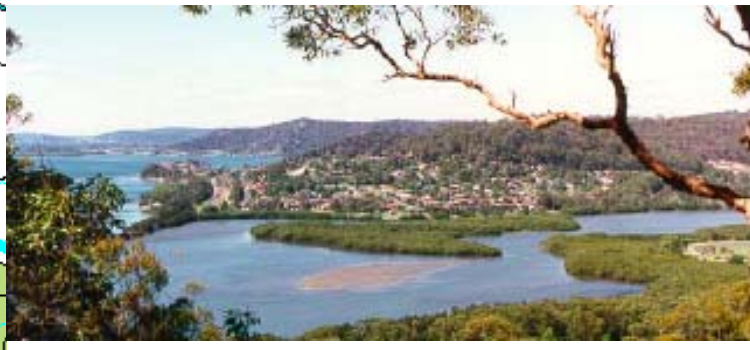
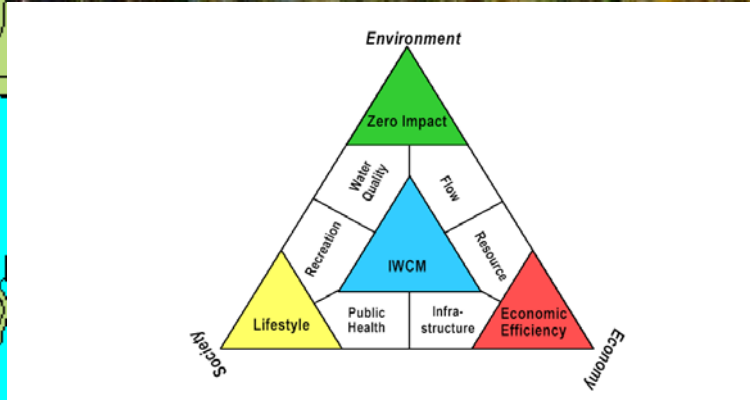
Meeting the challenge





Gosford City Council

Integrated Water Cycle Management Study

Phase 2: IWCM Sub-Plan

July 2007

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Quality Assurance Statement			
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Revision Schedule					
Revision	**Date**	**Description**	**Prepared**	**Reviewed**	**Approved**
Rev A	May 2007	Draft	Carly Price Kate Smolenska	Emma Pryor	Adam Joyner
Rev B	August 2007	Final report	Toby Gray	Caine Mertens	Caine Mertens

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Abbreviations

ABS	Australian Bureau of Statistics
ADWF	Average dry weather flow (wastewater)
ASS	Acid sulphate soils
BASIX	Building Sustainability Index
BOM	Bureau of Meteorology
CMA	Catchment Management Authority
CPI	Consumer Price Index
DCP	Development Control Plan
DEC (EPA)*	NSW Department of Environment and Conservation (formerly Environment Protection Authority)
DEUS	NSW Department of Energy, Utilities and Sustainability
DNR (DIPNR)*	NSW Department of Natural Resources (formerly Dept. Infrastructure Planning & Natural Resources)
DOC (DPWS)*	NSW Department of Commerce (formerly Dept. of Public Works and Services)
DOP (DIPNR)*	NSW Department of Planning (formerly Dept. Infrastructure Planning & Natural Resources)
DSS	Decision Support System – a combined end use and least cost planning model
GCC	Gosford City Council
GIS	Geographical information system
GWCWA	Gosford/Wyong Councils' Water Authority
IWCM	Integrated Water Cycle Management
LGA	Local government area
LWU	Local water utility
NPV	Net present value
OMA	Operation, maintenance and administration costs
PRG	Project Reference Group – representing water management and community stakeholders
PWWF	Peak wet weather flow (wastewater)
STP	Sewage treatment plant (or wastewater treatment plant)
TN	Total nitrogen
TP	Total phosphorus
TSS	Total suspended solids
UFW	Unaccounted-for-water
WELS	Water Efficiency Labelling and Standards (system)
WMA	The *Water Management Act 2000*
WP2050	*WaterPlan 2050* – GWCWA's long term water resource plan
WSC	Wyong Shire Council
WSUD	Water Sensitive Urban Design
WTP	Water treatment plant (or Water Filtration Plant)

* In April 2007, the names of NSW state government agencies were changed. The names of agencies that were applicable during the development of the study have been adopted in this report.

EXECUTIVE SUMMARY

Gosford City Council (GCC) has prepared an Integrated Water Cycle Management (IWCM) Sub-Plan to explore options for sustainably managing the provision of water supply, sewerage and stormwater services. This report documents the local IWCM scenarios developed for GCC.

Integrated Water Cycle Management Process

IWCM is a new best practice approach to water utility strategic planning. It is a requirement of the NSW Department of Energy, Utilities and Sustainability's (DEUS) *Best Practice Management of Water Supply and Sewerage Guidelines* 2004 (the IWCM guidelines) and forms part of a range of initiatives by the NSW Government to improve water management across the state. A distinctive feature of the IWCM Strategy process is the consideration of opportunities arising through integrated approaches to management of urban water services, such as water reuse and conservation approaches.

The IWCM planning process was initiated adopting the DEUS IWCM guidelines and included consideration of bulk supply and local integrated opportunities for both GCC and Wyong Shire Council (WSC) areas. However, due to Council's bulk supply strategic planning efforts being fast-tracked with the current drought, the IWCM process has now been split into two parts:

1. IWCM Sub-Plans (of which there will be two, one each for Gosford and Wyong). These plans focus on identifying and assessing (against the triple bottom line) water efficiency and local sewage, stormwater and greywater recycling options that could be put in place in each local government area; and

2. *WaterPlan 2050,* which is focused on identifying surface water sources and bulk (or large scale) alternative water sources, such as head works augmentation.

The Sub-Plans and *WaterPlan 2050* are to be agglomerated into a single strategic water planning tool to be known as *WaterPlan 2050 – IWCM Strategy for the Central Coast*, to be developed by GWCWA.

This Sub-Plan has been prepared in consultation with stakeholders. To facilitate stakeholder consultation, a Project Reference Group (PRG) representing Council, community, government agencies and other stakeholders was formed to help guide this project.

Water cycle issues requiring management were identified through a desktop review process and consultation with stakeholders. The development of the IWCM Sub-Plan has considered localised options to address water cycle issues (tabled within this report).

Management Options

Options for consideration in developing scenarios that addressed the issues raised were identified through previous studies, including the *Concept Study*, and the PRG (Goals and Options Workshop) and the Project Team. The options outlined are applicable by the Water Utility, Gosford Council as well as the Catchment Management Authority. It should be noted that this sub-plan is only concerned with options potentially implemented by GCC. Other bulk water supply options relevant to the water utility will be reviewed within WP2050.

Assessment of Management Options

The PRG undertook an initial assessment of the water cycle options to identify those options recommended by stakeholders and aid in the development of the proposed water cycle scenarios.

Scenario Establishment

Based on the outcomes of the detailed option assessment, five IWCM scenarios were built illustrating increasing levels of integration between the urban water services. The scenarios established are set out in the following table.

