoirs			100%	1,435	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48
Trunk & Gravity Mains			100%	2,154	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
Telemetry			100%	26	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Augmentation																			
Emergency bore connections (50% subsidy o	100%			1,780	356	712	712												
New water supply (incl. main, pump st, retic	100%			20,000											7000	13000			
Treated Effluent Reuse																			
All effluent to river, then 160 ML/y to park/ golf courses		100%		2,146				446	1700										
Demand Management																			
Pricing, education & BASIX (No capital cost)																			
MURRUMBATEMAN																			
Treatment																			
Investigations to determine alternate source	100%			132				132											
Distribution																			
Renewals																			
Augmentation																			
WTP 0.9 ML/d (cl only) (35% subsidy over co	100%			1,406			281	1125											
Demand Management																			
Stormwater Harvesting																			
GUNDAROO																			
Treatment																			
Distribution																			
Renewals																			
Augmentation																			
Groundwater study	100%			130					130										
Water supply concept/design/construction	100%			2,770						520	250	1500	500						
Demand Management																			
Stormwater Harvesting																			
BOWNING/BINALONG																			
Treatment																			
Distribution																			
1.1ML/d microfiltration plant + telemetry system update		100%		1,733							343	1390							
Renewals																			
Binalong 1.8 ML reservoir replacement			100%	582						116	466								
Augmentation																			
Demand Management																			
Villages																			
Treatment																			
Distribution																			
Villages water main extensions		100%		80		20		20			20		20						
Renewals																			
Augmentation																			
Demand Management																			
Stormwater Harvesting																			
Total				63,597	985	1,276	1,407	5,082	6,429	6,535	2,918	3,229	859	339	7,339	13,339	339	339	339
Improved LOS				29,218	356	712	993	1,257	130	2,020	1,750	1,500	500		7,000	13,000			
Other New System Assets (growth w				23,869	290	225	75	3,486	5,960	4,060	363	1,390	20						
Renewals				10,510	339	339	339	339	339	455	805	339	339	339	339	339	339	339	339
Other Grants (Yass borehole & Murru				1,144	150	300	300	394											

Asset	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
YASS															
Yass Dam															
Dredging investigation															
Earthquake study															
Movement study															
Dam storage survey															
Raising dam wall engineering studies															
Raising dam wall design/construction															
Off-creek dam investigations															
Off-creek dam design/construction															
Yass River flow gauging (2 locations)															
Treatment															
Water Softening (provisional)															
Filtration plant augmentation	1600	6400													
Install walkway over WTP filters															
Distribution															
Trunk mains under Yass River															
Mount St WPS - raw water pumps															
Chlorine dosing facility to Morton reservoir															
Provide standpipe to supply at O'Connor Parr															
RENEWALS - ALL SYSTEMS															
Yass Dam	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170
Bores	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
WTP	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
Pump Stations	7	7	7	7	7	7	7	7	7	7	7	7	7	7	4
Reservoirs	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48
Trunk & Gravity Mains	80	80	80	80	80	80	80	80	80	80	80	80			
Telemetry	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Augmentation															
Emergency bore connections (50% subsidy o															
New water supply (incl. main, pump st, retic															
Treated Effluent Reuse															
All effluent to river, then 160 ML/y to park/ golf courses															
Demand Management															
Pricing, education & BASIX (No capital cost)															
MURRUMBATEMAN															
Treatment															
Investigations to determine alternate source															
Distribution															
Renewals															
Augmentation															
WTP 0.9 ML/d (cl only) (35% subsidy over co															
Demand Management															
Stormwater Harvesting															
GUNDAROO															
Treatment															
Distribution															
Renewals															
Augmentation															
Groundwater study															
Water supply concept/design/construction															
Demand Management															
Stormwater Harvesting															
BOWNING/BINALONG															
Treatment															
Distribution															
1.1ML/d microfiltration plant + telemetry system update															
Renewals															
Binalong 1.8 ML reservoir replacement															
Augmentation															
Demand Management															
Villages															
Treatment															
Distribution															
Villages water main extensions															
Renewals															
Augmentation															
Demand Management															
Stormwater Harvesting															
Total	1,939	6,739	339	339	339	339	339	339	339	339	339	339	259	259	257
Improved LOS															
Other New System Assets (growth w	1,600	6,400													
Renewals	339	339	339	339	339	339	339	339	339	339	339	339	259	259	257
Other Grants (Yass borehole & Murru															

Water Traditional Case - OMA and Revenue Overrides (increases in current expenditure) (2005/06$)

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	03/04	04/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Additional capital works in traditional Case																																
Dam raise by 3 m (1,590 ML capacity increase) - Not additional OMA, with existing facilities			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Off river storage 500 ML capacity increase			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WTP Add GAC / PAC units (13 ML/d)																																
Chemical (Operation)			5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Maintenance			4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Energy			15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
Yass Emergency bore connections																																
Operation						30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Energy						3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Yass efluent to river, then 160 ML/y to park/ golf courses																																
Operation								42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4
Maintenance								42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4
Energy								1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Murrumbateman WTP 0.9 ML/d (cl only)																																
Maintenance							35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2
Energy							30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6
Operation (Microfiltration, sampling, testing)							18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2
Chemical costs							9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Engineering/supervision							60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Gundaroo water supply																																
Maintenance										8.15	8.15	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3
Energy										2.05	2.05	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Operation (Microfiltration, sampling, testing)										3.35	3.35	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
Engineering/supervision										30	30	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Binalong 1.1ML/d microfiltration plant + telemetry system update																																
Maintenance											39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1
Energy											37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4
Operation (Microfiltration, sampling, testing)											21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1
Engineering/supervision											60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Binalong 1.8 ML reservoir replacement			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Additional OMA expenditure in traditional case																																
DSS pricing + rainwater tank + education (all admin costs)			43	43	43	68	43	43	43	43	68	43	43	43	43	68	43	43	43	43	68	43	43	43	43	68	43	43	43	43	68	43
DSP review after adopting IWCM / Regular update (all admin costs)					8					8					8					8					8					8		
SBP & Pricing review after adopting IWCM / Regular update (all admin costs)					10					10					10					10					10					10		
Demand management plan update (all admin costs)					15					15					15					15					15					15		
Study on sensitivity of Yass dam yield (all admin costs)																																
Drought Management plan preparation in consistenci with other strategic planning studies (all admin costs)					20					20					20					20					20					20		
Boreholes audit & water quality monitoring in Murrumbateman water source (all operation costs)				14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14

Water Traditional Case - OMA and Revenue Overrides (increases in current expenditure) (2005/06$'000)

	30 Year			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	TOTAL	03/04	04/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Administration	11,901	250	267	378	312	402	312	317	323	325	385	338	347	357	358	418	371	381	393	392	451	405	414	426	421	479	432	442	454	445	503	455	465
Engineering & Supervision	8,556	45	44	116	116	117	119	181	185	184	217	279	311	316	317	319	322	324	329	329	332	334	336	341	340	342	345	347	350	349	351	353	355
Operations Expenses	13,885	217	229	310	288	313	357	407	395	399	407	434	478	449	455	461	466	472	478	484	490	496	542	504	510	514	520	524	527	531	535	540	591
Maintenace Expenses	13,916	228	233	255	262	267	272	318	372	383	400	447	461	467	473	479	485	491	497	503	509	515	521	527	533	539	545	551	557	563	569	575	581
Energy Cost	3,620	23	28	46	47	48	52	83	85	86	89	128	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151
Chemical Cost	1,569	57	54	30	31	32	33	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
Purchase of Water	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Expenses	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	53,446	820	855	1,135	1,056	1,179	1,145	1,350	1,404	1,422	1,544	1,673	1,776	1,770	1,786	1,862	1,831	1,857	1,888	1,901	1,977	1,947	2,012	1,999	2,007	2,079	2,049	2,073	2,099	2,101	2,173	2,140	2,211

050626 Yass Valley Council IWCM

Capital Works Program Water - Integrated Case 1
2005

All values are in year 2005 $'000

Asset	Type of works				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Improved LOS	New System Assets	Renewals	30 year total	2005/06	2006/07	2007/08	2008/09	2009/1(	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/2	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
					2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
YASS																																		
Yass Dam																																		
Off-creek dam investigations		100%																																
Off-creek dam design/construction		100%																																
Yass River flow gauging (2 locations)		100%		60	25	35																												
Dredging investigation		100%		100	100																													
Earthquake study		100%		60	60																													
Movement study		100%		15		15																												
Dam storage survey		100%		30	30																													
Raising dam wall engineering studies		100%		250	75	100	75																											
Raising dam wall design/construction		100%		11,000				3000	4000	4000																								
Treatment																																		
Water Softening (provisional)	100%			3,000						1500	1500																							
Filtration plant augmentation		100%		8,000																1600	6400													
Install walkway over WTP filters		100%		35		35																												
Distribution																																		
Trunk mains under Yass River		100%		200					200																									
Mount St WPS - raw water pumps		100%		120					60	60																								
Chlorine dosing facility to Morton reservoir		100%		20		20																												
Provide standpipe to supply at O'Connor Parr		100%		20				20																										
RENEWALS - ALL SYSTEMS																																		
Yass Dam			100%	5,100	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170
Bores			100%	24	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
WTP			100%	995	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
Pump Stations			100%	200	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	4
Reservoirs			100%	1,435	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48
Trunk & Gravity Mains			100%	2,154	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80			
Telemetry			100%	26	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Augmentation																																		
Emergency bore connections (50% subsidy	100%			1,780	356	712	712																											
New water supply (incl. main, pump st, retic	100%			20,000											7000	13000																		
Treated Effluent Reuse																																		
All efluent to river, then 160 ML/y to park/ golf courses		100%		2,146				446	1700																									
Demand Management																																		
Pricing, education & BASIX (No capital cost)																																		
MURRUMBATEMAN																																		
Treatment																																		
Investigations to determine alternate source	100%			132				132																										
Distribution																																		
Renewals																																		
Augmentation																																		
WTP 0.9 ML/d (cl only) (35% subsidy over c	100%			1,406			281	1125																										
Demand Management																																		
Stormwater Harvesting																																		
GUNDAROO																																		
Treatment																																		
Distribution																																		
Renewals																																		
Augmentation																																		
Groundwater study	100%			130					130																									
Water supply concept/design/construction	100%			2,770						520	250	1500	500																					
Demand Management																																		
Stormwater Harvesting																																		
BOWNING/BINALONG																																		
Treatment																																		
Distribution																																		
1.1ML/d microfiltration plant + telemetry system update		100%		1,733							343	1390																						
Renewals																																		
Binalong 1.8 ML reservoir replacement			100%	582						116	466																							
Augmentation																																		
Demand Management																																		
Villages																																		
Treatment																																		
Distribution																																		
Villages water main extensions		100%		80		20		20			20		20																					
Renewals																																		
Augmentation																																		
Demand Management																																		
Stormwater Harvesting																																		
			Total	**63,597**	**985**	**1,276**	**1,407**	**5,082**	**6,429**	**6,535**	**2,918**	**3,229**	**859**	**339**	**7,339**	**13,339**	**339**	**339**	**339**	**1,939**	**6,739**	**339**	**339**	**339**	**339**	**339**	**339**	**339**	**339**	**339**	**339**	**259**	**259**	**257**
	Improved LOS			**29,218**	356	712	993	1,257	130	2,020	1,750	1,500	500		7,000	13,000																		
	Other New System Assets (growth v			**23,869**	290	225	75	3,486	5,960	4,060	363	1,390	20							1,600	6,400													
	Renewals			**10,510**	339	339	339	339	339	455	805	339	339	339	339	339	339	339	339	339	339	339	339	339	339	339	339	339	339	339	339	259	259	257
	Other Grants (Yass borehole & Murr			**1,144**	150	300	300	394																										

Water Integrated Case 1 - OMA and Revenue Overrides (increases in current expenditure) (2005/06$'000)

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	03/04	04/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Additional capital works in Integrated Case 1																																
Dam raise by 3 m (1,590 ML capacity increase) - Not additional OMA, with existing facilities			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Off river storage 500 ML capacity increase			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WTP Add GAC / PAC units (13 ML/d)																																
Chemical (Operation)			5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Maintenance			4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Energy			15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
Yass Emergency bore connections																																
Operation						30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Energy						3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Yass effluent to river, then 160 ML/y to park/ golf courses																																
Operation								42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4
Maintenance								42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4
Energy								1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Murrumbateman WTP 0.9 ML/d (cl only)																																
Maintenance							35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2
Energy							30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6
Operation (Microfiltration, sampling, testing)							18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2
Chemical costs							9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Engineering/supervision							60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Gundaroo water supply																																
Maintenance										8.15	8.15	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3
Energy										2.05	2.05	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Operation (Microfiltration, sampling, testing)										3.35	3.35	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
Engineering/supervision										30	30	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Binalong 1.1ML/d microfiltration plant + telemetry system update																																
Maintenance											39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1
Energy											37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4
Operation (Microfiltration, sampling, testing)											21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1
Engineering/supervision											60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Binalong 1.8 ML reservoir replacement			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Additional OMA expenditure in Integrated Case 1																																
DSS																																
Administration (Pricing + rainwater tank + education + showerhead)			43	74	75	102	78	79	81	82	108	85	86	88	89	115	91	92	93	95	121	97	98	99	100	126	43	43	43	43	68	43
Operation (UFW reduction)			114	114	114	114	114	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41
DSP review after adopting IWCM / Regular update (all admin costs)					8					8					8					8					8					8		
SBP & Pricing review after adopting IWCM / Regular update (all admin costs)					10					10					10					10					10					10		
Demand management plan update (all admin costs)					15					15					15					15					15					15		
Drought Management plan preparation in consistenci with other strategic planning studies (all admin costs)					20					20					20					20					20					20		
Boreholes audit & water quality monitoring in Murrumbateman water source (all operation costs)				14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14

Water Integrated Case 1 - OMA and Revenue Overrides (increases in current expenditure) (2005/06$'000)

	30 Year			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	TOTAL	03/04	04/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Administration	13,777	250	267	401	366	457	394	375	382	386	447	426	412	423	426	487	466	452	465	465	526	506	491	504	500	559	538	465	477	468	526	503	488
Engineering & Supervision	8,556	45	44	116	116	117	119	181	185	184	217	279	311	316	317	319	322	324	329	329	332	334	336	341	340	342	345	347	350	349	351	353	355
Operations Expenses	15,478	217	229	424	402	427	471	521	436	440	448	475	519	490	496	502	507	513	519	525	531	537	583	545	551	555	561	565	568	572	576	581	632
Maintenace Expenses	13,916	228	233	255	262	267	272	318	372	383	400	447	461	467	473	479	485	491	497	503	509	515	521	527	533	539	545	551	557	563	569	575	581
Energy Cost	3,620	23	28	46	47	48	52	83	85	86	89	128	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151
Chemical Cost	1,569	57	54	30	31	32	33	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
Purchase of Water	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Expenses	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	56,916	820	855	1,271	1,223	1,348	1,340	1,521	1,504	1,523	1,647	1,802	1,882	1,877	1,895	1,972	1,967	1,969	2,002	2,016	2,093	2,089	2,130	2,118	2,127	2,200	2,196	2,137	2,163	2,165	2,237	2,229	2,275