Water Management Option	Traditional Scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Sewage Collection and Treatment					
Improved Sewage Treatment Plant treatment				✓	✓✓
Improved trade waste management		✓	✓	✓	✓
Infiltration and inflow reduction program		✓	✓	✓	✓
Sewerage backlog and extension	✓	✓	✓	✓	✓✓
Smart sewers (low inflow and infiltration)			✓	✓	✓
Conservation					
Government initiated programs (WELS & BASIX)	WELS	✓	✓	✓	✓
Community IWCM education		✓	✓✓	✓✓	✓✓
Fixture retrofits and rebates		✓	✓✓	✓✓	✓✓
Rainwater tanks in new developments			✓	✓	✓✓
Enhanced pricing			✓	✓	✓✓
High water user audits		✓	✓	✓	✓
Leakage reduction program	✓	✓✓	✓✓✓	✓✓✓	✓✓✓
Source Substitution					
Stormwater harvesting and reuse			✓	✓✓	✓✓
Promotion of on-site greywater recycling		✓	✓	✓	✓
Recycled water use through a "third pipe" system			✓	✓✓	✓✓✓
Urban stormwater					
Current initiatives		✓	✓	✓	✓
Water sensitive urban design DCPs		✓	✓	✓	✓
Current flood mitigation works in key areas	✓	✓	✓	✓	✓
Catchment					
Current catchment initiatives		✓	✓	✓	✓
Improved catchment activities			✓	✓	✓

Water Management Option	Traditional Scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Improved monitoring, legislation, system efficiency, design and funding			✓	✓	✓

Note: Increasing number of ticks represents an increasing intensity and application of the water management option.

The scenarios established were modelled in terms of their impact on the following:

- Potable water demands;
- Wastewater flow generation;
- Proportion of demand management achieved by water conservation and source substitution; and
- Urban pollutant loads.

Scenario Comparison and Recommendations

The information assembled and developed in this report, together with *WaterPlan 2050* provides the basis for GCC's contribution to the development of the *WaterPlan 2050 – IWCM Strategy for the Central Coast*. This information includes description of water management options, capital works and operational expenditure plans, and stakeholder recommendations.

It is important to note that *WaterPlan 2050* has been developed on the assumption that future annual water demands for the Gosford-Wyong water supply system will be reduced by approximately 14% through the implementation of water saving measures. With the exception of the Traditional Scenario, all of the scenarios in this Sub-Plan fulfil Gosford's contribution to this requirement.

A summary of key recommendations for development of the IWCM Strategy, applicable to all integrated scenarios, are set out in within the body of this report. The capital works program and schedule of operation, maintenance and administration expenses associated with the scenarios are included in a separate report document titled, *Gosford City Council Capital Works Estimates, April 2007.*

Scenario Adoption

This strategy has identified a number of scenarios which satisfies the original water saving target set within *WaterPlan 2050*. This strategy shows that Scenario 1 reaches the water saving targets set by *WaterPlan 2050* for the least cost to GCC. Gosford City Council and the DEUS have expressed a preference for Scenario 1.

Monitoring and review

The monitoring and review processes recommended in association with the IWCM Strategy implementation are tabled below.

Implementation Key Sensitivities and Monitoring Actions

Key Sensitivities of Scenarios	Key Monitoring Actions
Customer response to pricing increases. Price signals may be insufficient to cause changes in customer behaviour. Customers may not reduce their use of water as forecast.	Water consumption records, drawn from customer billing information, should be monitored and climate-corrected quarterly following the introduction of price increases with the aim of quantifying the savings achieved.
Effectiveness of BASIX. As a relatively new regulatory regime, the actual impact of BASIX on consumption is not well understood. Enforcement of the regulation is generally only possible during development approval processes.	Tag customers impacted by BASIX in the customer database such that actual data on their consumption can be tracked on a quarterly basis to determine the on-going success of BASIX.
Effectiveness of the existing and planned recycled effluent initiatives. The schemes currently in place and planned for the GCC LGA are relatively new. The long-term potable demand substituted by these initiatives may vary from the theoretical replaced consumption assumed.	Tag customers utilising these schemes and monitor quarterly both their potable and treated effluent consumption. Reconcile against historical consumption records.
Population growth. The rate of population growth may differ from that assumed in the forecast. Demand forecasts are sensitive to changes in growth rates and dwelling types.	Annually track changes in growth rates and dwelling composition.
Climate change. Initial modelling of mid-range climate changes applied to Gosford's demand responses suggests demand forecasts may increase by 5%.	Track climate change modelling at the international and national level and revise forecasts as new information comes to light.

The Next Steps

Implementation of the Strategy will include on-going monitoring and review. Future IWCM strategies will be developed to monitor and review the current IWCM. These strategies will be developed within the review period outlined by the IWCM guidelines.

The recommendations made in the IWCM Sub-Plan, provide the framework for the sustainable management of GCC's local urban water services into the future. For successful implementation, it requires on-going support by Council, the community and relevant government agencies.

1 INTRODUCTION

Council has embarked upon the preparation of an Integrated Water Cycle Management (IWCM) Strategy Study to explore options for sustainably managing the provision of water supply, sewerage and stormwater services. This report documents the IWCM scenarios for Gosford City Council (GCC).

This report documents the IWCM scenarios for Gosford City Council.

This section sets out the objectives of this planning process and background information important to the strategic planning process.

1.1 IWCM Objectives

IWCM is a best-practice approach to local water utility (LWU) strategic planning. It is a requirement of the Department of Energy, Utilities and Sustainability (DEUS) *Best Practice Management of Water Supply and Sewerage Guidelines 2004* (IWCM Guidelines) and forms part of a range of initiatives by the NSW Government to improve water management for LWUs. Although considered a major utility, rather than a LWU, GCC have committed to this best-practice initiative.

IWCM is a way of integrating the three urban water services of water supply, sewerage and stormwater to ensure water is utilised optimally, now and in the future. It does this by considering potential savings across the urban water services. IWCM also looks at integrating the provision of urban water services with the management of the water supply catchment and water resources.

An IWCM planning process considers issues such as:

- Future town water and service needs;
- The availability of water including rainwater, effluent and stormwater; and
- Other water users, including the environment and future generations.

To identify water cycle management issues, the IWCM approach involves community, government regulators and water utility input. Once water cycle issues have been identified, strategies to manage them can be developed.

There are often many different ways in which to manage issues. To identify the most appropriate solutions for local circumstances, the IWCM approach involves a collaborative triple bottom line (TBL - economic, environmental and social) assessment of the strategies developed.

The IWCM planning approach is recognised as best-practice for the management of water supply, sewerage and stormwater services.

IWCM is important because it helps to:

1. Balance the needs of water users, including towns and the environment (a whole of water cycle approach).
2. Reduce the pressure on water resources by ensuring a wide range of water sources, including rainwater, stormwater and treated effluent, are considered.