050626 Yass Valley Council IWCM

Capital Works Program Water - Integrated Case 2

2005

All values are in year 2005 $'000

Asset	Type of works				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Improved LOS	New System Assets	Renewals	30 year total	2005/06	2006/07	2007/08	2008/09	2009/1(	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/2!	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
					2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
YASS																																		
Yass Dam																																		
Off-creek dam investigations		100%																																
Off-creek dam design/construction		100%																																
Yass River flow gauging (2 locations)		100%		60	25	35																												
Dredging investigation		100%		100	100																													
Earthquake study		100%		60	60																													
Movement study		100%		15		15																												
Dam storage survey		100%		30	30																													
Raising dam wall engineering studies		100%		250	75	100	75																											
Raising dam wall design/construction		100%		11,000				3000	4000	4000																								
Treatment																																		
Water Softening (provisional)	100%			3,000						1500	1500																							
Filtration plant augmentation		100%		8,000																1600	6400													
Install walkway over WTP filters		100%		35		35																												
Distribution																																		
Trunk mains under Yass River		100%		200					200																									
Mount St WPS - raw water pumps		100%		120					60	60																								
Chlorine dosing facility to Morton reservoir		100%		20		20																												
Provide standpipe to supply at O'Connor Parr		100%		20				20																										
RENEWALS - ALL SYSTEMS																																		
Yass Dam			100%	5,100	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170
Bores			100%	24	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
WTP			100%	995	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
Pump Stations			100%	200	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	4
Reservoirs			100%	1,435	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48
Trunk & Gravity Mains			100%	2,154	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80			
Telemetry			100%	26	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Augmentation																																		
Emergency bore connections (50% subsidy	100%			1,780	356	712	712																											
New water supply (incl. main, pump st, retic	100%			20,000											7000	13000																		
Treated Effluent Reuse																																		
Dual reticulation north/south Yass		100%		5,914				1183	4732																									
Demand Management																																		
Pricing, education & BASIX (No capital cost)																																		
MURRUMBATEMAN																																		
Treatment																																		
Investigations to determine alternate source	100%			132				132																										
Distribution																																		
Renewals																																		
Augmentation																																		
WTP 0.9 ML/d (cl only) (35% subsidy over c	100%			1,406			281	1125																										
Demand Management																																		
Stormwater Harvesting																																		
GUNDAROO																																		
Treatment																																		
Distribution																																		
Renewals																																		
Augmentation																																		
Groundwater study	100%			130					130																									
Water supply concept/design/construction	100%			2,770						520	250	1500	500																					
Demand Management																																		
Stormwater Harvesting																																		
BOWNING/BINALONG																																		
Treatment																																		
Distribution																																		
1.1ML/d microfiltration plant + telemetry system update		100%		1,733							343	1390																						
Renewals																																		
Binalong 1.8 ML reservoir replacement			100%	582						116	466																							
Augmentation																																		
Demand Management																																		
Villages																																		
Treatment																																		
Distribution																																		
Villages water main extensions		100%		80		20		20			20		20																					
Renewals																																		
Augmentation																																		
Demand Management																																		
Stormwater Harvesting																																		
Total				**67,366**	**985**	**1,276**	**1,407**	**5,819**	**9,461**	**6,535**	**2,918**	**3,229**	**859**	**339**	**7,339**	**13,339**	**339**	**339**	**339**	**1,939**	**6,739**	**339**	**339**	**339**	**339**	**339**	**339**	**339**	**339**	**339**	**339**	**259**	**259**	**257**
Improved LOS				**29,218**	356	712	993	1,257	130	2,020	1,750	1,500	500		7,000	13,000																		
Other New System Assets (growth v				**27,638**	290	225	75	4,223	8,992	4,060	363	1,390	20							1,600	6,400													
Renewals				**10,510**	339	339	339	339	339	455	805	339	339	339	339	339	339	339	339	339	339	339	339	339	339	339	339	339	339	339	339	259	259	257
Other Grants (Yass borehole & Murr				**1,144**	150	300	300	394																										

Water Integrated Case 2 - OMA and Revenue Overrides (increases in current expenditure) (2005/06$'000)

	03/04	04/05	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
			2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Additional capital works in Integrated Case 2																																
Dam raise by 3 m (1,590 ML capacity increase) - Not additional OMA, with existing facilities			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Off river storage 500 ML capacity increase			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WTP Add GAC / PAC units (13 ML/d)																																
Chemical (Operation)			5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Maintenance			4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Energy			15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
Yass Emergency bore connections																																
Operation						30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Energy						3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Dual reticulation north/south Yass																																
Operation								473	473.2	473.2	473.2	473.2	473.2	473.2	473.2	473.2	473.2	473.2	473.2	473.2	473.2	473.2	473.2	473.2	473.2	473.2	473.2	473.2	473.2	473.2	473.2	473.2
Maintenance								148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
Energy								2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Murrumbateman WTP 0.9 ML/d (cl only)																																
Maintenance							35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2
Energy							30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6
Operation (Microfiltration, sampling, testing)							18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2
Chemical costs							9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Engineering/supervision							60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Gundaroo water supply																																
Maintenance										8.15	8.15	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3
Energy										2.05	2.05	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Operation (Microfiltration, sampling, testing)										3.35	3.35	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
Engineering/supervision										30	30	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Binalong 1.1ML/d microfiltration plant + telemetry system update																																
Maintenance											39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1
Energy											37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4
Operation (Microfiltration, sampling, testing)											21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1
Engineering/supervision											60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Binalong 1.8 ML reservoir replacement			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Additional OMA expenditure in Integrated Case 2																																
DSS																																
Administration (Pricing + rainwater tank + education + showerhead)			43	74	75	102	78	79	81	82	108	85	86	88	89	115	91	92	93	95	121	97	98	99	100	126	43	43	43	43	68	43
Operation (UFW reduction)			114	114	114	114	114	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41
DSP review after adopting IWCM / Regular update (all admin costs)					8					8					8					8					8					8		
SBP & Pricing review after adopting IWCM / Regular update (all admin costs)					10					10					10					10					10					10		
Demand management plan update (all admin costs)					15					15					15					15					15					15		
Drought Management plan preparation in consistenci with other strategic planning studies (all admin costs)					20					20					20					20					20					20		
Boreholes audit & water quality monitoring in Murrumbateman water source (all operation costs)				14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14

Water Integrated Case 2 - OMA and Revenue Overrides (increases in current expenditure) (2005/06$'000)

	30 Year TOTAL	03/04	04/05	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
				2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Administration	13,777	250	267	401	366	457	394	375	382	386	447	426	412	423	426	487	466	452	465	465	526	506	491	504	500	559	538	465	477	468	526	503	488
Engineering & Supervision	8,556	45	44	116	116	117	119	181	185	184	217	279	311	316	317	319	322	324	329	329	332	334	336	341	340	342	345	347	350	349	351	353	355
Operations Expenses	26,248	217	229	424	402	427	471	521	866	870	879	906	950	921	927	933	938	944	950	956	962	968	1014	976	982	986	992	996	999	1003	1007	1012	1063
Maintenace Expenses	16,556	228	233	255	262	267	272	318	477	488	505	552	567	573	579	585	591	597	603	609	615	621	627	633	639	645	651	657	663	669	675	681	687
Energy Cost	3,638	23	28	46	47	48	52	83	86	87	90	128	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152
Chemical Cost	1,569	57	54	30	31	32	33	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
Purchase of Water	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Expenses	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	70,344	820	855	1,271	1,223	1,348	1,340	1,521	2,041	2,060	2,184	2,339	2,419	2,414	2,432	2,509	2,505	2,507	2,539	2,553	2,630	2,626	2,667	2,655	2,664	2,737	2,733	2,674	2,700	2,702	2,774	2,766	2,812

050626 Yass Valley Council IWCM

Capital Works Program Water - Integrated Case 3
2005
All values are in year 2005 $'000

Asset	Type of works				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Improved LOS	New System Assets	Renewals	30 year total	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
					2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
YASS																																		
Yass Dam																																		
Yass River flow gauging (2 locations)		100%		60	25	35																												
Treatment																																		
Water Softening (provisional)	100%			3,000						1500	1500																							
Filtration plant augmentation		100%		8,000																1600	6400													
Install walkway over WTP filters		100%		35		35																												
Distribution																																		
Trunk mains under Yass River		100%		200					200																									
Mount St WPS - raw water pumps		100%		120					60	60																								
Chlorine dosing facility to Morton reservoir		100%		20		20																												
Provide standpipe to supply at O'Connor Parr		100%		20				20																										
RENEWALS - ALL SYSTEMS																																		
Yass Dam			100%	5,100	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170
Bores			100%	24	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
WTP			100%	995	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
Pump Stations			100%	200	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	4
Reservoirs			100%	1,435	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48
Trunk & Gravity Mains			100%	2,154	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80			
Telemetry			100%	26	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Augmentation																																		
Emergency bore connections (50% subsidy	100%			1,780	356	712	712																											
New water supply (incl. main, pump st, reti	100%			20,000											7000	13000																		
Treated Effluent Reuse																																		
Indirect potable reuse scheme (1.8 ML/day)		100%		2,993				593	2400																									
Demand Management																																		
Pricing, education & BASIX (No capital cost)																																		
MURRUMBATEMAN																																		
Treatment																																		
Investigations to determine alternate sourc	100%			132				132																										
Distribution																																		
Renewals																																		
Augmentation																																		
WTP 0.9 ML/d (cl only) (35% subsidy over c	100%			1,406			281	1125																										
Demand Management																																		
Stormwater Harvesting																																		
GUNDAROO																																		
Treatment																																		
Distribution																																		
Renewals																																		
Augmentation																																		
Groundwater study	100%			130					130																									
Water supply concept/design/construction	100%			2,770						520	250	1500	500																					
Demand Management																																		
Stormwater Harvesting																																		
Treatment																																		
Distribution																																		
1.1ML/d microfiltration plant + telemetry system update		100%		1,733							343	1390																						
Renewals																																		
Binalong 1.8 ML reservoir replacement			100%	582						116	466																							
Augmentation																																		
Demand Management																																		
Villages																																		
Treatment																																		
Distribution																																		
Villages water main extensions		100%		80		20		20			20		20																					
Renewals																																		
Augmentation																																		
Demand Management																																		
Stormwater Harvesting																																		
Total				**52,989**	**720**	**1,161**	**1,332**	**2,229**	**3,129**	**2,535**	**2,918**	**3,229**	**859**	**339**	**7,339**	**13,339**	**339**	**339**	**339**	**1,939**	**6,739**	**339**	**339**	**339**	**339**	**339**	**339**	**339**	**339**	**339**	**339**	**259**	**259**	**257**
Improved LOS				**29,218**	356	712	993	1,257	130	2,020	1,750	1,500	500		7,000	13,000																		
**Other New System Assets (growth **				**13,261**	25	110		633	2,660	60	363	1,390	20							1,600	6,400													
Renewals				**10,510**	339	339	339	339	339	455	805	339	339	339	339	339	339	339	339	339	339	339	339	339	339	339	339	339	339	339	339	259	259	257
Other Grants (Yass borehole & Murr				**1,144**	150	300	300	394																										

Water Integrated Case 3 - OMA and Revenue Overrides (increases in current expenditure) (2005/06$'000)

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	03/04	04/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Additional capital works in Integrated Case 3																																
Dam raise by 3 m (1,590 ML capacity increase) - Not additional OMA, with existing facilities			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Off river storage 500 ML capacity increase			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WTP Add GAC / PAC units (13 ML/d)																																
Chemical (Operation)			5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Maintenance			4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Energy			15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
Yass Emergency bore connections																																
Operation						30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Energy						3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Indirect potable reuse (1.8 Ml/day)																																
Operation								239	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239	239
Maintenance								75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
Energy								15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Murrumbateman WTP 0.9 ML/d (cl only)																																
Maintenance							35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2
Energy							30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6
Operation (Microfiltration, sampling, testing)							18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2
Chemical costs							9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Engineering/supervision							60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Gundaroo water supply																																
Maintenance										8.15	8.15	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3
Energy										2.05	2.05	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Operation (Microfiltration, sampling, testing)										3.35	3.35	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
Engineering/supervision										30	30	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Binalong 1.1ML/d microfiltration plant + telemetry system update																																
Maintenance											39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1
Energy											37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4
Operation (Microfiltration, sampling, testing)											21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1
Engineering/supervision											60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Binalong 1.8 ML reservoir replacement			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Additional OMA expenditure in Integrated Case 3																																
DSS																																
Administration (Pricing + rainwater tank + education + showerhead)			43	74	75	102	78	79	81	82	108	85	86	88	89	115	91	92	93	95	121	97	98	99	100	126	43	43	43	43	68	43
Operation (UFW reduction)			114	114	114	114	114	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41
DSP review after adopting IWCM / Regular update (all admin costs)					8					8					8					8					8					8		
SBP & Pricing review after adopting IWCM / Regular update (all admin costs)					10					10					10					10					10					10		
Demand management plan update (all admin costs)					15					15					15					15					15					15		
Drought Management plan preparation in consistenci with other strategic planning studies (all admin costs)					20					20					20					20					20					20		
Boreholes audit & water quality monitoring in Murrumbateman water source (all operation costs)				14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14

Water Integrated Case 3 - OMA and Revenue Overrides (increases in current expenditure) (2005/06$'000)

	30 Year			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	TOTAL	03/04	04/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Administration	13,777	250	267	401	366	457	394	375	382	386	447	426	412	423	426	487	466	452	465	465	526	506	491	504	500	559	538	465	477	468	526	503	488
Engineering & Supervision	8,556	45	44	116	116	117	119	181	185	184	217	279	311	316	317	319	322	324	329	329	332	334	336	341	340	342	345	347	350	349	351	353	355
Operations Expenses	20,403	217	229	424	402	427	471	521	633	637	645	672	716	687	693	699	704	710	716	722	728	734	780	742	748	752	758	762	765	769	773	778	829
Maintenace Expenses	14,727	228	233	255	262	267	272	318	404	415	432	479	493	499	505	511	517	523	529	535	541	547	553	559	565	571	577	583	589	595	601	607	613
Energy Cost	3,965	23	28	46	47	48	52	83	99	100	103	142	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165
Chemical Cost	1,569	57	54	30	31	32	33	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
Purchase of Water	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Expenses	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	62,996	820	855	1,271	1,223	1,348	1,340	1,521	1,747	1,766	1,890	2,045	2,125	2,121	2,138	2,215	2,211	2,213	2,245	2,259	2,336	2,332	2,373	2,361	2,370	2,443	2,439	2,380	2,406	2,408	2,480	2,472	2,518

050626 Yass Valley Council IWCM

Capital Works Program Sewerage - Base Case 2005

All values are in year 2005 $'000

Asset	Type of works			30 year total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Improved LOS	New System Assets	Renewals		2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
					2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
YASS																																		
Transfer																																		
River bank SPS diesel generator study and installation		100%		2,000									300		1700																			
All SPS invertigation of standby power supply		100%		50						50																								
Installation of power supply to other SPS		100%		350								150	200																					
Upgrade River bank SPS		100%		20		20																												
Treatment																																		
Yass STP upgrade (50% subsidy over pre-cons	100%			8,000		800	800	3200	3200																									
Yass STP Environmental assessment		100%		40													40																	
Yass STP renewal/augmentation design/construction		100%		8,800																							400	400	2000	5000	1000			
Effluent Management																																		
Soil monitoring system fro land irrigation		100%		40				40																										
Reuse to parks and ovals		100%		500				250	250																									
Automation of fixed irrigators		100%		20		20																												
Discharge																																		
Renewals																																		
River bank SPS new pumps			100%	240			120		120																									
Upsize trunk mains			100%	400					200		200																							
Mains renewals			100%	1,800	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Refurbish pumps			100%	280			20		20		20		20		20		20		20		20		20		20		20		20		20		20	
Sludge pond rehabilitation (3 pumps in rotation)			100%	690	25	35	20	25	20	25	20	25	20	25	20	25	20	25	20	25	20	25	20	25	20	25	20	25	20	25	20	25	20	25
I/I investigations - Yass township			100%	70	70																													
Modelling and infiltration study			100%	150		150																												
SGE Service																																		
Subsidy Scheme																																		
MURRUMBATEMAN																																		
Treatment																																		
Murrumbateman sewerage (50% subsidy over	100%			3,800		760	1520	1520																										
Distribution																																		
Renewals																																		
Augmentation																																		
Demand Management																																		
Stormwater Harvesting																																		
BINALONG																																		
Treatment																																		
Binalong sewerage (50% subsidy shown on th	100%			4,300				300	1500	2500																								
Distribution																																		
Renewals																																		
Augmentation																																		
Demand Management																																		
Stormwater Harvesting																																		
Treatment																																		
Bowning sewerage (50% subsidy shown on th	100%			3,500							300	1500	1700																					
Distribution																																		
Renewals																																		
Augmentation																																		
Demand Management																																		
Stormwater Harvesting																																		
GUNDAROO																																		
Treatment																																		
Sewerage supply study/design/construction	100%			3,060								60	250	250	1000	1500																		
Distribution																																		
Renewals																																		
Augmentation																																		
Demand Management																																		
Stormwater Harvesting																																		
SUTTON																																		
Treatment																																		
Distribution																																		
Renewals																																		
Augmentation																																		
Demand Management																																		
Stormwater Harvesting																																		
Total				38,110	155	1,845	2,540	5,395	5,370	2,635	600	1,795	2,550	335	2,800	1,585	140	85	100	85	100	85	100	85	100	85	500	485	2,100	5,085	1,100	85	100	85
Improved LOS				22,660		1,560	2,320	5,020	4,700	2,500	300	1,560	1,950	250	1,000	1,500																		
Other New System Assets (growth w				11,820		40		290	250	50		150	500		1,700		40										400	400	2,000	5,000	1,000			
Renewals				3,630	155	245	220	85	420	85	300	85	100	85	100	85	100	85	100	85	100	85	100	85	100	85	100	85	100	85	100	85	100	85
Other Grants				4,940		780.000	1160	1880	####																									

Sewerage Base Case - OMA and Revenue Overrides (increases in current expenditure) (2005/06$)

Source: Figure 12, Page 78 of YVC SBP

	30 Year			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	TOTAL	05/06	04/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Administration																																	
Sewerage strategies review	50					50																											
Gunderoo DSPs update	30					30																											
Community consultation - Murrumbateman sewering	2			2																													
Update Financial Plan (FINMOD)	42			7					7					7					7					7					7				
Update pricing tariff plan (DEUS model)	42			7					7					7					7					7					7				
Update developer charge calculations	42			7					7					7					7					7					7				
Update liquid trade waste pricing	18			3					3					3					3					3					3				
Apply for water smart funding from NCC (effluent reuse)	3			3																													
IWCM Plan	75			75																													
Customer education	60			2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
DSP review								10					10					10					10					10					10
Total adjustment	424			106	2	82	2	12	26	2	2	2	12	26	2	2	2	12	26	2	2	2	12	26	2	2	2	12	26	2	2	2	12
Override (Inflated to 05/06$ and pro-rata adjustment for…)		117	133	246	142	227	146	168	186	169	173	176	197	220	190	194	197	215	239	207	210	213	231	256	220	222	224	243	269	231	233	236	255
Engineering & Supervision																																	
W&S coordinator	1140			38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38
Graduated engineers	900			30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Operator training courses				3					3					3					3					3					3				
Total adjustment	2058			71	68	68	68	68	71	68	68	68	68	71	68	68	68	68	71	68	68	68	68	71	68	68	68	68	71	68	68	68	68
Override (Inflated to 05/06$ and pro-rata adjustment for…)		57	46	120	118	120	122	130	135	141	144	146	153	160	158	161	164	167	174	172	175	178	179	186	183	185	187	189	196	192	194	196	198
Operations Expenses																																	
Yass town - prepare due diligence plan	10				10																												
Biosolid management options study	25					25																											
Implement biosolid management option	440						50	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Linking GIS to asset register	30					20	10																										
CCTV inspection on sewer mains	90			3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Smoke testing						30	30																										
Total adjustment	655			3	13	78	93	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Override (Inflated to 05/06$ and pro-rata adjustment for…)		266	296	310	325	397	418	363	368	393	400	408	426	434	442	449	457	465	472	480	487	495	500	505	510	515	521	526	531	536	542	546	552
Maintenace Expenses																																	
Total adjustment																																	
Override (Inflated to 05/06$ and pro-rata adjustment for…)		37	26	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57
Energy Cost																																	
Total adjustment																																	
Override (Inflated to 05/06$ and pro-rata adjustment for…)		35	38	41	42	43	44	46	48	50	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74
Chemical Cost																																	
Total adjustment																																	
Override (Inflated to 05/06$ and pro-rata adjustment for…)		8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Other Expenses																																	
Total adjustment																																	
Override (Inflated to 05/06$ and pro-rata adjustment for…)		149	127	137	141	144	147	153	159	165	170	174	177	180	183	186	189	192	195	198	201	204	207	210	213	216	219	222	225	228	231	234	237
Other Revenue																																	
Total adjustment																																	
Override (Inflated to 05/06$ and pro-rata adjustment for…)		151	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130
Total OMA	28099			746	657	818	762	740	771	788	805	820	868	908	886	902	918	949	989	965	980	996	1022	1061	1029	1040	1052	1080	1120	1085	1097	1108	1137

Additional capital works in Integrated Scenario 3

Additional OMA expenditure in Integrated Scenario 3

050626 Yass Valley Council IWCM

Capital Works Program Sewerage - Traditional Case 2005

All values are in year 2005 $'000

Asset	Type of works: Improved LOS	New System Assets	Renewals	30 year total	1 2005/06 2005	2 2006/07 2006	3 2007/08 2007	4 2008/09 2008	5 2009/10 2009	6 2010/11 2010	7 2011/12 2011	8 2012/13 2012	9 2013/14 2013	10 2014/15 2014	11 2015/16 2015	12 2016/17 2016	13 2017/18 2017	14 2018/19 2018	15 2019/20 2019
YASS																			
Transfer																			
River bank SPS diesel generator study and installation		100%		2,000									300		1700				
All SPS invertigation of standby power supply		100%		50						50									
Installation of power supply to other SPS		100%		350								150	200						
Upgrade River bank SPS		100%		20		20													
Treatment																			
Yass STP upgrade (1.9 ML/day) (50% subsidy	100%			12,167		1217	1217	4867	4867										
Yass STP Environmental assessment		100%		40													40		
Yass STP renewal/augmentation design/construction		100%		8,800															
Effluent Management																			
Soil monitoring system fro land irrigation		100%		40				40											
Reuse to parks and ovals		100%		500				250	250										
Automation of fixed irrigators		100%		20		20													
Discharge																			
Renewals (Excl STP as it will be upgraded)																			
Pump Stations			100%	482	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
Gravity Mains			100%	1,671	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58
Raising Mains			100%	195	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Telemetry			100%	25	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Investigations/studies																			
I/I investigations - Yass township	100%			70	70														
Modelling and infiltration study	100%			150		150													
SGE Service																			
Subsidy Scheme																			
MURRUMBATEMAN																			
Treatment																			
Murrumbateman sewerage (50% subsidy over	100%			3,800		760	1520	1520											
Distribution																			
Renewals																			
Augmentation																			
Demand Management																			
Stormwater Harvesting																			
BINALONG																			
Treatment																			
Binalong sewerage (50% subsidy)	100%			4,300				300	1500	2500									
Distribution																			
Renewals																			
Augmentation																			
Demand Management																			
Stormwater Harvesting																			
Treatment																			
Bowning sewerage (50% subsidy)	100%			3,500							300	1500	1700						
Distribution																			
Renewals																			
Augmentation																			
Demand Management																			
Stormwater Harvesting																			
GUNDAROO																			
Treatment																			
Sewerage supply study/design/construction	100%			3,060								60	250	250	1000	1500			
Distribution																			
Renewals																			
Augmentation																			
Demand Management																			
Stormwater Harvesting																			
SUTTON																			
Treatment																			
Distribution																			
Renewals																			
Augmentation																			
Demand Management																			
Stormwater Harvesting																			
Total				**41,248**	**150**	**2,247**	**2,817**	**7,057**	**6,697**	**2,630**	**380**	**1,790**	**2,530**	**330**	**2,780**	**1,580**	**120**	**80**	**80**
Improved LOS				**27,048**	70	2,127	2,737	6,687	6,367	2,500	300	1,560	1,950	250	1,000	1,500			
Other New System Assets (growth w				**11,820**		40		290	250	50		150	500		1,700		40		
Renewals				**2,380**	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
Other Grants				**6,523**		988	1368	2463	1703										

Asset	16 2020/21 2020	17 2021/22 2021	18 2022/23 2022	19 2023/24 2023	20 2024/25 2024	21 2025/26 2025	22 2026/27 2026	23 2027/28 2027	24 2028/29 2028	25 2029/30 2029	26 2030/31 2030	27 2031/32 2031	28 2032/33 2032	29 2033/34 2033	30 2034/35 2034
YASS															
Transfer															
River bank SPS diesel generator study and installation															
All SPS invertigation of standby power supply															
Installation of power supply to other SPS															
Upgrade River bank SPS															
Treatment															
Yass STP upgrade (1.9 ML/day) (50% subsidy															
Yass STP Environmental assessment															
Yass STP renewal/augmentation design/construction								400	400	2000	5000	1000			
Effluent Management															
Soil monitoring system fro land irrigation															
Reuse to parks and ovals															
Automation of fixed irrigators															
Discharge															
Renewals (Excl STP as it will be upgraded)															
Pump Stations	17	17	17	17	17	17	17	17	17	17	17	17	17	17	
Gravity Mains	58	58	58	58	58	58	58	58	58	58	58	58	58	58	
Raising Mains	5	5	5	5	5	5	5	5	5	5	5	5	5	5	60
Telemetry	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Investigations/studies															
I/I investigations - Yass township															
Modelling and infiltration study															
SGE Service															
Subsidy Scheme															
MURRUMBATEMAN															
Treatment															
Murrumbateman sewerage (50% subsidy over															
Distribution															
Renewals															
Augmentation															
Demand Management															
Stormwater Harvesting															
BINALONG															
Treatment															
Binalong sewerage (50% subsidy)															
Distribution															
Renewals															
Augmentation															
Demand Management															
Stormwater Harvesting															
Treatment															
Bowning sewerage (50% subsidy)															
Distribution															
Renewals															
Augmentation															
Demand Management															
Stormwater Harvesting															
GUNDAROO															
Treatment															
Sewerage supply study/design/construction															
Distribution															
Renewals															
Augmentation															
Demand Management															
Stormwater Harvesting															
SUTTON															
Treatment															
Distribution															
Renewals															
Augmentation															
Demand Management															
Stormwater Harvesting															
Total	**80**	**80**	**80**	**80**	**80**	**80**	**80**	**480**	**480**	**2,080**	**5,080**	**1,080**	**80**	**80**	**60**
Improved LOS															
Other New System Assets (growth w								400	400	2,000	5,000	1,000			
Renewals	80	80	80	80	80	80	80	80	80	80	80	80	80	80	60
Other Grants															

Traditional Case - OMA and Revenue Overrides (increases in current expenditure) (2005/06$'000)

	03/04	04/05	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
			2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Additional capital works in Traditional Scenario																																
Yass STP upgrade (1.9 ML/day)																																
Operation								90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90
Maintenance								309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309	309
Energy								60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Chemical cost								8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Engineering & Supervision								60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Additional OMA expenditure in Traditional Scenario																																
DSP review after adopting IWCM / Regular update (all admin costs)					8					8					8					8					8					8		
SBP & Pricing review after adopting IWCM / Regular update (all admin costs)					10					10					10					10					10					10		
On-site sewerage systems audit program (excl from SGE fund - incl in general fund)		see here																														
Adminisration																																
Operation																																
Engineering & Supervision																																

Traditional Case - OMA and Revenue Overrides (increases in current expenditure) (2005/06$'000)

	30 Year TOTAL	03/04	04/05	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
				2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Administration	6,209	117	133	222	142	215	146	158	162	169	191	176	187	196	190	212	197	205	215	207	228	213	221	232	220	240	224	233	245	231	251	236	245
Engineering & Supervision	6,423	57	46	120	118	120	122	130	195	201	204	206	213	220	218	221	224	227	234	232	235	238	239	246	243	245	247	249	256	252	254	256	258
Operations Expenses	16,027	37	26	310	325	397	418	363	458	483	490	498	516	524	532	539	547	555	562	570	577	585	590	595	600	605	611	616	621	626	632	636	642
Maintenace Expenses	8,988	37	26	28	29	30	31	32	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366
Energy Cost	3,267	35	38	41	42	43	44	46	108	110	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134
Chemical Cost	230	8	1	1	1	1	1	1	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Other Expenses	5,737	149	127	137	141	144	147	153	159	165	170	174	177	180	183	186	189	192	195	198	201	204	207	210	213	216	219	222	225	228	231	234	237
TOTAL	46,880			859	798	950	909	883	1,433	1,480	1,520	1,521	1,562	1,591	1,596	1,633	1,634	1,658	1,687	1,690	1,726	1,727	1,746	1,774	1,769	1,801	1,798	1,819	1,848	1,840	1,873	1,869	1,891

	03/04	04/05	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
GENERAL FUND OMA COSTS																																
On-site sewerage systems audit program																																
Adminisration					50					15					15					15					15					15		
Operation					25					25					25					25					25					25		
Engineering & Supervision					60					60					60					60					60					60		
GENERAL FUND OMA TOTAL			**0**	**0**	**135**	**0**	**0**	**0**	**0**	**100**	**0**	**0**	**0**	**0**	**100**	**0**	**0**	**0**	**0**	**100**	**0**	**0**	**0**	**0**	**100**	**0**	**0**	**0**	**0**	**100**	**0**	**0**

050626 Yass Valley Council IWCM

Capital Works Program Sewerage - Integrated Scenario 1
2005
All values are in year 2005 $'000