3. Ensure that the measures for supplying urban water services into the future are put in place.

4. Integrate catchment management and urban water service provision.

5. Make sure that local communities can participate in the planning and delivery of urban water services.

The GCC IWCM Sub-Plan contains:

1. A summary of the water cycle management issues facing Gosford.

2. Five scenarios illustrating the possible ways that the local urban water services of Gosford can be provided in the future.

3. An economic, environmental and social assessment of the costs and benefits of each scenario.

4. A capital works plan for implementing the selected scenario.

5. The technical engineering assessments utilised in developing the scenarios.

The objective of this project is to develop an IWCM Sub-Plan to help the Gosford community and GCC to address their immediate urban water challenges and to decide how their urban water services will be provided sustainably in the future.

1.2 The Integrated Water Cycle Management Process

The DEUS *Integrated Water Cycle Management Guidelines 2004* set out a two-step process for IWCM planning:

- **Concept Study:** a scoping study to provide the context for urban water services and identify urban water cycle issues. For Gosford, this study was completed in November 2006.

- **IWCM Strategy:** to develop a balanced, long-term planning strategy to address urban water cycle needs. This document will constitutes a step towards this requirement.

As discussed further in Section 1.3, for Gosford and Wyong, the IWCM Strategy step has been altered to result in the development of an IWCM Sub-Plan. Although only local water management options (i.e. water supply, sewerage and stormwater management excluding bulk supply options) are to be under consideration in development of the IWCM Sub-Plan, the general process of developing the plan is consistent with the IWCM Strategy process summarised in Figure 1-1.

The Gosford IWCM Sub-Plan considers local water management options as WaterPlan 2050 has considered all bulk water supply options.

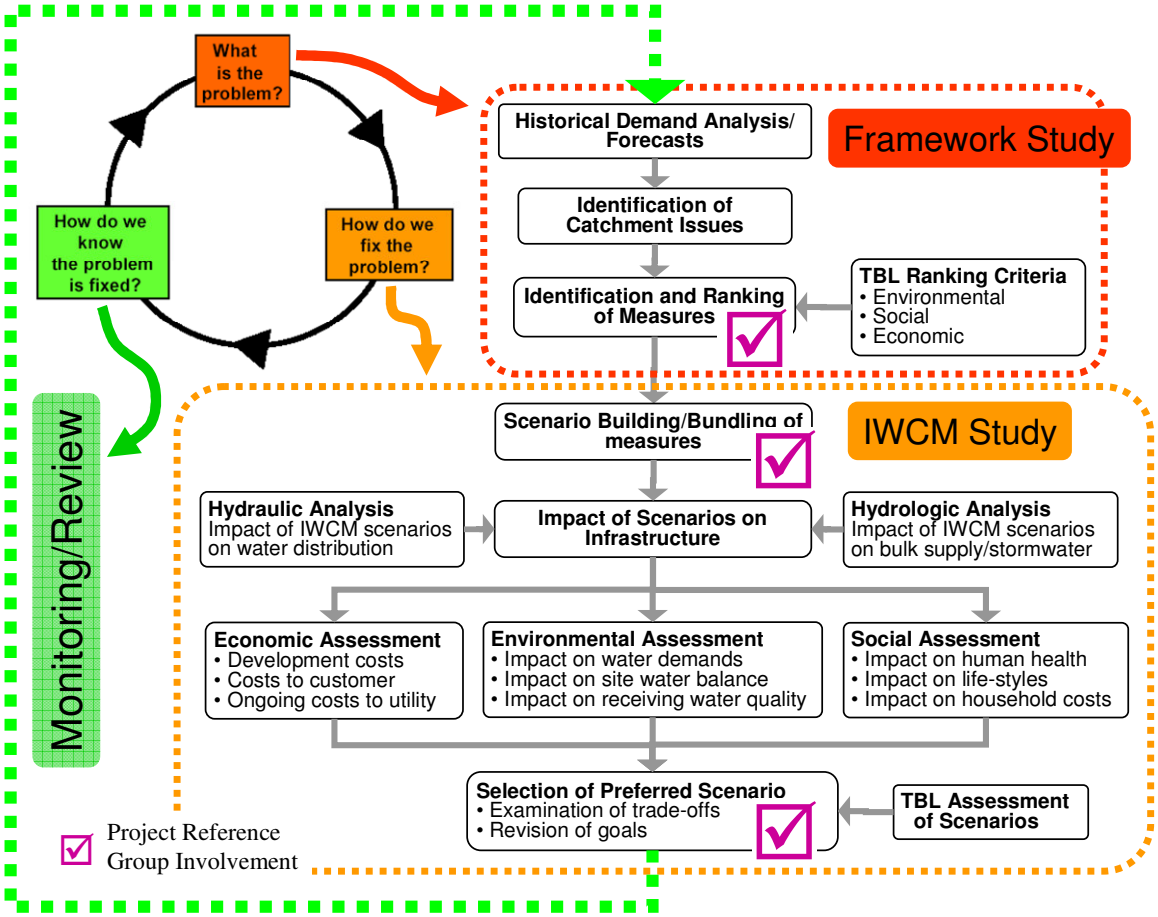


Figure 1-1: The Integrated Water Cycle Management Planning Process

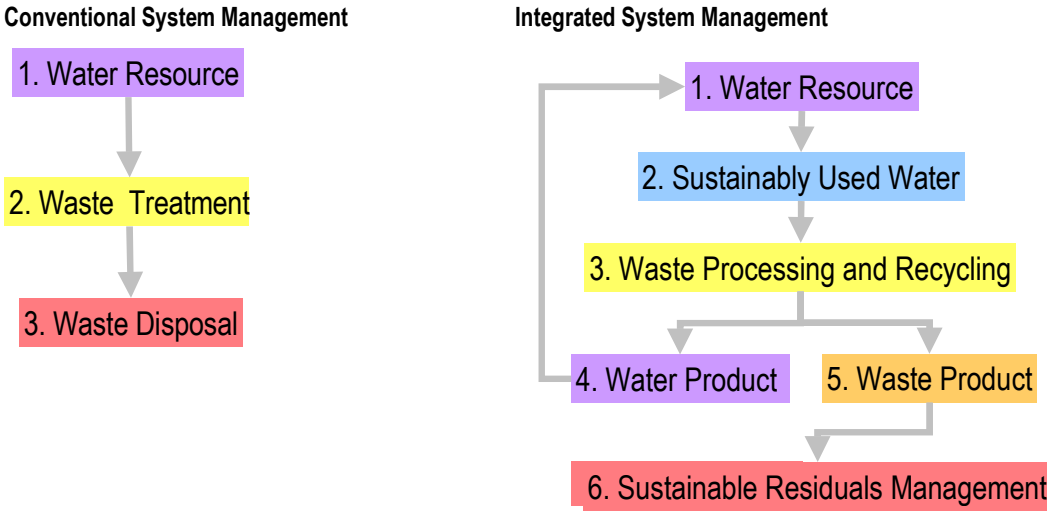
IWCM offers the opportunity to examine urban water supply, wastewater and stormwater management in a single planning framework, in a whole of catchment context. This approach is possible through recent advances in information management and analysis and seeks to avoid the piecemeal development of water supply, wastewater and urban stormwater facilities that has occurred in the past.

IWCM offers the opportunity to examine urban water supply, wastewater and stormwater management in a single planning framework, in a whole of catchment context.

Conventional water system management, where each element of the water cycle is treated sequentially, has provided us many important benefits. It has provided secure sources of clean water for drinking and use in industry and commerce, as well as treating our waste streams to minimise the impacts on the environment. With increasing population growth, increased awareness of the value of water, effects of a prolonged drought, uncertainties of climate change and more stringent regulatory regimes, we are increasingly becoming aware that conventional water system management does not facilitate consideration of the "big picture". The current system generally uses water only once or not at all in the case of stormwater running off impervious surfaces.

Consideration of all water sources and uses in a single framework creates opportunities for increasing the efficiency of water use and improving management of the water cycle. By examining integrated options for management of the water cycle, we maximise the opportunity to discover new ways of doing things, as well as making ourselves aware of the synergies in all parts of water cycle management.

It is also becoming apparent that current and increasing levels of natural resource use, including water and land uses, are not sustainable. The integrated approach to water management seeks to balance the competing demands on available resources within catchments to develop a strategy to ensure a sustainable water future. It will encourage a shift in system management (Figure 1-2).



- Sequential management of individual water system components
- Limited consideration of 'big picture' and resource utilisation impacts
- Leads to unsustainable outcomes

- Integrated management of all water system components
- Full consideration of 'big picture' and resource management impacts (including triple bottom line)
- Leads to more sustainable outcomes

Figure 1-2: Integrated System Management (DEUS, 2003)

1.3 Background

The GCC IWCM planning process was initiated adopting the DEUS IWCM guidelines and included consideration of bulk supply and local integrated opportunities. However, due to Council's bulk supply strategic planning efforts being fast-tracked with the current drought, the traditional IWCM process has now been split into two parts:

The IWCM Sub-Plans and WaterPlan 2050 will be agglomerated into a single strategic water planning tool to be known as WaterPlan 2050 – IWCM Strategy for the Central Coast.

1. IWCM Sub-Plans (of which there are two, one each for Gosford and Wyong); and

2. *WaterPlan 2050*.

These two parts are to be agglomerated into a single strategic water planning tool to be known as *WaterPlan 2050 – IWCM Strategy for the Central Coast*. This over-arching plan is to be developed separately by the two councils after the completion of *WaterPlan 2050* and the two IWCM Sub-Plans.

Many aspects of sustainably managing the water supply, sewerage and stormwater systems have been considered as part of *WaterPlan 2050* and the objectives and focus of the plan coincide with many of the IWCM planning process objectives and the IWCM Sub-Plan outcomes (for further details see Table 1-1).

WaterPlan 2050 focused on identifying surface water sources and bulk (or large scale) alternative water sources such as groundwater and head works augmentation to ensure that the growing population of the Central Coast has sufficient water to meet their needs for the next 50 years. *WaterPlan 2050* involved ongoing stakeholder participation and consultation through a specially constituted Community Liaison Group. A preliminary draft of *WaterPlan 2050* was exhibited on public display in November 2006 to facilitate community input.

The two councils, in consultation with DEUS, defined the interface between these two studies (Figure 1-3). A 50 year IWCM Sub-Plan has been produced separately for both Gosford and Wyong councils. These plans focus on identifying and assessing water efficiency and local sewage, stormwater and greywater recycling options that could be put in place in each local government area (LGA). These plans have a 50 year planning horizon (from 2005 to 2055). The IWCM Sub-Plans were also prepared with stakeholder input (for further details see Section 1.4).

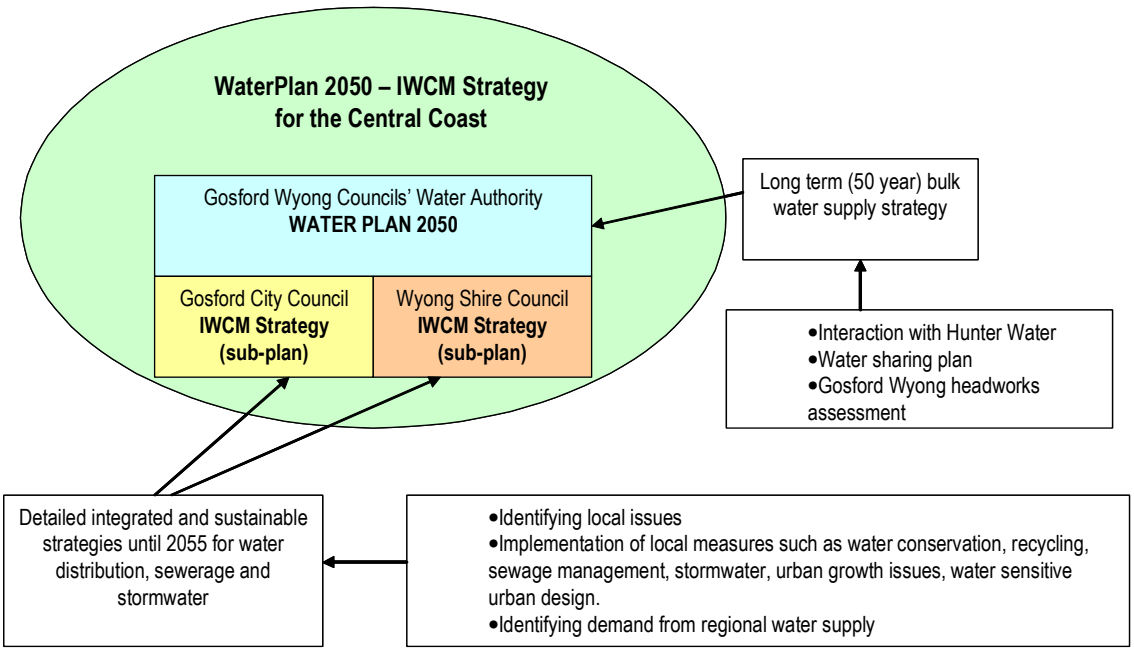


Figure 1-3: Integration of IWCM Sub-Plans into *WaterPlan 2050*

Connecting the WaterPlan2050 and IWCM Processes

Most of the time, run of river flows are harvested to meet the needs of the Gosford and Wyong communities. Mangrove Creek Dam is the only significant storage in the combined water supply scheme, and is drawn upon to supplement water supplies in times of lower river flows. Over the past 10 years, the supplies in this storage have been continuously drawn down.

Mangrove Creek Dam was originally designed to operate in conjunction with transfers from the upper Wyong River. The infrastructure to facilitate these transfers has not yet been constructed. As this dam provides the primary storage for drought security, there has been a need to review the options to facilitate the recovery of the dam. The options fall into two broad

categories: transfers from adjoining surface water sources; and development of alternative water sources.