Asset	Type of works				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Improved LOS	New System Assets	Renewals	30 year total	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
					2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
YASS																																		
Transfer																																		
River bank SPS diesel generator study and installation		100%		2,000									300		1700																			
All SPS invertigation of standby power supply		100%		50						50																								
Installation of power supply to other SPS		100%		350								150	200																					
Upgrade River bank SPS		100%		20		20																												
Treatment																																		
Yass STP upgrade (1.8 ML/day) (50% subsidy	100%			11,772		1177	1177	4709	4709																									
Yass STP Environmental assessment		100%		40													40																	
Yass STP renewal/augmentation design/construction		100%		8,800																							400	400	2000	5000	1000			
Effluent Management																																		
Soil monitoring system fro land irrigation		100%		40				40																										
Reuse to parks and ovals		100%		500				250	250																									
Automation of fixed irrigators		100%		20		20																												
Discharge																																		
Renewals (Excl STP as it will be upgraded)																																		
Pump Stations			100%	482	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	
Gravity Mains			100%	1,671	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	
Raising Mains			100%	195	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	60
Telemetry			100%	25	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Investigations/studies																																		
I/I investigations - Yass township	100%			70	70																													
Modelling and infiltration study	100%			150		150																												
SGE Service																																		
Subsidy Scheme																																		
MURRUMBATEMAN																																		
Treatment																																		
Murrumbateman sewerage (50% subsidy over	100%			3,800		760	1520	1520																										
Distribution																																		
Renewals																																		
Augmentation																																		
Demand Management																																		
Stormwater Harvesting																																		
BINALONG																																		
Treatment																																		
Binalong sewerage (50% subsidy)	100%			4,300				300	1500	2500																								
Distribution																																		
Renewals																																		
Augmentation																																		
Demand Management																																		
Stormwater Harvesting																																		
Treatment																																		
Bowning sewerage (50% subsidy)	100%			3,500							300	1500	1700																					
Distribution																																		
Renewals																																		
Augmentation																																		
Demand Management																																		
Stormwater Harvesting																																		
GUNDAROO																																		
Treatment																																		
Sewerage supply study/design/construction	100%			3,060								60	250	250	1000	1500																		
Distribution																																		
Renewals																																		
Augmentation																																		
Demand Management																																		
Stormwater Harvesting																																		
SUTTON																																		
Treatment																																		
Distribution																																		
Renewals																																		
Augmentation																																		
Demand Management																																		
Stormwater Harvesting																																		
Total				**40,852**	**150**	**2,207**	**2,777**	**6,899**	**6,539**	**2,630**	**380**	**1,790**	**2,530**	**330**	**2,780**	**1,580**	**120**	**80**	**80**	**80**	**80**	**80**	**80**	**80**	**80**	**80**	**480**	**480**	**2,080**	**5,080**	**1,080**	**80**	**80**	**60**
Improved LOS				**26,652**	70	2,087	2,697	6,529	6,209	2,500	300	1,560	1,950	250	1,000	1,500																		
Other New System Assets (growth w				**11,820**		40		290	250	50		150	500		1,700		40										400	400	2,000	5,000	1,000			
Renewals				**2,380**	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	60
Other Grants				**6,373**		969	1349	2408	1648																									

Integrated Scenario 1 - OMA and Revenue Overrides (increases in current expenditure) (2005/06$'000)

	03/04	04/05	1 2005/06 2005	2 2006/07 2006	3 2007/08 2007	4 2008/09 2008	5 2009/10 2009	6 2010/11 2010	7 2011/12 2011	8 2012/13 2012	9 2013/14 2013	10 2014/15 2014	11 2015/16 2015	12 2016/17 2016	13 2017/18 2017	14 2018/19 2018	15 2019/20 2019	16 2020/21 2020	17 2021/22 2021	18 2022/23 2022	19 2023/24 2023	20 2024/25 2024	21 2025/26 2025	22 2026/27 2026	23 2027/28 2027	24 2028/29 2028	25 2029/30 2029	26 2030/31 2030	27 2031/32 2031	28 2032/33 2032	29 2033/34 2033	30 2034/35 2034
Additional capital works in Integrated Scenario 1																																
Yass STP upgrade (1.8 ML/day)																																
Operation								84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84
Maintenance								294	294	294	294	294	294	294	294	294	294	294	294	294	294	294	294	294	294	294	294	294	294	294	294	294
Energy								54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54
Chemical cost								8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Engineering & Supervision								60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Additional OMA expenditure in Integrated Scenario 1																																
DSP review after adopting IWCM / Regular update (all admin costs)					8					8					8					8					8					8		
SBP & Pricing review after adopting IWCM / Regular update (all admin costs)					10					10					10					10					10					10		
On-site sewerage systems audit program (excl from SGE fund - incl in general fund)		see here																														
Adminisration																																
Operation																																
Engineering & Supervision																																

Integrated Scenario 1 - OMA and Revenue Overrides (increases in current expenditure) (2005/06$'000)

	30 Year TOTAL	03/04	04/05	1 2005/06 2005	2 2006/07 2006	3 2007/08 2007	4 2008/09 2008	5 2009/10 2009	6 2010/11 2010	7 2011/12 2011	8 2012/13 2012	9 2013/14 2013	10 2014/15 2014	11 2015/16 2015	12 2016/17 2016	13 2017/18 2017	14 2018/19 2018	15 2019/20 2019	16 2020/21 2020	17 2021/22 2021	18 2022/23 2022	19 2023/24 2023	20 2024/25 2024	21 2025/26 2025	22 2026/27 2026	23 2027/28 2027	24 2028/29 2028	25 2029/30 2029	26 2030/31 2030	27 2031/32 2031	28 2032/33 2032	29 2033/34 2033	30 2034/35 2034
Administration	6,209	117	133	222	142	215	146	158	162	169	191	176	187	196	190	212	197	205	215	207	228	213	221	232	220	240	224	233	245	231	251	236	245
Engineering & Supervision	6,423	57	46	120	118	120	122	130	195	201	204	206	213	220	218	221	224	227	234	232	235	238	239	246	243	245	247	249	256	252	254	256	258
Operations Expenses	15,869	37	26	310	325	397	418	363	452	477	484	492	510	518	526	533	541	549	556	564	571	579	584	589	594	599	605	610	615	620	626	630	636
Maintenace Expenses	8,632	37	26	28	29	30	31	32	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351
Energy Cost	3,109	35	38	41	42	43	44	46	102	104	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128
Chemical Cost	230	8	1	1	1	1	1	1	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Other Expenses	5,737	149	127	137	141	144	147	153	159	165	170	174	177	180	183	186	189	192	195	198	201	204	207	210	213	216	219	222	225	228	231	234	237
TOTAL	46,209			859	798	950	909	883	1,406	1,453	1,493	1,494	1,535	1,564	1,569	1,606	1,607	1,631	1,660	1,663	1,699	1,700	1,719	1,747	1,742	1,774	1,771	1,792	1,821	1,813	1,846	1,842	1,864

GENERAL FUND OMA COSTS																																
On-site sewerage systems audit program																																
Adminisration					50					15					15					15					15					15		
Operation					25					25					25					25					25					25		
Engineering & Supervision					60					60					60					60					60					60		
GENERAL FUND OMA TOTAL			**0**	**0**	**135**	**0**	**0**	**0**	**0**	**100**	**0**	**0**	**0**	**0**	**100**	**0**	**0**	**0**	**0**	**100**	**0**	**0**	**0**	**0**	**100**	**0**	**0**	**0**	**0**	**100**	**0**	**0**

050626 Yass Valley Council IWCM

Capital Works Program Sewerage - Integrated Scenario 2
2005
All values are in year 2005 $'000

Asset	Type of works				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Improved LOS	New System Assets	Renewals	30 year total	2005/06	2006/07	2007/08	2008/09	2009/1(	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/2!	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
					2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
YASS																																		
Transfer																																		
River bank SPS diesel generator study and installation		100%		2,000									300		1700																			
All SPS invertigation of standby power supply		100%		50						50																								
Installation of power supply to other SPS		100%		350								150	200																					
Upgrade River bank SPS		100%		20		20																												
Treatment																																		
Yass STP upgrade (1.8 ML/day + advance filtr	100%			12,682		1268	1268	5073	5073																									
Yass STP Environmental assessment		100%		40													40																	
Yass STP renewal/augmentation design/construction		100%		8,800																							400	400	2000	5000	1000			
Effluent Management																																		
Soil monitoring system fro land irrigation		100%		40				40																										
Reuse to parks and ovals		100%		500				250	250																									
Automation of fixed irrigators		100%		20		20																												
Discharge																																		
Renewals (Excl STP as it will be upgraded)																																		
Pump Stations			100%	482	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	
Gravity Mains			100%	1,671	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	
Raising Mains			100%	195	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	60
Telemetry			100%	25	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Investigations/studies																																		
I/I investigations - Yass township	100%			70	70																													
Modelling and infiltration study	100%			150		150																												
SGE Service																																		
Subsidy Scheme																																		
MURRUMBATEMAN																																		
Treatment																																		
Murrumbateman sewerage (50% subsidy over	100%			3,800		760	1520	1520																										
Distribution																																		
Renewals																																		
Augmentation																																		
Demand Management																																		
Stormwater Harvesting																																		
BINALONG																																		
Treatment																																		
Binalong sewerage (50% subsidy)	100%			4,300				300	1500	2500																								
Distribution																																		
Renewals																																		
Augmentation																																		
Demand Management																																		
Stormwater Harvesting																																		
Treatment																																		
Bowning sewerage (50% subsidy)	100%			3,500							300	1500	1700																					
Distribution																																		
Renewals																																		
Augmentation																																		
Demand Management																																		
Stormwater Harvesting																																		
GUNDAROO																																		
Treatment																																		
Sewerage supply study/design/construction	100%			3,060								60	250	250	1000	1500																		
Distribution																																		
Renewals																																		
Augmentation																																		
Demand Management																																		
Stormwater Harvesting																																		
SUTTON																																		
Treatment																																		
Distribution																																		
Renewals																																		
Augmentation																																		
Demand Management																																		
Stormwater Harvesting																																		
			Total	**41,762**	**150**	**2,298**	**2,868**	**7,263**	**6,903**	**2,630**	**380**	**1,790**	**2,530**	**330**	**2,780**	**1,580**	**120**	**80**	**80**	**80**	**80**	**80**	**80**	**80**	**80**	**80**	**480**	**480**	**2,080**	**5,080**	**1,080**	**80**	**80**	**60**
	Improved LOS			**27,562**	70	2,178	2,788	6,893	6,573	2,500	300	1,560	1,950	250	1,000	1,500																		
	Other New System Assets (growth w			**11,820**		40		290	250	50		150	500		1,700		40										400	400	2,000	5,000	1,000			
	Renewals			**2,380**	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	60
	Other Grants			**6,719**		1014	1394	2536	1776																									

Integrated Scenario 2 - OMA and Revenue Overrides (increases in current expenditure) (2005/06$'000)

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	03/04	04/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Additional capital works in Integrated Scenario 2																																
Yass STP upgrade (1.8 ML/day + advance filtration)																																
Operation								84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84
Maintenance								317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317
Energy								54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54
Chemical cost								8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Engineering & Supervision								60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Additional OMA expenditure in Integrated Scenario 2																																
DSP review after adopting IWCM / Regular update (all admin costs)					8					8					8					8					8					8		
SBP & Pricing review after adopting IWCM / Regular update (all admin costs)					10					10					10					10					10					10		
Incentive for better on-site sewerage systems (all admin costs) (excl from SGE fund - incl in g		see here																														
On-site sewerage systems audit program (excl from SGE fund - incl in general fund)		see here																														
Adminisration																																
Operation																																
Engineering & Supervision																																

Integrated Scenario 2 - OMA and Revenue Overrides (increases in current expenditure) (2005/06$'000)

	30 Year			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	TOTAL	03/04	04/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
	60585			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Administration	6,209	117	#VALUE!	222	142	215	146	158	162	169	191	176	187	196	190	212	197	205	215	207	228	213	221	232	220	240	224	233	245	231	251	236	245
Engineering & Supervision	6,423	57	46	120	118	120	122	130	195	201	204	206	213	220	218	221	224	227	234	232	235	238	239	246	243	245	247	249	256	252	254	256	258
Operations Expenses	15,869	37	26	310	325	397	418	363	452	477	484	492	510	518	526	533	541	549	556	564	571	579	584	589	594	599	605	610	615	620	626	630	636
Maintenace Expenses	9,200	37	26	28	29	30	31	32	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374
Energy Cost	3,109	35	38	41	42	43	44	46	102	104	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128
Chemical Cost	230	8	1	1	1	1	1	1	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Other Expenses	5,737	149	127	137	141	144	147	153	159	165	170	174	177	180	183	186	189	192	195	198	201	204	207	210	213	216	219	222	225	228	231	234	237
TOTAL	46,777			859	798	950	909	883	1,429	1,476	1,516	1,517	1,558	1,587	1,592	1,629	1,630	1,654	1,683	1,686	1,722	1,723	1,742	1,770	1,765	1,797	1,794	1,815	1,844	1,836	1,869	1,865	1,887

		2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
GENERAL FUND OMA COSTS																															
On-site sewerage systems audit program																															
Adminisration				50					15					15					15					15					15		
Operation				25					25					25					25					25					25		
Engineering & Supervision				60					60					60					60					60					60		
Incentive for better on-site sewerage systems (all admin costs)					175	150	150	150	150	150	150	150	150	150																	
GENERAL FUND OMA TOTAL		**0**	**0**	**135**	**175**	**150**	**150**	**150**	**250**	**150**	**150**	**150**	**150**	**250**	**0**	**0**	**0**	**0**	**100**	**0**	**0**	**0**	**0**	**100**	**0**	**0**	**0**	**0**	**100**	**0**	**0**

050626 Yass Valley Council IWCM

Capital Works Program Sewerage - Integrated Scenario 3
2005
All values are in year 2005 $'000

Asset	Type of works			30 year total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Improved LOS	New System Assets	Renewals		2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
					2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
YASS																																		
Transfer																																		
River bank SPS diesel generator study and installation		100%		2,000									300		1700																			
All SPS invertigation of standby power supply		100%		50						50																								
Installation of power supply to other SPS		100%		350								150	200																					
Upgrade River bank SPS		100%		20		20																												
Treatment																																		
Yass STP upgrade (1.8 ML/day adv filtration +	100%			13,982		1398	1398	5593	5593																									
Yass STP Environmental assessment		100%		40													40																	
Yass STP renewal/augmentation design/construction		100%		8,800																							400	400	2000	5000	1000			
Effluent Management																																		
Soil monitoring system fro land irrigation		100%		40				40																										
Reuse to parks and ovals		100%		500				250	250																									
Automation of fixed irrigators		100%		20		20																												
Discharge																																		
Renewals (Excl STP as it will be upgraded)																																		
Pump Stations			100%	482	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	
Gravity Mains			100%	1,671	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	
Raising Mains			100%	195	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	60
Telemetry			100%	25	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Investigations/studies																																		
I/I investigations - Yass township	100%			70	70																													
Modelling and infiltration study	100%			150		150																												
SGE Service																																		
Subsidy Scheme																																		
MURRUMBATEMAN																																		
Treatment																																		
Murrumbateman sewerage (50% subsidy over	100%			3,800		760	1520	1520																										
Distribution																																		
Renewals																																		
Augmentation																																		
Demand Management																																		
Stormwater Harvesting																																		
BINALONG																																		
Treatment																																		
Binalong sewerage (50% subsidy)	100%			4,300				300	1500	2500																								
Distribution																																		
Renewals																																		
Augmentation																																		
Demand Management																																		
Stormwater Harvesting																																		
Treatment																																		
Bowning sewerage (50% subsidy)	100%			3,500							300	1500	1700																					
Distribution																																		
Renewals																																		
Augmentation																																		
Demand Management																																		
Stormwater Harvesting																																		
GUNDAROO																																		
Treatment																																		
Sewerage supply study/design/construction	100%			3,060								60	250	250	1000	1500																		
Distribution																																		
Renewals																																		
Augmentation																																		
Demand Management																																		
Stormwater Harvesting																																		
SUTTON																																		
Treatment																																		
Distribution																																		
Renewals																																		
Augmentation																																		
Demand Management																																		
Stormwater Harvesting																																		
			Total	**43,062**	**150**	**2,428**	**2,998**	**7,783**	**7,423**	**2,630**	**380**	**1,790**	**2,530**	**330**	**2,780**	**1,580**	**120**	**80**	**80**	**80**	**80**	**80**	**80**	**80**	**80**	**80**	**480**	**480**	**2,080**	**5,080**	**1,080**	**80**	**80**	**60**
	Improved LOS			**28,862**	70	2,308	2,918	7,413	7,093	2,500	300	1,560	1,950	250	1,000	1,500																		
	Other New System Assets (growth w			**11,820**		40		290	250	50		150	500		1,700		40										400	400	2,000	5,000	1,000			
	Renewals			**2,380**	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	60
	Other Grants			**7,213**		1079	1459	2718	1958																									