WaterPlan 2050 has focused on identifying surface water sources and bulk (or large scale) alternative water sources, such as, using groundwater in addition to surface water or stormwater and treated effluent to meet environmental flow requirements.

The outcomes of the IWCM Sub-Plans align with the objectives of WaterPlan 2050.

All of the bulk water options in *WaterPlan 2050* assume that both Wyong and Gosford councils will put in place continuing programs to improve the efficiency of water use and local recycling schemes for the recycling of stormwater and treated wastewater (GWCWA, 2006). It is the role of the IWCM Sub-Plans to identify viable alternative water sources and water efficiency options in each of the Wyong and Gosford LGAs. The outcomes of the IWCM Sub-Plans integrated with the bulk water options considered in *WaterPlan 2050* as illustrated in Table 1-1.

Table 1-1: Alignment of IWCM Sub-Plan Outcomes and *WaterPlan 2050* Objectives

WaterPlan 2050 Objectives	IWCM Sub-Plan Outcomes
Achieve a safe, reliable and secure water supply.	Identification of viable local alternative water sources to assist in improving the security of the supply through diversification of sources.
Ensure the supply and use of water is efficient and affordable.	Assessment of a wide variety of demand management measures to improve the efficiency of water consumption. A TBL based analysis of scenarios to understand their economic, environmental and social contexts.
Protect the health of the rivers and the environment.	Identification of opportunities to reduce urban discharges by reusing treated sewage effluent and stormwater and reduce extractions of water from the environment.
Involve the community in the development and selection of proposed options.	Inclusion of a Project Reference Group (PRG) at all key points in the IWCM Sub-Planning. The group included some members of the Community Liaison Group assisting in the preparation of the *WaterPlan 2050*.
Ensure that the proposed measures can be implemented.	Due consideration of policy, guidelines and legislation in identifying and assessing options to assist in the implementation of preferred measures.

1.4 Stakeholder Consultation in IWCM Planning

The development of the IWCM Sub-Plan included stakeholder consultation. To assist in the identification of water management issues and the evaluation of solutions to those issues, a Project Reference Group (PRG) was formed. The PRG included stakeholders representing community groups, government agencies and Council. Full details of PRG membership and project involvement are set out in Appendix A. The PRG provided a forum for government and community involvement in the development of the IWCM Sub-Plan.

During the Concept Study, the PRG was convened twice:

1. Goals and Options Workshop: the PRG reviewed and verified the issues identified through desktop analysis; identified potential options to address the issues; and, identified TBL criteria against which to assess the options.

2. Options Assessment and Scenario Building Workshop: the PRG undertook a preliminary assessment of options using the TBL criteria and completed preliminary bundling of the options into scenarios. The PRG option preferences, reflected in this preliminary bundling, were considered in the final bundling of options into scenarios (Section 0).

The PRG was convened once during the strategy phase to assess the IWCM Sub-Plan Scenarios. The process and outcomes of this workshop are detailed in Section 3.2.

1.5 The Study Area

The IWCM Sub-Plan study area covers the Gosford LGA (Figure 1-4), which is located on the Central Coast of New South Wales (Figure 1-5), approximately 75 kilometres north of Sydney. The LGA covers approximately 1,028 square kilometres and consists of coastal, flat and hilly terrain. The eastern and western boundaries of the city are defined by the Tasman Sea (South Pacific Ocean) and the old Great North Road between Wiseman's Ferry and Bucketty, respectively. The northern boundary of the LGA is located near the settlements of Kulnura, Central Mangrove, Somersby, Lisarow and Forresters Beach while the southern boundary is defined by the Hawkesbury River.

The Gosford LGA includes numerous urban areas, a major estuary - Brisbane Water, four coastal lagoons, small farming and forested areas, and substantial semi-rural areas. The LGA has a population in excess of 166,000 residents and accommodates a seasonal population increase due to tourism.

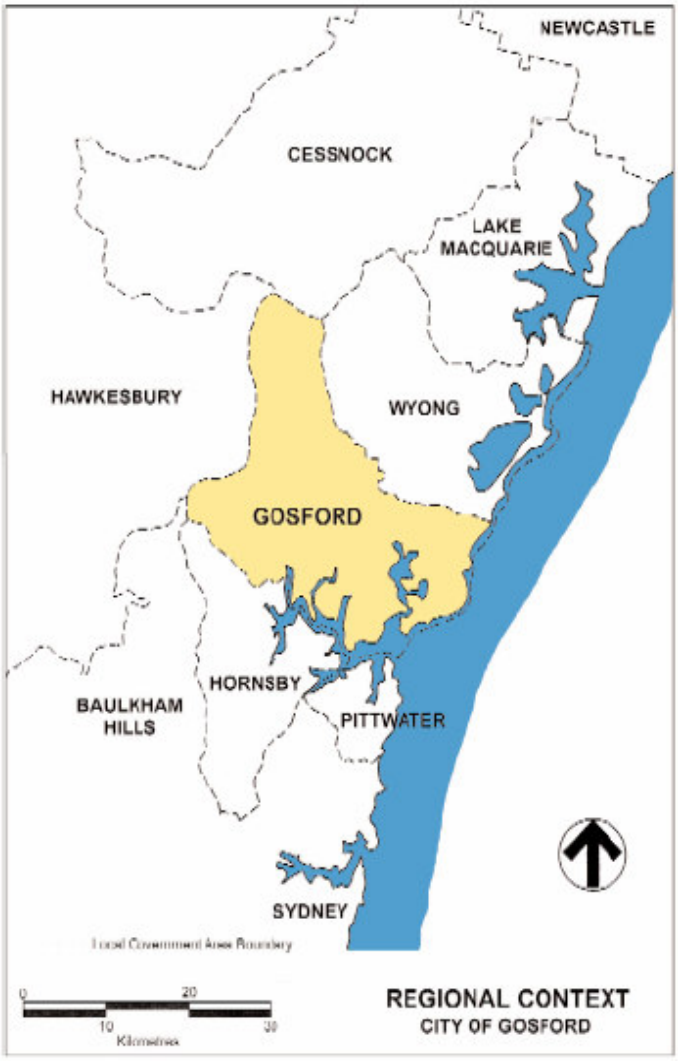
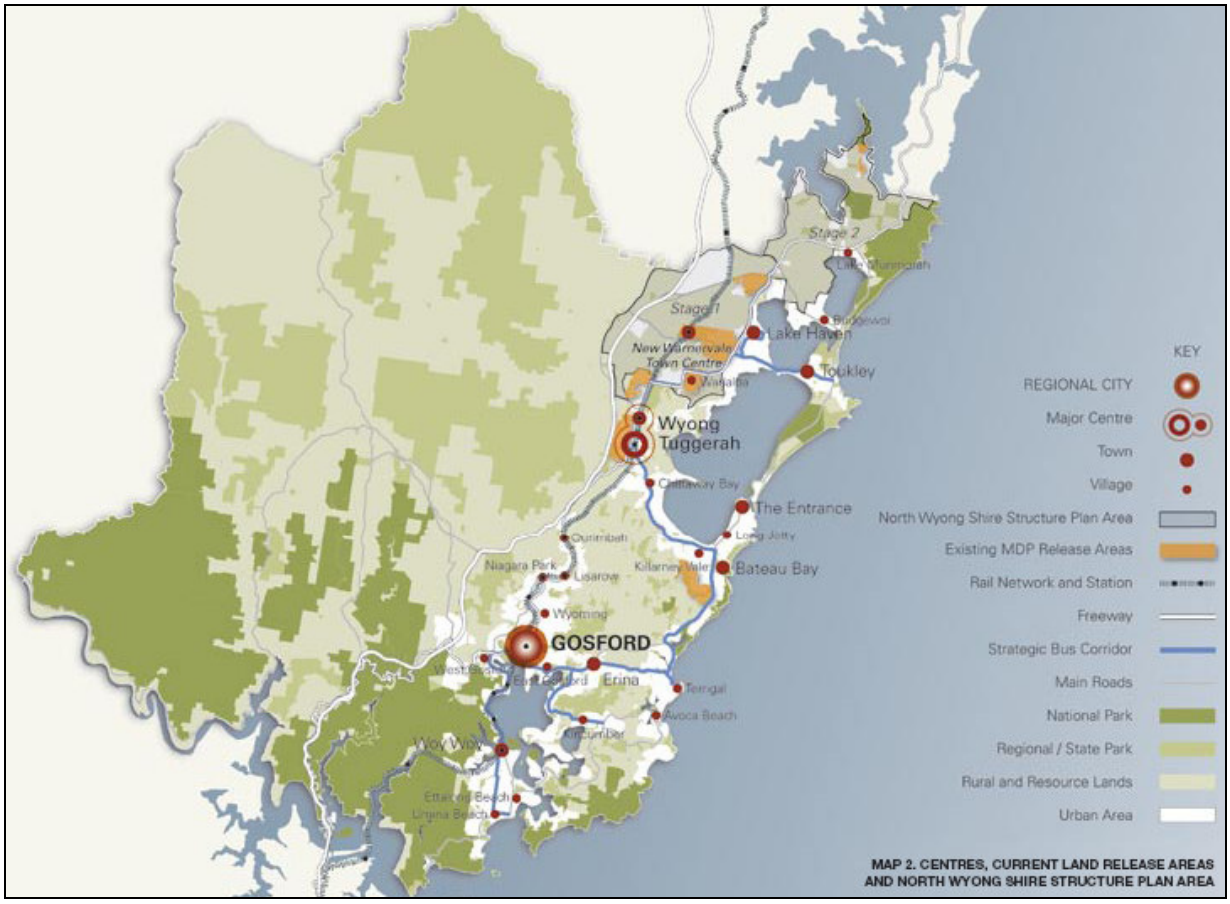


Figure 1-4: Gosford City Council Local Government Area (LGA)



Source: DoP, 2006.

Figure 1-5: Urban Centres and Land Release Areas of the Central Coast

1.6 Water Cycle Issues for Gosford

Water cycle issues were identified in the *Gosford IWCM Concept Study*. These issues were then defined and prioritised by stakeholders in the PRG. The issues are summarised in Table 1-2. The development of the IWCM Sub-Plan considered localised options to address these issues.

Table 1-2: Water Cycle Issues for Gosford

Issue	Description
Climate change through global warming and greenhouse gas emissions	Predicted changes in weather patterns and sea levels will have impacts on the water cycle of GCC.
Nutrients and water quality	Changes to the nutrient and sediment loads within the GCC due to changes in land usage will have potential impact on local ecosystems.
Environmental flows	Potential changes to low flow allocation as per Water Sharing Plans – will be further investigated as part of *WaterPlan 2050*.
Acid sulphate soils	Ecological impacts during construction activities. Degradation of sub-surface infrastructure.

Issue	Description
Salinity	Salinity hazard indicated to be low in Gosford LGA. Irrigation induced water table rise may create problems.
Soil Erosion	Increased nutrient and sediment loads in waterways. Sources include building sites, land clearing and decline in riparian vegetation.
Suitability of soils for effluent reuse application	Some soils in the LGA area may not be suitable for receiving reclaimed water.
Urbanisation	Uncertainty in population growth numbers.
Water demands and water use – Demand management	Expected increase in the permanent residential population will increase water demands. Currently no pricing tiers exist to encourage conservation.
Water demands and water use – Source substitution	Expected increase in the permanent residential population will increase water demands.
Water Supply System - future planning for long-term stability	Reliability of supply is of current concern. Decisions to be made on the supply options for the development of the water supply system will be done as part of *WaterPlan 2050.* Concerns exist over the reliability of water supply data.
Wastewater system	Operational improvements in the waste water system are desirable. Currently only 1% of available sewage is being recycled (DEUS, 2005). Increased recycling schemes may provide opportunities for increased environmental flows and potable water substitution.
Urban stormwater	Urban stormwater management faces numerous challenges including the maintaining environmental quality within waterways as well as upkeep of local stormwater infrastructure.
Flooding	Flooding with GCC is exasperated by urban development and existing drainage infrastructure is in need of upgrades. WSUD is being considered in flood mitigation measures. Funding is a significant issue.
On-site wastewater treatment systems	With increasing rural residential development, more on-site sewage systems may be implemented.