Integrated Scenario 3 - OMA and Revenue Overrides (increases in current expenditure) (2005/06$'000)

	03/04	04/05	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
			2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Additional capital works in Integrated Scenario 3																																
Yass STP upgrade (1.8 ML/day adv filtration + membrane)																																
Operation								75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
Maintenance								350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
Energy								54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54
Chemical cost								8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Engineering & Supervision								60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Additional OMA expenditure in Integrated Scenario 3																																
DSP review after adopting IWCM / Regular update (all admin costs)					8					8					8					8					8					8		
SBP & Pricing review after adopting IWCM / Regular update (all admin costs)					10					10					10					10					10					10		
Incentive for better on-site sewerage systems (all admin costs) (excl from SGE fund - incl in g		see here																														
On-site sewerage systems audit program (excl from SGE fund - incl in general fund)		see here																														
Adminisration																																
Operation																																
Engineering & Supervision																																

Integrated Scenario 3 - OMA and Revenue Overrides (increases in current expenditure) (2005/06$'000)

	30 Year TOTAL	03/04	04/05	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
				2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Administration	6,209	117	#VALUE!	222	142	215	146	158	162	169	191	176	187	196	190	212	197	205	215	207	228	213	221	232	220	240	224	233	245	231	251	236	245
Engineering & Supervision	6,423	57	46	120	118	120	122	130	195	201	204	206	213	220	218	221	224	227	234	232	235	238	239	246	243	245	247	249	256	252	254	256	258
Operations Expenses	15,650	37	26	310	325	397	418	363	443	468	475	483	501	509	517	524	532	540	547	555	562	570	575	580	585	590	596	601	606	611	617	621	627
Maintenace Expenses	10,015	37	26	28	29	30	31	32	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407
Energy Cost	3,109	35	38	41	42	43	44	46	102	104	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128
Chemical Cost	230	8	1	1	1	1	1	1	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Other Expenses	5,737	149	127	137	141	144	147	153	159	165	170	174	177	180	183	186	189	192	195	198	201	204	207	210	213	216	219	222	225	228	231	234	237
TOTAL	47,373			859	798	950	909	883	1,453	1,500	1,540	1,541	1,582	1,611	1,616	1,653	1,654	1,678	1,707	1,710	1,746	1,747	1,766	1,794	1,789	1,821	1,818	1,839	1,868	1,860	1,893	1,889	1,911
	0																																

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
GENERAL FUND OMA COSTS																															
On-site sewerage systems audit program																															
Adminisration				50					15					15					15					15					15		
Operation				25					25					25					25					25					25		
Engineering & Supervision				60					60					60					60					60					60		
Incentive for better on-site sewerage systems (all admin costs)					175	150	150	150	150	150	150	150	150	150																	
GENERAL FUND OMA TOTAL		**0**	**0**	**135**	**175**	**150**	**150**	**150**	**250**	**150**	**150**	**150**	**150**	**250**	**0**	**0**	**0**	**0**	**100**	**0**	**0**	**0**	**0**	**100**	**0**	**0**	**0**	**0**	**100**	**0**	**0**

Appendix H

Financial Analysis of Draft Scenarios

A series of financial models were developed to assess the draft water and sewerage IWCM scenarios using FINMOD, the financial model developed by DWE for local water utilities. The inputs and outcomes of these models are discussed below.

Input Data and Assumptions

Base data utilised in the YVC financial models are summarised in Table H-1 below.

Table H-1: Input Data

Item	**Data Used**	
Historical Data	Historical Financial Statements from 2003/04 and 2004/05 supplied by YVC	
Financial Data	Inflation Rate 2.5% pa Borrowing Interest Rate 6.5% pa Investment Interest Rate 5.5% pa	
Balance sheet key data (2004/05)	**Water Supply**	**Sewerage**
Cash ($'000)	3,315	3,145
Debt ($'000)	20	0
System Assets (2004/05)	**Water Supply**	**Sewerage**
Replacement Costs ($'000)	33,224	12,119
Assessments/Bills	**Water Supply**	**Sewerage**
Residential Growth Rates (30 year average, Shirewide) % p.a.	0.79	0.79
06/07 Typical Residential Bill (TRB) ($/assessment)	434	475
06/07 Typical Developer Charge ($/assessment)	8,702	4,262
% of TRB for Vacant Assessments	46	100
Pensioner Rebate Subsidy (%)	55	55
Other	**Water Supply**	**Sewerage**
Existing Loan Payments ($'000)	Principal: 20 Interest: 3	Nil
Capital Works Programs - Base Case ($'000)	55,783	38,110
Capital Works Grants ($'000) from 07/08	694	4,160

Item	Data Used
Operation, Maintenance and Administration (OMA) Costs ($'000)	Based on YVC OMA expenditure forecasts used in the strategic business plans (with overrides for OMA expenditure in IWCM scenarios)

Only the capital works and OMA expenditure varied between different scenarios.

Outcomes

A summary of the major outcomes of the financial comparison are given in Table H-2 and Table H-3. These tables provide a representation of the results for each initial scenario, and are provided to demonstrate the key outcomes of the modelling, in particular the difference in financial outcomes, such as cash levels and borrowings.

Table H-2: Water Supply Modelling Results

Scenario	30yr Capital Works Program (05/06 $'000)	30yr OMA (05/06$'000)	Typical Residential Bill (05/06$ per assessment) 2007/08 onwards	Typical Developer Charge (05/06$ per assessment)
Base case Scenario	55,783	40,824	670	8,702
Traditional Scenario	63,597	53,446	870	8,400
Integrated Scenario 1	63,597	56,916	940	7,200
Integrated Scenario 2	67,366	70,344	1,100	7,900
Integrated Scenario 3	52,989	62,996	880	6,000

Table H-3: Sewerage Modelling Results

Scenario	30yr Capital Works Program (05/06 $'000)	30yr OMA (05/06 $'000)	Typical Residential Bill (05/06$ per assessment)	Typical Developer Charge (05/06$ per assessment)
Base case Scenario	38,110	28,099	620	4,262
Traditional Scenario	41,248	41,143	680	9,200
Integrated Scenario 1	40,852	40,472	670	9,100
Integrated Scenario 2	41,762	41,040	735	9,300

Scenario	30yr Capital Works Program (05/06 $'000)	30yr OMA (05/06 $'000)	Typical Residential Bill (05/06$ per assessment)	Typical Developer Charge (05/06$ per assessment)
Integrated Scenario 3	43,062	41,636	745	9,600

Notes:

1. Capital works includes works for improved levels of service (LOS), renewals and growth.
2. All figures are in 2005/06 dollars (ie. not inflated). They will need to be adjusted for inflation.
3. Net cash in the final year for all the options in the water supply fund is similar for all scenarios.

Financing New Works

Where possible, the capital works program and recurrent expenditure is funded through existing cash levels which is determined by the amount of income generated from bills (TRB). Where planned expenditure exceeds the available cash levels, loans are required. A minimum cash level of at least 20% of annual turnover has been maintained for each fund. Loans and grants required to fund the draft water and sewerage scenarios are presented in Table H-4 and Table H-45 respectively.

Table H-4: New Loans and Grants - Water Supply (05/06 $'000)

Year		Base Case	Traditional	Scenario 1	Scenario 2	Scenario 3
07/08	Loans	0	0	0	0	0
	Grants	306	338	338	338	338
08/09	Loans	0	0	4000	4000	0
	Grants	240	394	394	394	394
09/10	Loans	0	6000	6000	9000	0
10/11	Loans	6000	6000	6000	6000	0
11/12	Loans	4000	2000	0	2000	0
12/13	Loans	0	0	0	2000	0
15/16	Loans	7000	7000	7000	7000	7000
16/17	Loans	13000	13000	13000	13000	7000
20/21	Loans	0	1600	1600	1600	0
21/22	Loans	6400	6400	6400	6400	6400
TOTAL	**Loans**	**36,400**	**42,000**	**44,000**	**51,000**	**20,400**
	Grants	**546**	**732**			

The major water supply capital works expenditure is to occur around 2015-2017 with the water supply augmentation.

The major sewerage capital works expenditure is to occur around 2008-2010 with the Yass STP upgrade.

Table H-5: New Loans and Grants – Sewerage (05/06 $'000)

Year		Base Case	Traditional	Scenario 1	Scenario 2	Scenario 3
07/08	Loans	1,159	1,370	1,349	1,393	1,459
	Grants	1,160	1,368	1,349	1,394	1,459
08/09	Loans	3,429	3,514	3,411	4,647	4,985
	Grants	1,880	2,463	2,408	2,536	2,718
09/10	Loans	3,830	3,914	3,811	5,047	5,385
	Grants	1,120	1,703	1,648	1,776	1,958
10/11	Loans	2,551	1,251	1,250	2,551	1,251
12/13	Loans	1,709	1,709	1,709	1,709	1,709
13/14	Loans	2,450	2,450	2,450	2,450	2,450
15/16	Loans	2,700	2,700	2,700	2,700	2,700
16/17	Loans	1,500	1,500	1,500	1,500	1,500
29/30	Loans	800	800	800	200	0
30/31	Loans	4,000	0	0	3,800	4,000
TOTAL	**Loans**	**24,128**	**19,208**	**18,980**	**25,997**	**25,439**
	Grants	**4,160**	**5,534**	**5,405**	**5,706**	**6,135**

Analysis of Outcomes

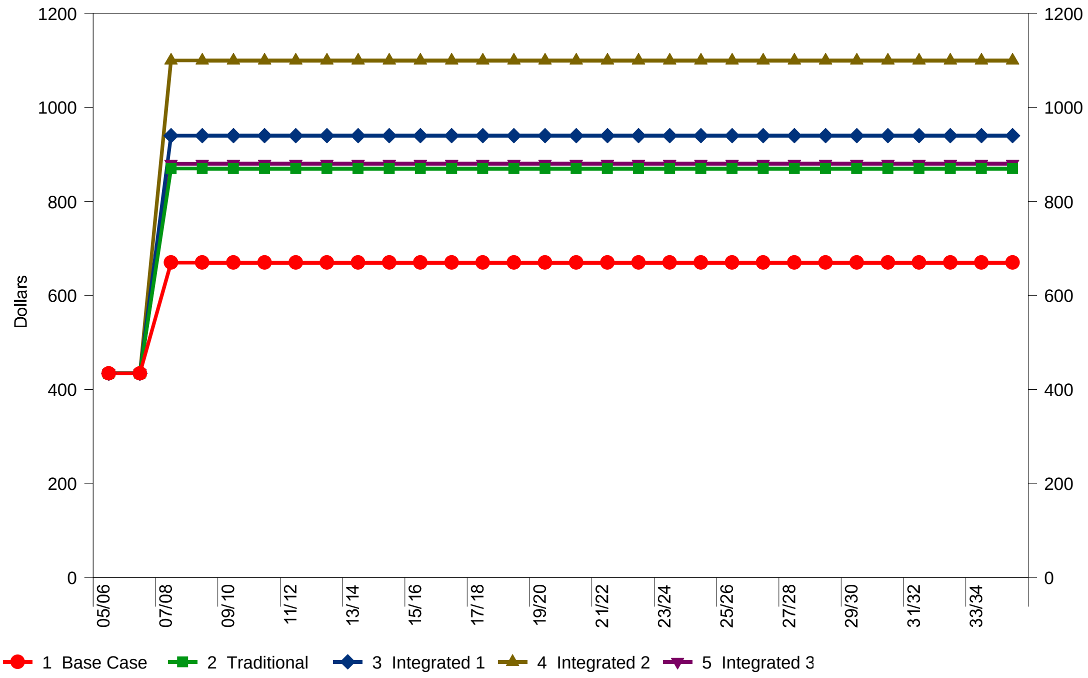
The financial modelling provided an indication of the relative cost of each scenario to YVC and their customer's in terms of a TRB. The following conclusions have been drawn from the analysis. Graphs of the TRB for water and sewerage over the next 30 years for all scenarios are presented in Figure H-1 and Figure H-2.

Water Supply:

- The current TRB needs to increase to meet the current operation and maintenance costs of YVC's water supply business;
- With the proposed implementation of new capital works items, the TRB needs to increase further to ensure that these projects can be paid for and to ensure the long term sustainability of YVC's water supply business; and

- Of the integrated scenarios, Scenario 3 provides the lowest TRB of $880/ET and lowest developer charge of $6,000/ET.

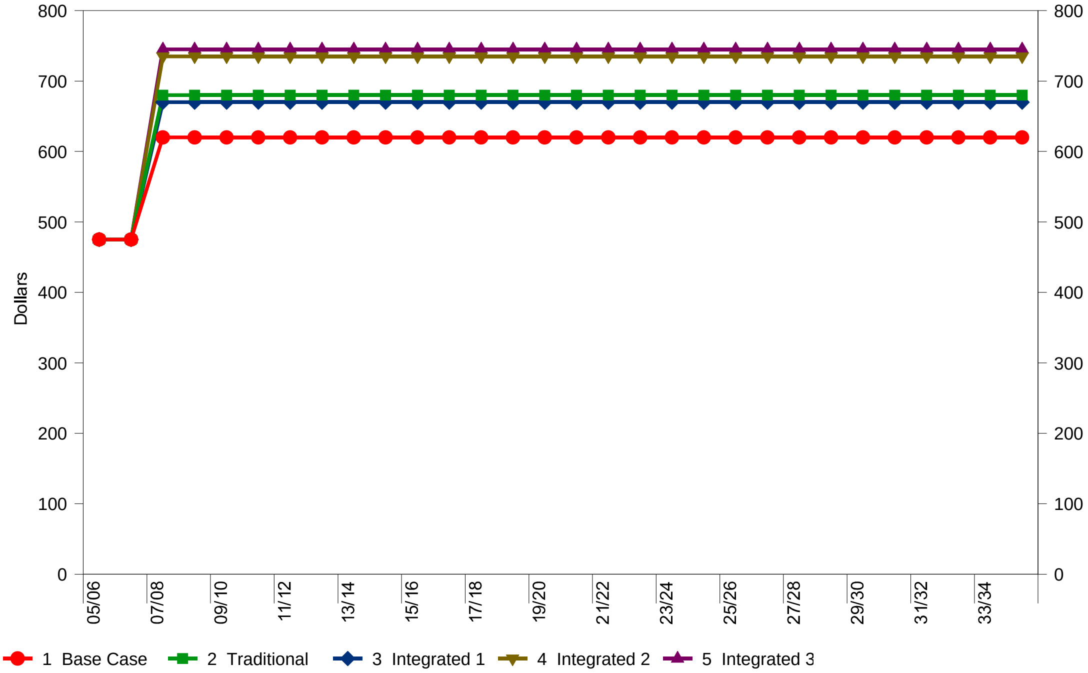
Figure H-1: Typical Residential Bill (TRB) 2005/06$ for Draft Water Supply Scenarios



Sewerage:

- The current TRB needs to increase to meet the current operation and maintenance costs of YVC's sewerage business;
- With the proposed implementation of new capital works items, the TRB and developer charge need to increase further to ensure that these projects can be paid for and to ensure the long term sustainability of YVC's sewerage business; and
- Of the integrated scenarios, Scenario 1 provides the lowest TRB of $670/ET and lowest developer charge of $9,100/ET.