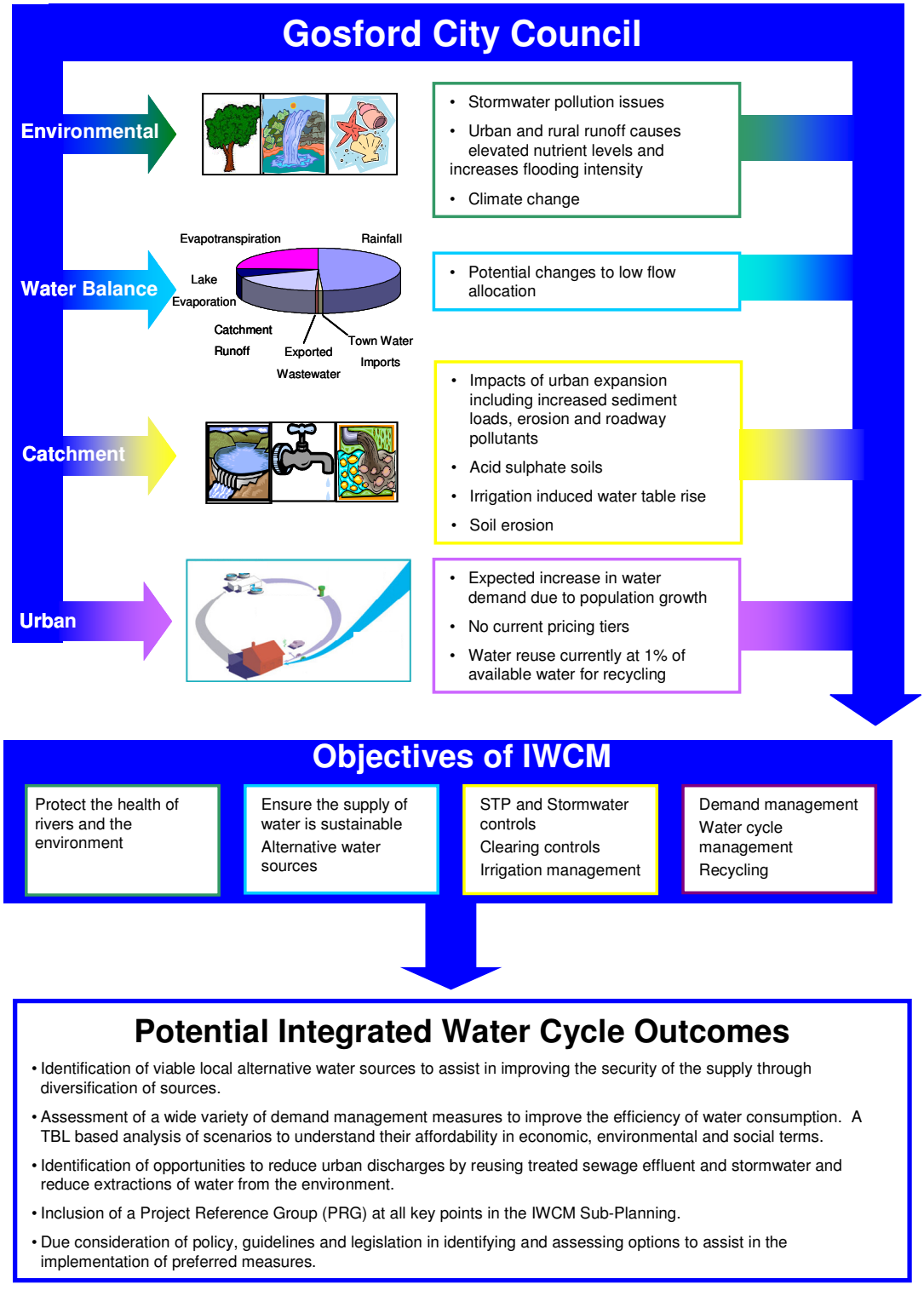


Figure 1-6: Gosford IWCM Issues and Objectives

2 SCENARIO ESTABLISHMENT

This section outlines the establishment of the IWCM scenarios and their associated water cycle projections. Each IWCM scenario represents a combination of water supply, sewerage, stormwater and catchment management options in response to the urban water cycle issues (Table 1-2) identified in the *Gosford IWCM Concept Study*.

This section discusses:

- Stakeholder involvement in establishing scenarios;
- The development of baseline forecasts of water demands and wastewater flows (i.e. flows from STPs) to establish the predicted demands for water if no effort is made to manage demand;
- The investigation and assessment of options to manage each of the issues identified;
- The compilation of five different scenarios of the future of water supply, sewerage and stormwater services in GCC; and
- The impacts of each of these five scenarios in terms of water demand, wastewater generation, urban pollutant loads and capital and operating costs.

2.1 Stakeholder Involvement in Scenario Establishment

Communities are increasingly participating in the choice associated with the provision of urban water services. Community participation in the planning process is considered best-practice and aligns with community needs.

The process of developing the scenarios is summarised in Figure 2-1.

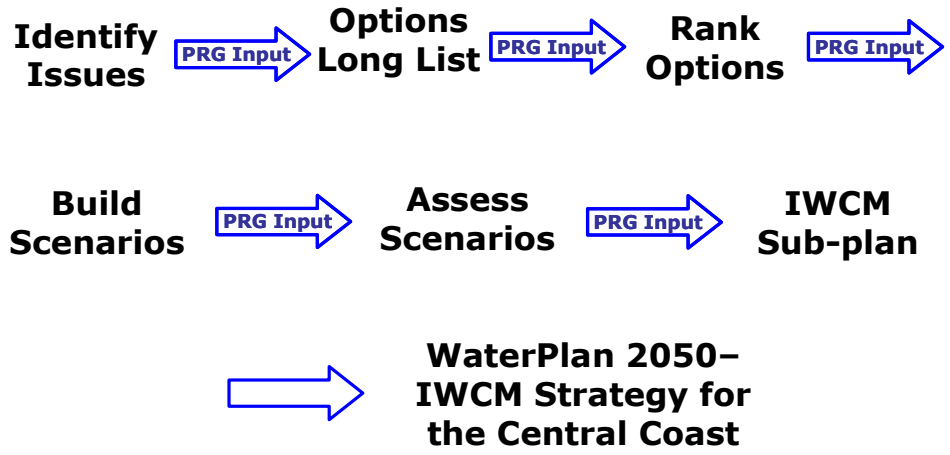


Figure 2-1: IWCM Development Process

During the development of this strategy two PRG workshops were held to gather information from the public and relevant stakeholders. Each of these workshops were designed to

contribute towards the development of the Gosford sub-plan, the following table outlines the objective of each of the workshops held.

Table 2-1 IWCM Strategy PRG Workshops and Objectives

PRG Workshop	Workshop Objectives
Goals and Options Workshop (PRG1 – part of IWCM concept study)	Provide understanding of the IWCM process and PRG role Review the identified IWCM issues Identify PRG IWCM goals and assessment criteria Identify PRG IWCM options
Scenario Bundling Workshop (PRG 2)	Bundle the IWCM options into water cycle scenarios. Confirm the criteria for scenario assessment.
Gosford Sub-plan Adoption (PRG 3)	Introduce IWCM process changes and objectives (in line with integrating the sub-plans into the overarching central coast IWCM). Present analysis of bundled scenarios. Define PRG's assessment of each scenario to be inputted into WaterPlan 2050. Discuss the next steps in developing an integrated strategic plan – WP2050.

Options for consideration in developing scenarios were identified through previous studies, including the *Concept Study*, and by the PRG (Goals and Options Workshop PRG 1) and the Project Team. The options identified by the PRG are set out in Table 2-2). These options were then considered in developing the local IWCM scenarios for GCC.