Figure H-2: Typical Residential Bill (TRB) 2005/06$ for Draft Sewerage Scenarios



Appendix I

Capital Works Programs and OMA Schedules for Stormwater and Catchment Management

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Capital Works Program Stormwater - Base Case 2005

All values are in year 2005 $'000

Asset	Type of works				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Improved LOS	New System Assets	Renewals	30 year total	2005/06	2006/07	2007/08	2008/09	2009/1(	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/2	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
					2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
WATER QUALITY																																		
Encourage community awareness of ar	100%			90	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Devise & implement community aware	100%			30	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
In-house staff and contractors training	100%																																	
Chinaman's Creek audit to identify poll	100%																																	
Review fertiliser/herbicide use at the g	100%																																	
CDB audit for potential litter trapping s	100%																																	
Intercept/treat runoff (Vegetated buffer strips) at roads and car parks		100%		86	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Continue street sweeping in Yass (alre	100%																																	
Adoption of Dep of Housing urban stor	100%																																	
Eliminate unsealed road shoulders in n	100%																																	
Roadworks - erosion & sediment contr	100%																																	
Significant stands of vegetation to be r	100%																																	
Tip site leaching monitoring	100%																																	
Pritchett & Polding St inlet works weed	100%																																	
Drain Olympic pool to sewer		100%																																
Develop and implement procedures on	100%																																	
Best-practice maintenance of unsealed	100%			6	6																													
Willow removal program	100%																																	
Cigarette trays on CBD area		100%		8					3										3										3					
Water quality controls during construct	100%																																	
Revegetation strategies to lower groun	100%																																	
Remove of sediment	100%																																	
Install pollution control at truck washes		100%		69	11					11					11					11					11					11				
Riparian buffer zone revegetation	100%			172	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Chinamans Creek rehabilitation			100%																															
Polding/Pritchett St Urban drainage	100%			25	25																													
Polding/Pritchett St Urban drainage			100%	98	25	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Crago St Urban drainage	100%			35	35																													
Crago St Urban drainage			100%	102		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
BINALONG																																		
Binalong Strategy - Urban drainage	100%			55	25	30																												
			Total	**784**	**139**	**49**	**19**	**19**	**22**	**30**	**19**	**19**	**19**	**19**	**30**	**19**	**19**	**19**	**22**	**30**	**19**	**19**	**19**	**19**	**30**	**19**	**19**	**19**	**22**	**30**	**19**	**19**	**19**	**19**
	Improved LOS			**420**	100	40	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Other New System Assets (growth v			**165**	14	3	3	3	6	14	3	3	3	3	14	3	3	3	6	14	3	3	3	3	14	3	3	3	6	14	3	3	3	3
	Renewals			**199**	25	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	Other Grants																																	

Yass Valley Council

OMA ($'000) 2005

Stormwater - Base Case

All values are in year 2005/06 $'000

Project	Type of works: Labour	Type of works: Materials	Project Total	1 2005/06	2 2006/07	3 2007/08	4 2008/09	5 2009/10	6 2010/11	7 2011/12	8 2012/13	9 2013/14	10 2014/15	11 2015/16	12 2016/17	13 2017/18	14 2018/19	15 2019/20	16 2020/21	17 2021/22	18 2022/23	19 2023/24	20 2024/25	21 2025/26	22 2026/27	23 2027/28	24 2028/29	25 2029/30	26 2030/31	27 2031/32	28 2032/33	29 2033/34	30 2034/35
WATER QUALITY																																	
Encourage community awareness of and involveme		100%	30	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Devise & implement community awa	100%		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
In-house staff and contractors trainir	100%		15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Chinaman's Creek audit to identify p	100%		18	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Review fertiliser/herbicide use at the	80%	20%	30	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CDB audit for potential litter trapping	100%		0																														
Intercept/treat runoff (Vegetated but	70%	30%	69	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Continue street sweeping in Yass (Al	70%	30%	0																														
Adoption of Dep of Housing urban st	100%		0																														
Eliminate unsealed road shoulders in	70%	30%	0																														
Roadworks - erosion & sediment con	70%	30%	0																														
Significant stands of vegetation to be	100%		0																														
Tip site leaching monitoring	70%	30%	150	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Pritchett & Polding St inlet works wee	80%	20%	75	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Drain Olympic pool to sewer	30%	70%	0																														
Develop and implement procedures c	100%		0																														
Best-practice maintenance of unseale	100%		0																														
Willow removal program	100%		135	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Cigarette trays on CBD area	30%	70%	0																														
Water quality controls during constru	100%		0																														
Revegetation strategies to lower gro	70%	30%	34	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Remove of sediment	100%		34	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Install pollution control at truck wash	30%	70%	0																														
Riparian buffer zone revegetation	70%	30%	34	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Chinamans Creek rehabilitation	30%	70%	150	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Polding/Pritchett St Urban drainage	30%	70%	0																														
Crago St Urban drainage	30%	70%	0																														
BINALONG																																	
Binalong Strategy - Urban drainage	30%	70%	0																														
Total			775	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	25.83307
Labour			533	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Materials			242	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Total			775																														

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Capital Works Program Stormwater - Traditional Scenario
2005
All values are in year 2005 $'000

Asset	Type of works				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Improved LOS	New System Assets	Renewals	30 year total	2005/06	2006/07	2007/08	2008/09	2009/1(	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/2!	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
					2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
WATER QUALITY																																		
Encourage community awareness of	100%			90	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Devise & implement community awa	100%			30	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
In-house staff and contractors traini	100%																																	
Chinaman's Creek audit to identify p	100%																																	
Educate community/businesses re fe	100%			30		3			3			3			3			3			3			3			3			3			3	
Review fertiliser/herbicide use at the	100%																																	
Determine litter trouble spots / incre	100%																																	
Litter streams monitoring	100%																																	
CDB audit for potential litter trapping	100%																																	
Intercept/treat runoff (Vegetated buffer strips) a		100%		86	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Illegal dumping enforcement prograi	100%			75	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Continue street sweeping in Yass (al	100%																																	
Adoption of Dep of Housing urban st	100%																																	
Eliminate unsealed road shoulders in	100%																																	
WSUD encouraged through S94 whe	100%																																	
Roadworks - erosion & sediment con	100%																																	
Significant stands of vegetation to be	100%																																	
Update LEP enhancement initiative	100%																																	
Tip site leaching monitoring	100%																																	
Pritchett & Polding St inlet works we	100%																																	
Drain Olympic pool to sewer		100%																																
Negotiation with horse owners re alt	100%																																	
Revegetation of gravel table drains which are alig		100%																																
Develop and implement procedures (	100%																																	
Best-practice maintenance of unseal	100%			6	6																													
Willow removal program	100%																																	
Cigarette trays on CBD area		100%		8					3										3										3					
Rehabilitation plan and implementati	100%																																	
Water quality controls during constru	100%																																	
Revegetation strategies to lower gro	100%																																	
Remove of sediment	100%																																	
Weed audit and mgt plan along Yass	100%																																	
Install pollution control at truck washes		100%		69	11					11					11					11					11					11				
Riparian buffer zone revegetation	100%			172	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
3x Water quality monitoring sites (C	100%																																	
By 2016 improve the quality of drain	100%																																	
Chinamans Creek rehabilitation			100%																															
Polding/Pritchett St Urban drainage	100%			25	25																													
Polding/Pritchett St Urban drainage			100%	98	25	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Crago St Urban drainage	100%			35	35																													
Crago St Urban drainage			100%	102		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Reduce the incidence of water pollution																																		
Reduce stormwater runoff																																		
BINALONG																																		
Binalong Strategy - Urban drainage	100%			55	25	30																												
			Total	**875**	**142**	**54**	**21**	**21**	**27**	**32**	**21**	**24**	**21**	**21**	**35**	**21**	**21**	**24**	**24**	**32**	**24**	**21**	**21**	**24**	**32**	**21**	**24**	**21**	**24**	**35**	**21**	**21**	**24**	**21**
	Improved LOS			**511**	103	45	12	12	15	12	12	15	12	12	15	12	12	15	12	12	15	12	12	15	12	12	15	12	12	15	12	12	15	12
	Other New System Assets (growth v			**165**	14	3	3	3	6	14	3	3	3	3	14	3	3	3	6	14	3	3	3	3	14	3	3	3	6	14	3	3	3	3
	Renewals			**199**	25	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6

Other Grants

Yass Valley Council

OMA ($'000) 2005

Stormwater - Traditional Scenario

All values are in year 2005/06 $'000

Project	Type of works		Project Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Labour	Materials		2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
LITY																																	
Update SWM Plan	100%		120			20					20					20					20					20					20		
Encourage community awareness of and involveme		100%	30	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Devise & implement community awa	100%		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
In-house staff and contractors trainin	100%		15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Chinaman's Creek audit to identify p	100%		18	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Educate community/businesses re fe	100%		0																														
Review fertiliser/herbicide use at the	80%	20%	30	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Determine litter trouble spots / incre	100%		120	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Litter streams monitoring	100%		36	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CDB audit for potential litter trapping	100%		0																														
Intercept/treat runoff (Vegetated but	70%	30%	69	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Illegal dumping enforcement program	100%		30	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Continue street sweeping in Yass (Al	70%	30%	0																														
Adoption of Dep of Housing urban st	100%		0																														
Eliminate unsealed road shoulders in	70%	30%	0																														
WSUD encouraged through S94 whe	100%		0																														
Roadworks - erosion & sediment con	70%	30%	0																														
Significant stands of vegetation to be	100%		0																														
Update LEP enhancement initiative	100%		0																														
Tip site leaching monitoring	70%	30%	150	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Pritchett & Polding St inlet works we	80%	20%	75	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Drain Olympic pool to sewer	30%	70%	0																														
Negotiation with horse owners re alt	100%		30	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Revegetation of gravel table drains w	70%	30%	52	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Develop and implement procedures o	100%		0																														
Best-practice maintenance of unseale	100%		0																														
Willow removal program	100%		135	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Cigarette trays on CBD area	30%	70%	0																														
Rehabilitation plan and implementati	30%	70%	172	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Water quality controls during constru	100%		0																														
Revegetation strategies to lower gro	70%	30%	34	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Remove of sediment	100%		34	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Weed audit and mgt plan along Yass	100%		34	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Install pollution control at truck wash	30%	70%	0																														
Riparian buffer zone revegetation	70%	30%	34	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3x Water quality monitoring sites (Cl	0%	100%	648	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
By 2016 improve the quality of drain	50%	50%	0																														
Chinamans Creek rehabilitation	30%	70%	150	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Polding/Pritchett St Urban drainage	30%	70%	0																														
Crago St Urban drainage	30%	70%	0																														
BINALONG																																	
Binalong Strategy - Urban drainage	30%	70%	0																														
	Total		2,017	63	63	83	63	63	63	63	83	63	63	63	63	83	63	63	63	63	83	63	63	63	63	83	63	63	63	63	83	63	63.232676
	Labour		991	29	29	49	29	29	29	29	49	29	29	29	29	49	29	29	29	29	49	29	29	29	29	49	29	29	29	29	49	29	29
	Materials		1,026	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34
	Total		2,017																														

050626 Yass Valley Council IWCM

Capital Works Program Catchment - Base Case
2005
All values are in year 2005 $'000

Asset	Type of works				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Improved LOS	New System Assets	Renewals	30 year total	2005/06	2006/07	2007/08	2008/09	2009/1(	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/2	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
					2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
ALL																																		
Catchment Management Strategy	100%			450	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20
Yass River Catchment Improvement	100%			750	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
GUNDAROO & JUGIONG																																		
Weed control / River care Gundaroo	100%			150	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
			Total	**1,350**	**40**	**50**	**40**	**50**	**40**	**50**	**40**	**50**	**40**	**50**	**40**	**50**	**40**	**50**	**40**	**50**	**40**	**50**	**40**	**50**	**40**	**50**	**40**	**50**	**40**	**50**	**40**	**50**	**40**	**50**
	Improved LOS			**1,350**	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50
	**Other New System Assets (growth **																																	
	Renewals																																	
	Other Grants																																	

Yass Valley Council

OMA ($'000) | **2005**

Catchment - Base Case

All values are in year 2005/06 $'000

Project	Type of works: Labour	Type of works: Materials	Project Total	1 2005/06	2 2006/07	3 2007/08	4 2008/09	5 2009/10	6 2010/11	7 2011/12	8 2012/13	9 2013/14	10 2014/15	11 2015/16	12 2016/17	13 2017/18	14 2018/19	15 2019/20
ALL																		
All OMA expenditure (10% CWP)	70%	30%	135	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4
		Total	**135**	**4**	**5**	**4**	**5**	**4**	**5**	**4**	**5**	**4**	**5**	**4**	**5**	**4**	**5**	**4**
	Labour		95	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3
	Materials		41	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1
	Total		135															

Project	16 2020/21	17 2021/22	18 2022/23	19 2023/24	20 2024/25	21 2025/26	22 2026/27	23 2027/28	24 2028/29	25 2029/30	26 2030/31	27 2031/32	28 2032/33	29 2033/34	30 2034/35
ALL															
All OMA expenditure (10% CWP)	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5
Total	**5**	**4**	**5**	**4**	**5**	**4**	**5**	**4**	**5**	**4**	**5**	**4**	**5**	**4**	**5**
Labour	4	3	4	3	4	3	4	3	4	3	4	3	4	3	3.5
Materials	2	1	2	1	2	1	2	1	2	1	2	1	2	1	1.5
Total															

050626 Yass Valley Council IWCM

Capital Works Program Catchment - Traditional Scenario
2005
All values are in year 2005 $'000

Asset	Type of works: Improved LOS	New System Assets	Renewals	30 year total	1 2005/06 2006	2 2006/07 2007	3 2007/08 2008	4 2008/09 2009	5 2009/1(2010	6 2010/11 2011	7 2011/12 2012	8 2012/13 2013	9 2013/14 2014	10 2014/15 2015	11 2015/16 2016	12 2016/17 2017	13 2017/18 2018	14 2018/19 2019	15 2019/20 2020
ALL																			
Encourage ecologically sustainable agricultural practices that do not further exacerb	100%																		
Encourage landholders to fence remnant vegetation and riparian zone to protect anc	100%			187	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Develop a vegetation strategy for the LGA	100%			40			20					4					4		
Further development and implementation of education and awareness campaigns to	100%																		
Provide financial and/or 'in kind' support for local groups undertaking projects that a	100%			300	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Reduce amount of soil erosion and sedimentation incidences in the LGA	100%																		
Develop and implement a regular water quality monitoring program	100%			750	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Encourage sustainable water use (eg. retrofit programs)	100%																		
Agro-forestry for Groundwater Interception	100%			56	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Developing and Implementing Best Management Practices for Dry land Cropping Sys	100%			107	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Riparian Restoration	100%			347	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Riverine Assessment	100%			286	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Protection and Enhancement of Native Vegetation in the Murrumbidgee Catchment.	100%			346	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Yass River Salinity and Water Quality	100%			730	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
Catchment Management Strategy	100%			450	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10
Yass River Catchment Improvement	100%			750	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
GUNDAROO & JUGIONG																			
Jugiong Creek Salinity and Water Quality	100%			1,076	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
Weed control / River care Gundaroo	100%			150	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
			Total	**5,560**	**179**	**189**	**199**	**189**	**179**	**189**	**179**	**193**	**179**	**189**	**179**	**189**	**183**	**189**	**179**
	Improved LOS			**5,560**	179	189	199	189	179	189	179	193	179	189	179	189	183	189	179

Asset	16 2020/21 2021	17 2021/22 2022	18 2022/23 2023	19 2023/24 2024	20 2024/2! 2025	21 2025/26 2026	22 2026/27 2027	23 2027/28 2028	24 2028/29 2029	25 2029/30 2030	26 2030/31 2031	27 2031/32 2032	28 2032/33 2033	29 2033/34 2034	30 2034/35 2035
ALL															
Encourage ecologically sustainable agricultural practices that do not further exacerb															
Encourage landholders to fence remnant vegetation and riparian zone to protect anc	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Develop a vegetation strategy for the LGA			4					4					4		
Further development and implementation of education and awareness campaigns to															
Provide financial and/or 'in kind' support for local groups undertaking projects that a	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Reduce amount of soil erosion and sedimentation incidences in the LGA															
Develop and implement a regular water quality monitoring program	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Encourage sustainable water use (eg. retrofit programs)															
Agro-forestry for Groundwater Interception	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Developing and Implementing Best Management Practices for Dry land Cropping Sys	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Riparian Restoration	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Riverine Assessment	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Protection and Enhancement of Native Vegetation in the Murrumbidgee Catchment.	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Yass River Salinity and Water Quality	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
Catchment Management Strategy	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20
Yass River Catchment Improvement	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
GUNDAROO & JUGIONG															
Jugiong Creek Salinity and Water Quality	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
Weed control / River care Gundaroo	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Total	**189**	**179**	**193**	**179**	**189**	**179**	**189**	**183**	**189**	**179**	**189**	**179**	**193**	**179**	**189**
Improved LOS	189	179	193	179	189	179	189	183	189	179	189	179	193	179	189

Other New System Assets (growth v

Renewals

Other Grants

Yass Valley Council

OMA ($'000) | **2005**

Catchment - Traditional Scenario

All values are in year 2005/06 $'000

Project	Type of works: Labour	Type of works: Materials	Project Total	1 2005/06	2 2006/07	3 2007/08	4 2008/09	5 2009/10	6 2010/11	7 2011/12	8 2012/13	9 2013/14	10 2014/15	11 2015/16	12 2016/17	13 2017/18	14 2018/19	15 2019/20
ALL																		
All OMA expenditure (10% CWP)	70%	30%	556	18	19	20	19	18	19	18	19	18	19	18	19	18	19	18
Total			**556**	**18**	**19**	**20**	**19**	**18**	**19**	**18**	**19**	**18**	**19**	**18**	**19**	**18**	**19**	**18**

Project	16 2020/21	17 2021/22	18 2022/23	19 2023/24	20 2024/25	21 2025/26	22 2026/27	23 2027/28	24 2028/29	25 2029/30	26 2030/31	27 2031/32	28 2032/33	29 2033/34	30 2034/35
ALL															
All OMA expenditure (10% CWP)	19	18	19	18	19	18	19	18	19	18	19	18	19	18	19
Total	**19**	**18**	**19**	**18**	**19**	**18**	**19**	**18**	**19**	**18**	**19**	**18**	**19**	**18**	**18.9**

Appendix J

Triple Bottom Line Assessment Process

Triple Bottom Line Assessment

The scenarios developed were ranked using a Triple Bottom Line (TBL) assessment. The methodology and outcomes of this assessment for YVC is detailed below.

Triple Bottom Line Measures

TBL assessment is an approach of assessing individual or bundled management options against a set of social, environment and economic measures. It is possible to develop many environmental and social measures upon which to measure the appropriateness of the management options. However, for practical purposes, it is necessary to identify key criteria which best represent local values.

The inputs of the PRG, government agencies and YVC staff, as part of the community consultation process (during the Concept Study phase) were utilised to determine a set of triple bottom line assessment measures for YVC (refer Appendix A). These measures are set out in Table J - 1. Generally, it is difficult to classify measures as wholly environmental, social or economic. Most criteria could be readily categorised as two or three.

Table J - 1: Triple Bottom Line Objectives and Measures.

Concept Study Phase		Strategy Plan Phase
Objectives identified by PRG	**Measure identified by PRG**	**Measure used in TBL Assessment of Scenarios**
Improved security of water supply both now and into the future.	Reduced frequency of high level restrictions.	Increase in System Drought-Proofing
Sustainable funding to provide affordable services.	Available grants realised. Developers contributing their share. Change in typical residential water and sewer bills. Suitable infrastructure provided.	Satisfaction of remaining pre-requisites for grants from DEUS (DMP and DrMP)
		Not used. All scenarios include updated DSP and FP.
		Change in combined residential water and sewage bill compared to current ($/year)
		Asset Replacement Program ($'000)
		Levels of Service (water supply quantity for Bowning and Binalong) achieved
		Compliance with ADWG (%)
		Improvement in Yass STP effluent quality (%)
Improved matching of water demand with available water sources.	Improvement in meeting Interim Environmental Objectives (IEO) for water quality and quantity.	Improvement in water quality in Yass River through increased level of effluent treatment and reduction in pollution from on-site systems and stormwater
		Implementation of measures to achieve Yass River Flow Objectives
		Percentage of on-site systems improved or replaced with reticulated sewerage or best practice technologies
		Catchment improvements implemented ($/assessment) through stormwater and catchment levy

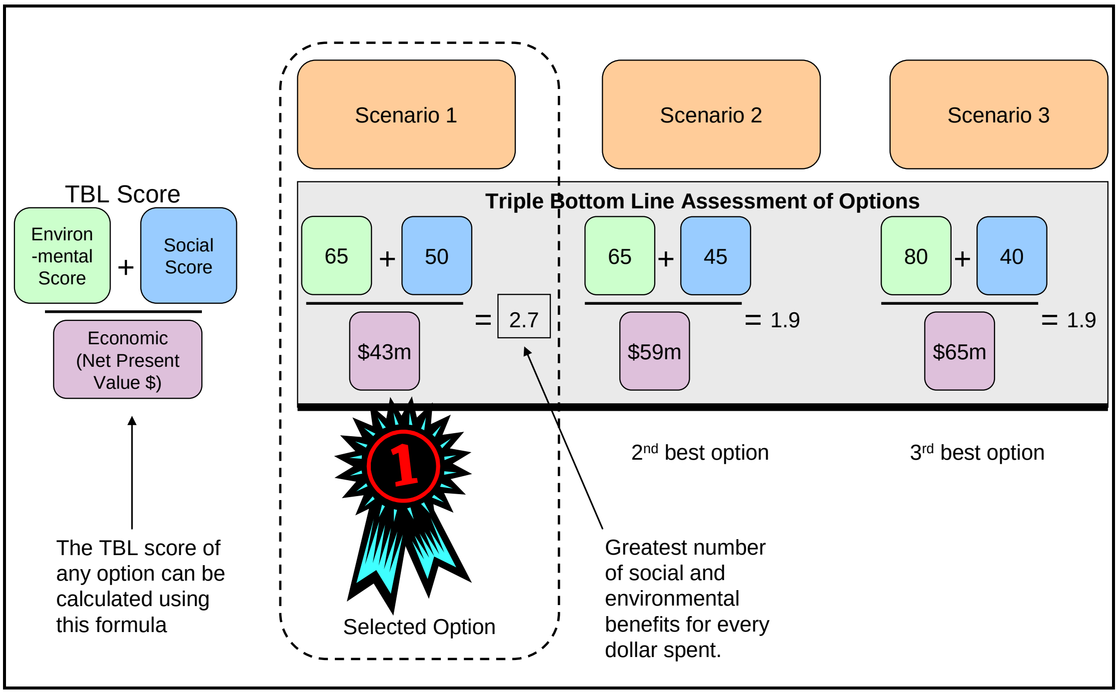
Concept Study Phase		Strategy Plan Phase
Objectives identified by PRG	**Measure identified by PRG**	**Measure used in TBL Assessment of Scenarios**
	Change in cost of operating.	OMA expenditure per residential assessment compared to current ($/year)
	Increase in volume of water recycled.	Replacement of raw water extraction with alternative water sources (effluent, stormwater etc) (ML/a effluent reused)
	Offset in potable water usage.	Water consumption per assessment (kL/year)
		Uptake of water efficient technologies (% of accounts)
Improved catchment management practices.	Improvement in meeting Interim Environmental Objectives (IEO) for water quality and quantity.	As above
-	-	Annual cost per kL of water produced ($/kL)

Ranking of Scenarios Against Triple Bottom Line Measures

Each of the three scenarios were ranked, using the TBL measures in Table J - 1.

An example of the TBL assessment approach applied to the YVC draft IWCM Scenarios is set out in Figure J - 1.

Figure J - 1: TBL Assessment Approach.



Based on the measures set, each option was assigned an environmental or social score and weightings for each measure were assigned by the PRG members (refer Appendix C). In order to rank the relative TBL performance of each option, the environmental and social scores for each option (using the weighting determined by the PRG) were summed and then divided by the net present value of the option. Ranking each option in this manner provides a measure of how many positive social and environmental outcomes every dollar invested would buy. Hence, this process provides an opportunity to assess the relative desirability of the outcomes of implementing different scenarios.

The ranking method (data used and scoring system) is presented in Table J - 2, Table J - 3 and Table J - 4.

The results of the assessment and the ranking of the draft scenarios was presented to the PRG in the second PRG workshop of the Strategy phase (refer Appendix C). The results are set out in Table J - 5.

Table J - 2: Triple Bottom Line Assessment Method.

Measure used in TBL Assessment	TBL Data Used and Results	Scoring System
Increase in System Drought-Proofing	In the traditional and integrated scenarios YVC will implement a Drought Management Plan. This is not currently undertaken (base case).	Yes = 1, No = 0
Satisfaction of remaining pre-requisites for grants from DEUS (DMP and DrMP)	In the traditional and integrated scenarios YVC will implement a Drought Management Plan (DrMP) and Demand Management Plan (DMP). Currently, the criterion for water conservation (demand management) is satisfied (base case). All other best-practice management criteria have been satisfied.	DMP = 1, DrMP =1
Change in combined residential water and sewage bill compared to current ($/year)	The 2007/08 typical residential bills (TRB) were determined using FINMOD, the financial model developed by DWE for local water utilities (refer Appendix I) for water supply and sewerage (in 2006/07 $). The TRB is the annual bill paid by a residential assessment with typical water use which is not a vacant or pensioner assessment. The result is expressed as the increase above the 2006/07 combined TRB of $1,290 per assessment.	Linear scoring (out of a maximum of 5). The score for each scenario is obtained by dividing that result (% increase) by the maximum result (multiplied by 5).
Asset Replacement Program ($'000)	Asset renewal expenditure can be targeted at problem areas such as system leakage, aging assets (replacement) and can reduce long term operating costs. The 2005/06 Strategic Business Plans (YVC, 2006a, 2006b) identify projected renewals investment of $150,000 p.a. for water supply (with some additional replacement cost in different years) and $100,000 p.a. for sewerage (with some additional replacement cost in different years). For the traditional and integrated scenarios, the required asset renewal expenditure considers the development of a condition based asset management plan and expenditure based on asset condition, remaining asset life and depreciation. The resulting expenditure is higher than in the base case. Increased capital expenditure is considered to improve asset condition.	Linear scoring (out of a maximum of 5). The score for each scenario is obtained by dividing that result by the maximum result (multiplied by 5).
Levels of Service (water supply quantity for Bowning and Binalong) achieved	The villages of Bowning and Binalong are supplied with water through a 100 mm rising main that is connected to the Yass reticulated water supply. The pipeline from Bowning to Binalong can currently supply only 75% of peak day demand (base case). The traditional and integrated scenarios include an increase in the size of the water main to supply the full peak day demand.	Yes = 1, No = 0

Measure used in TBL Assessment	TBL Data Used and Results	Scoring System
Compliance with ADWG (%)	Current (base case) compliance with the drinking water guidelines is approximately 96% (average). Treatment plant upgrades included in the traditional and integrated scenarios will achieve full compliance (100%).	Linear scoring (out of a maximum of 5). The score for each scenario is obtained by dividing that result by the maximum result (multiplied by 5).
Improvement in Yass STP effluent quality (%)	YVC currently (base case) plans to upgrade the Yass STP treatment process to meet licence limits and Pollution Reduction Programs (PRPs) which is expected to increase effluent quality by 70% (subjective). Integrated 2 scenario includes additional treatment (filtration) for dual reticulation effluent reuse which is expected to achieve a further 10% improvement (subjective). Integrated 3 scenario includes advanced STP processes (filtration and membranes) to satisfy indirect potable reuse requirements which is expected to achieve an additional 10% improvement (subjective).	Linear scoring (out of a maximum of 5). The score for each scenario is obtained by dividing that result by the maximum result (multiplied by 5).
Improvement in water quality in Yass River through increased level of effluent treatment and reduction in pollution from on-site systems and stormwater	In the IWCM Concept Study, water quality in the Yass River was assessed against the Water Quality Interim Environmental Objectives (IEOs) defined for *Murrumbidgee River and Lake George* catchment. Each of these objectives is defined by identified environmental values. The extent to which each value was considered protected was ranked from very poor to good, based on the percentage of samples where the indicator criteria were met. The dominant ranking against the indicator criteria for the available data was “poor” with a result of between 25% and 49% compliance. The existing situation was therefore given a result of 40%. Projects which are considered to influence this result include STP upgrades, stormwater quality improvement and effluent reuse schemes. These projects (included in the traditional and integrated scenarios) are expected to increase compliance with the IEOs.	Linear scoring (out of a maximum of 5). The score for each scenario is obtained by dividing that result by the maximum result (multiplied by 5).
Implementation of measures to achieve Yass River Flow Objectives	The river flow objectives (RFO) for the Murrumbidgee River catchment were discussed in the Yass STP water quality assessment (refer Appendix F). YVC does not currently implement measures to achieve the RFO. Demand management programs included in the traditional and integrated scenarios and indirect potable reuse (which will increase base flows) included in Integrated 3 scenario will satisfy the RFO.	Demand management = 1, Indirect potable reuse = 1
Percentage of on-site systems improved or replaced with reticulated sewerage or best practice technologies	YVC currently regulates the sewage management practices in new development areas without reticulated sewerage identifies systems at risk of environmental or health impacts. YVC plans to provide reticulated sewerage to the Binalong, Bowning, Murrumbateman and Gundaroo (base case, total of 600 lots sewered). This is expressed as a % of total assessments (12%). In integrated 1 and 2 scenarios, YVC will provide incentives for new advanced on-site systems in areas with high risk. This is expected to result in approximately 25% of systems improved or replaced.	Linear scoring (out of a maximum of 5). The score for each scenario is obtained by dividing that result by the maximum result (multiplied by 5).

Measure used in TBL Assessment	TBL Data Used and Results	Scoring System
Catchment improvements implemented ($/assessment) through stormwater and catchment levy	YVC currently provides a catchment levy of $25,000 to the CMA. In the integrated scenarios, this is expected to increase to $204,000 to fund the required catchment improvements identified in the catchment action plan. Yass customers do not currently pay a stormwater levy. The traditional and integrated scenarios include a levy to fund the stormwater management program. The levy is calculated using the total capital and operating cost divided by the average number of water and sewer assessments at 2035 as the total rateable assessments is not available (refer Section 7).	Linear scoring (out of a maximum of 5). The score for each scenario is obtained by dividing that result by the maximum result (multiplied by 5).
OMA expenditure per residential assessment compared to current ($/year)	The net present value of the OMA cost was divided by the number of assessments for each scenario and expressed as a % increase in OMA over the base case.	Linear scoring (out of a maximum of 5). The score for each scenario is obtained by dividing that result by the maximum result (multiplied by 5).
Replacement of raw water extraction with alternative water sources (effluent, stormwater etc) (ML/a effluent reused)	The volume of water sourced from recycled effluent (ML/a) has been determined for each scenario. This is expressed as the percentage replacement of raw water extracted at the end of the planning horizon (2036) determined from expected production of water.	Linear scoring (out of a maximum of 5). The score for each scenario is obtained by dividing that result by the maximum result (multiplied by 5).
Water consumption per assessment (kL/year)	YVC does not currently implement a demand management program. Low level demand management (WSP 1with BASIX, best-practice pricing, education) is included in the traditional scenario. Higher level demand management is included in the integrated scenarios (WSP 2 also including showerhead retrofit and UFW reduction). From the demand modeling undertaken for the IWCM Strategy, the expected town water consumption for residential houses at the end of the planning horizon (2036) was determined (refer Section 3). The result is expressed as the town water savings from the base case consumption.	Linear scoring (out of a maximum of 5). The score for each scenario is obtained by dividing that result by the maximum result (multiplied by 5).
Uptake of water efficient technologies (% of accounts)	YVC does not currently provide any incentive for uptake of water efficient technologies (base case). WSP 1 in the traditional scenario includes education on water savings which is expected to encourage 5% of customers to install water efficient devices. WSP 2 in the integrated scenarios includes the showerhead retrofit program which is expected to be adopted by a further 20% of customers.	Linear scoring (out of a maximum of 5). The score for each scenario is obtained by dividing that result by the maximum result (multiplied by 5).

Measure used in TBL Assessment	TBL Data Used and Results	Scoring System
Annual cost per kL of water produced ($/kL)	NPV of capital and operating cost divided by total average water production per annum expressed as a percentage increase in cost above the base case.	Linear scoring (out of a maximum of 5). The score for each scenario is obtained by dividing that result by the maximum result (multiplied by 5).

Table J - 3: Effluent Reuse Volumes.

Reuse Volume (ML/a)	Base Case	Traditional	Integrated 1	Integrated 2	Integrated 3
Demand Management Program	Baseline	WSP1	WSP2	WSP2	WSP2
DSS Production 2036 - Yass	1716	1533	1241	1241	1241
DSS Production 2036 - Murrumbatemen	146	146	146	146	146
Total YVC Production	1862	1679	1387	1387	1387
Reuse Options					
Agricultural application	160				
Park and golf course irrigation		160	160	160	
Dual reticulation (new development areas)				256	
Indirect potable					657
Total Yass Reuse	160	160	160	416	657

Table J - 4: Ultimate Residential Consumption.

Scenario	Base Case	Traditional	Integrated 1	Integrated 2	Integrated 3
DSS Results	Baseline	WSP1	WSP2	WSP2	WSP2
Single Residential Consumption per account (L/d)	470	-	-	-	-
No accounts	5412				
Savings above base case (ML/d)	-	0.4	1.3	1.3	1.3
Savings per account (kL/a)	-	27	88	88	88
Consumption per account (kL/a)	171	144	84	84	84

Table J - 5: TBL Assessment Results

Measures	Criteria Weighting	Base Case	Traditional	Integrated 1	Integrated 2	Integrated 3
Change in combined residential water and sewage bill compared to current ($/year)		**$1,290**	**$1,550**	**$1,610**	**$1,835**	**$1,625**
% increase in TRB		0%	20%	25%	42%	26%
Score	*3.0*	*5.0*	*2.6*	*2.1*	*0.0*	*1.9*
OMA expenditure per residential assessment compared to current ($/year)		**$214**	**$280**	**$291**	**$326**	**$309**
% increase in OMA		0%	31%	36%	52%	44%
Score	*3.0*	*5.0*	*2.0*	*1.6*	*0.0*	*0.8*
Annual Cost per kL of water produced ($/kL)		**$1.41**	**$1.86**	**$2.28**	**$2.47**	**$2.20**
% increase in cost		0%	33%	62%	76%	56%
Score	*1.0*	*5.0*	*2.9*	*0.9*	*0.0*	*1.3*
Water consumption per assessment (kL/year)		**171**	**144**	**84**	**84**	**84**
% reduction		0	16%	51%	51%	51%
Score	*1.0*	*0*	*1.5*	*5.0*	*5.0*	*5.0*
Increase in System Drought-Proofing						
Drought Management Plan implemented		0	1	1	1	1
Score	*2.0*	*0*	*5.0*	*5.0*	*5.0*	*5.0*
Satisfaction of remaining pre-requisites for grants from DEUS (DMP and DrMP)						

Measures	Criteria Weighting	Base Case	Traditional	Integrated 1	Integrated 2	Integrated 3
Drought Management Plan and Demand Management Plan implemented		1	2	2	2	2
Score	*3.0*	*3*	*5.0*	*5.0*	*5.0*	*5.0*
Improvement in water quality in Yass River through increased level of effluent treatment and reduction in pollution from on-site systems and stormwater						
% of samples complying with Interim WQO		40	60	70	75	75
Score	*1.0*	*2.7*	*4.0*	*4.7*	*5.0*	*5.0*
Catchment improvements implemented ($/assessment) through stormwater and catchment levy		**$5.69**	**$27.62**	**$68.30**	**$68.30**	**$68.30**
Score	*1.0*	*0.4*	*2.0*	*5.0*	*5.0*	*5.0*
Implementation of measures to achieve Yass River Flow Objectives		**0**	**1**	**1**	**1**	**2**
Score	*3.0*	*0*	*2.5*	*2.5*	*2.5*	*5.0*
Levels of Service (water supply quantity for Bowning and Binalong) achieved						
LOS achieved		0	1	1	1	1
Score	*3.0*	*0*	*5.0*	*5.0*	*5.0*	*5.0*
Compliance with ADWG (%)		**96**	**100**	**100**	**100**	**100**
Score	*3.0*	*4.8*	*5.0*	*5.0*	*5.0*	*5.0*
Improvement in Yass STP effluent quality (%)		**70**	**70**	**70**	**80**	**90**
Score	*3.0*	*3.9*	*3.9*	*3.9*	*4.4*	*5.0*

Measures	Criteria Weighting	Base Case	Traditional	Integrated 1	Integrated 2	Integrated 3
Replacement of raw water extraction with alternative water sources (effluent, stormwater etc) (ML/a effluent reused)		**160**	**160**	**160**	**416**	**657**
% replacement (of total raw water extracted)		9%	10%	12%	30%	47%
Score	*2.0*	*0.9*	*1.0*	*1.2*	*3.2*	*5.0*
Asset Replacement Program ($'000)		**$3,839**	**$5,530**	**$5,530**	**$5,530**	**$5,530**
% of total renewals required		69%	100%	100%	100%	100%
Score	*3.0*	*3.5*	*5.0*	*5.0*	*5.0*	*5.0*
Uptake of water efficient technologies (% of accounts)		**0**	**5**	**25**	**25**	**25**
Score	*1.0*	*0*	*1.0*	*5.0*	*5.0*	*5.0*
Percentage of on-site systems improved or replaced with reticulated sewerage or best practice technologies		**12%**	**12%**	**12%**	**37%**	**37%**
Score	*1.0*	*2*	*1.6*	*1.6*	*5.0*	*5.0*
Capital cost over thirty years (NPV $'000)		**$50,252**	**$56,875**	**$56,575**	**$59,990**	**$50,649**
Operating cost over thirty years (NPV $'000)		**$28,229**	**$36,971**	**$38,336**	**$42,987**	**$40,743**
TBL Score		**10.9**	**12.6**	**13.1**	**11.9**	**15.8**
Ranking		**5.0**	**3.0**	**2.0**	**4.0**	**1.0**

Appendix K

Capital Works Programs and OMA Schedules for Alternate Preferred Scenario

050626 Yass Valley Council IWCM

Capital Works Program Water - Integrated Case 1A
2005
All values are in year 2005 $'000

Asset	Type of works				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Improved LOS	New System Assets	Renewals	30 year total	2005/06	2006/07	2007/08	2008/09	2009/1(	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/2!	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
					2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
YASS																																		
Yass Dam																																		
Off-creek dam investigations		100%		150		150																												
Off-creek dam design/construction		100%		7,800			2800	5000																										
Yass River flow gauging (2 locations)		100%		60	25	35																												
Dredging investigation		100%		100	100																													
Earthquake study		100%		60	60																													
Movement study		100%		15		15																												
Dam storage survey		100%		30	30																													
Raising dam wall engineering studies		100%		250	75	100	75																											
Raising dam wall design/construction		100%		11,000				3000	4000	4000																								
Treatment																																		
Water Softening (provisional)	100%			3,000						1500	1500																							
Filtration plant augmentation		100%		8,000																1600	6400													
Install walkway over WTP filters		100%		35		35																												
Distribution																																		
Trunk mains under Yass River		100%		200					200																									
Mount St WPS - raw water pumps		100%		120					60	60																								
Chlorine dosing facility to Morton reservoir		100%		20		20																												
Provide standpipe to supply at O'Connor Parr		100%		20				20																										
RENEWALS - ALL SYSTEMS																																		
Yass Dam			100%	5,100	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170
Bores			100%	24	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
WTP			100%	995	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
Pump Stations			100%	200	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	4
Reservoirs			100%	1,435	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48
Trunk & Gravity Mains			100%	2,154	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80			
Telemetry			100%	26	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Augmentation																																		
Emergency bore connections (50% subsidy	100%			1,780	356	712	712																											
New water supply (incl. main, pump st, retic	100%			20,000											7000	13000																		
Treated Effluent Reuse																																		
All effluent to river, then 160 ML/y to park/ golf courses		100%		2,146				446	1700																									
Demand Management																																		
Pricing, education & BASIX (No capital cost)																																		
MURRUMBATEMAN																																		
Treatment																																		
Investigations to determine alternate source	100%			132				132																										
Distribution																																		
Renewals																																		
Augmentation																																		
WTP 0.9 ML/d (cl only) (35% subsidy over c	100%			1,406			281	1125																										
Demand Management																																		
Stormwater Harvesting																																		
GUNDAROO																																		
Treatment																																		
Distribution																																		
Renewals																																		
Augmentation																																		
Groundwater study	100%			130					130																									
Water supply concept/design/construction	100%			2,770						520	250	1500	500																					
Demand Management																																		
Stormwater Harvesting																																		
BOWNING/BINALONG																																		
Treatment																																		
Distribution																																		
1.1ML/d microfiltration plant + telemetry system update		100%		1,733							343	1390																						
Renewals																																		
Binalong 1.8 ML reservoir replacement			100%	582						116	466																							
Augmentation																																		
Demand Management																																		
Villages																																		
Treatment																																		
Distribution																																		
Villages water main extensions		100%		80		20		20			20		20																					
Renewals																																		
Augmentation																																		
Demand Management																																		
Stormwater Harvesting																																		
Total				71,547	985	1,426	4,207	10,082	6,429	6,535	2,918	3,229	859	339	7,339	13,339	339	339	339	1,939	6,739	339	339	339	339	339	339	339	339	339	339	259	259	257
Improved LOS				29,218	356	712	993	1,257	130	2,020	1,750	1,500	500		7,000	13,000																		
Other New System Assets (growth v				31,819	290	375	2,875	8,486	5,960	4,060	363	1,390	20							1,600	6,400													
Renewals				10,510	339	339	339	339	339	455	805	339	339	339	339	339	339	339	339	339	339	339	339	339	339	339	339	339	339	339	339	259	259	257
Other Grants (Yass borehole & Murr				1,144	150	300	300	394																										

Water Integrated Case 1A - OMA and Revenue Overrides (increases in current expenditure) (2005/06$'000)

				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
		03/04	04/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Additional capital works in Integrated Case 1																																	
Dam raise by 3 m (1,590 ML capacity increase) - Not additional OMA, with existing facilities				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Off river storage 500 ML capacity increase																																	
Operation	ope							30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Maintenance	mai							20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Engineering/supervision	eng							20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Energy	ene							181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181
WTP Add GAC / PAC units (13 ML/d)																																	
Chemical (Operation)	che			5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Maintenance	mai			4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Energy	ene			15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
Yass Emergency bore connections																																	
Operation	ope						30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Energy	ene						3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Yass efluent to river, then 160 ML/y to park/ golf courses																																	
Operation	ope								42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4
Maintenance	mai								42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4	42.4
Energy	ene								1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Murrumbateman WTP 0.9 ML/d (cl only)																																	
Maintenance	mai							35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2
Energy	ene							30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6
Operation (Microfiltration, sampling, testing)	ope							18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2
Chemical costs	che							9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Engineering/supervision	eng							60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Gundaroo water supply																																	
Maintenance	mai										8.15	8.15	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3
Energy	ene										2.05	2.05	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Operation (Microfiltration, sampling, testing)	ope										3.35	3.35	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
Engineering/supervision	eng										30	30	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Binalong 1.1ML/d microfiltration plant + telemetry system update																																	
Maintenance	mai											39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1
Energy	ene											37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4
Operation (Microfiltration, sampling, testing)	ope											21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1
Engineering/supervision	eng											60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Binalong 1.8 ML reservoir replacement				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Additional OMA expenditure in Integrated Case 1																																	
DSS																																	
Administration (Pricing + rainwater tank + education + sho	adm			43	74	75	102	78	79	81	82	108	85	86	88	89	115	91	92	93	95	121	97	98	99	100	126	43	43	43	43	68	43
Operation (UFW reduction)	ope			114	114	114	114	114	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41
DSP review after adopting IWCM / Regular update (all admin costs)	adm					8					8					8					8					8					8		
SBP & Pricing review after adopting IWCM / Regular update (all admin	adm					10					10					10					10					10					10		
Demand management plan update (all admin costs)	adm					15					15					15					15					15					15		
Drought Management plan preparation in consistenci with other strategic	adm					20					20					20					20					20					20		
Boreholes audit & water quality monitoring in Murrumbateman water sou	ope				14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14

Water Integrated Case 1 - OMA and Revenue Overrides (increases in current expenditure) (2005/06$'000)

	30 Year TOTAL	03/04	04/05	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
				2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Administration	13,777	250	267	401	366	457	394	375	382	386	447	426	412	423	426	487	466	452	465	465	526	506	491	504	500	559	538	465	477	468	526	503	488
Engineering & Supervision	9,076	45	44	116	116	117	119	201	205	204	237	299	331	336	337	339	342	344	349	349	352	354	356	361	360	362	365	367	370	369	371	373	375
Operations Expenses	16,258	217	229	424	402	427	471	551	466	470	478	505	549	520	526	532	537	543	549	555	561	567	613	575	581	585	591	595	598	602	606	611	662
Maintenace Expenses	14,436	228	233	255	262	267	272	338	392	403	420	467	481	487	493	499	505	511	517	523	529	535	541	547	553	559	565	571	577	583	589	595	601
Energy Cost	8,337	23	28	46	47	48	52	265	267	268	271	309	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332
Chemical Cost	1,569	57	54	30	31	32	33	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
Purchase of Water	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Expenses	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	63,453	820	855	1,271	1,223	1,348	1,340	1,773	1,755	1,775	1,899	2,054	2,133	2,129	2,146	2,224	2,219	2,221	2,253	2,267	2,344	2,340	2,381	2,369	2,378	2,452	2,448	2,388	2,414	2,416	2,488	2,480	2,526