Table 2-2: Options Identified by the PRG

Issue	PRG Suggested Options
Climate change through global warming and greenhouse gas emissions	See the issue 'Water Demand and Water Use - Source Substitution' for Options
Nutrients and Water Quality	Sewage treatment process upgrade and return flow
	Establishment of buffer zones alongside significant streams

Issue	PRG Suggested Options
	Rehabilitation of existing water courses
	Stormwater treatment ponds/wetlands in new developments
	Stormwater quality treatment detention basins in new developments
	Improved management of contaminated and landfill sites
Environmental Flows	Implement macro water sharing plan
	Purchase of competing licences
Acid Sulphate Soils	No specific options identified – recognise current management approaches
Salinity	Revegetation for dryland salinity effected areas
	Improved monitoring of farming practices
Soil Erosion	Protect and rehabilitate riparian zones in water supply catchment - in conjunction with Catchment Action Plan (CAP)
	Erosion and weed controls - in conjunction with CAP
Suitability of soils for effluent reuse application	No specific options identified
Urbanisation	No specific options identified
Water Demands and Water Use - Demand Management	WELS for all accounts
	BASIX for new residential accounts
	High water users audits for existing non-residential accounts
	Dual flush toilet retrofit for existing accounts
	Washing machine rebate for existing residential accounts
	Residential retrofit of showers and tap flow regulators for existing residential accounts
	Community rainwater tanks for general use in open space areas
	Efficiency controls on showerheads and tapware for new residential accounts
	Mandatory use of rainwater tanks for new development
	Adopt higher BASIX standards for new accounts
	Community IWCM education (promotions/guidelines) for new and existing accounts
	Community education/enhanced land care programs on a catchment level
	Landscaping/native planting controls (reduced garden water) for new accounts
	Enhanced conservation signal in water pricing for all accounts
Water Demands and Water Use - Source Substitution	Agricultural reclaimed water reuse
	Stormwater harvesting/reuse in existing key areas and new developments at a local level
	Retrofit of on-site greywater recycling for existing accounts
	Localised industrial treatment of sewage for existing non-residential accounts
	Retrofit of recycled water system to key existing users
	Extension of retrofit of recycled water system to feasible existing areas

Issue	PRG Suggested Options
	Rainwater tank rebate for existing residential customers
	Rainwater tank retrofit program for existing residential accounts
	Indirect potable reuse
	Stormwater harvesting at catchment scale
	Use effluent to off set environmental flows / return of recycled effluent to point of extraction
	On-site greywater recycling for new accounts
	Include plumbing in new development to allow for greywater
	Improved monitoring of non-town water supplies in existing systems
	Recycled water use through a "third pipe" for new developments
	Develop development control plans (DCPs) for water recycling: dual plumbing for large users, commercial, industrial & open space
	Localised industrial treatment of sewage for reuse in new non-residential developments
	Sewer mining in new open space developments
Water Supply System - future planning for long-term stability	Shared equipment and access funding sources for IWCM activities
	Aquifer storage and recovery
	Sewer mining for existing open space accounts
	Pressure reduction program for existing areas
	Active system leak detection and repair and Red Alert for existing systems
Wastewater system	Improved trade waste management
	Infiltration and inflow reduction program for existing areas
	Decentralised treatment cluster systems for new developments
Urban Stormwater	Stormwater treatment ponds/wetlands for existing areas
	WSUD DCPs for new developments
	Retrofit of WSUD to key existing areas
	Enhanced erosion controls during and after construction
	Smart sewers (low inflow and infiltration) for new developments
	Gross pollutant traps
Flooding	Litter/organics to stormwater reduction (bins)
	Flood mitigation works in key areas
	Detention basins with low flow release
	Traditional detention basins for new developments
	On-site detention in new developments
On-site wastewater treatment systems	Improve on-site systems on a catchment wide basis

During PRG 2 Stakeholders were also involved in defining criteria (Table 2-3) for assessing the relative performance of each of the scenarios with the aim of being able to determine a preferred scenario for implementation.

Table 2-3: Gosford and Wyong IWCM Assessment Criteria

Environmental	Social	Economic
Maintains water quality and minimises negative impact on biodiversity. Prevents long-term depletion of water resources. Is an energy and resource efficient option, and minimises green house gas emissions.	Aids in securing the reliability of water supply. Reduces individual water demand (L/per person/per day). Encourages and promotes society's acceptance of alternate water sources (reuse of grey water, treated water, stormwater, use of groundwater, etc).	Minimises long-term costs of urban water cycle infrastructure. Maintains an affordable water supply ($/ML). Includes economic incentives to use alternative sources of water.

In the second workshop, the PRG also undertook a preliminary bundling of options into scenarios. Each option was discussed and considered using the environmental, social and economic criteria determined by the PRG. This PRG ranking of options was used by the Project Team to understand the preferences of stakeholders with respect to the various management options when bundling options into scenarios.

The assessment completed by the PRG was an initial assessment only, used to rank and understand the preferences of the PRG. A complete TBL assessment was not possible in the sub-plan as the water cycle is not completely represented at this sub-plan's level. Therefore full supply side considerations are not included. The outcomes of the PRG assessment of options are set out in Appendix A.

Drawing on the DEUS guideline framework, and inputs from the PRG, five preliminary local IWCM scenarios were built by the PRG with increasing levels of integration between the urban water services:

1. The Traditional Scenario – the case likely to result from the traditional approach of undertaking separate water supply, sewerage and stormwater investigations and system management[1].

2. Scenario 1 – representing current GCC initiatives.

3. Scenarios 2 to 4 – an increased level of integration between the urban water systems building on Council's current and planned activities, as well as new integrated opportunities.

[1] The Traditional Scenario represents a continuance of historical trends in water management within GCC.

2.2 Baseline Forecasting Assumptions

Water demand analysis establishes a robust understanding of how water is used and moves through the urban water cycle. It is required in order to develop IWCM options, forecast demands and compare the options.

Analysis of historical water usage (including the impact of climate conditions) flow and load generation was made in the *Gosford IWCM Concept Study*. Baseline forecasts were also developed in order to identify potential water management issues. For detailed descriptions of the assumptions the reader is referred to the *Concept Study* report.

The forecast population served with water adopted for this study is plotted below (Figure 2-2). Population forecast figures were obtained from GCC and reflect those figures being used in the development of *WaterPlan 2050*[2]. Since the *Gosford IWCM Concept Study,* the population forecast has been extended, from the original planning horizon of 2035, to 2055. This is consistent with the 50 year planning horizon of *WaterPlan 2050*.

Growth projections for the Gosford LGA show an estimated increase in people to be serviced with water of approximately 50,000 between the Year 2005 and the Year 2055 (Figure 2-2). The projected 2055 figure for residential population served with water within Gosford LGA by 2055 is approximately 210,000 (479,000 for the combined Gosford and Wyong LGAs).

GCC anticipates that most of this growth will occur in urban centres, including Gosford CBD, North Gosford, West Gosford, Woy Woy and Terrigal[3]. Growth is expected primarily through infill and redevelopment, as well as take-up of permanent residential status at holiday houses. No significant greenfield development is expected within the LGA. For the purposes of developing demand and flow forecasts it has been assumed that by 2025:

The majority of new dwellings in Gosford LGA will be created through infill development.

- Gosford CBD will accommodate 10,000 additional residents in medium to high density dwellings;
- Other urban centres will accommodate 15,000 additional residents in medium to high density dwellings; and
- Low density development will accommodate approximately 10,000 additional residents.

Development of demand and flow forecasts has assumed the ratio between new residential dwelling types (single family, semi-detached and multi-family dwellings) to be in line with these projections. Allowance is also made for declining household sizes.

[2] It has been assumed that a 0.5 percent annual growth rate will apply from 2035 until the end of the 50 year planning horizon in 2055.
[3] Based on population data and sketches provided by GCC (D. Clarke, email 9-11-2006).

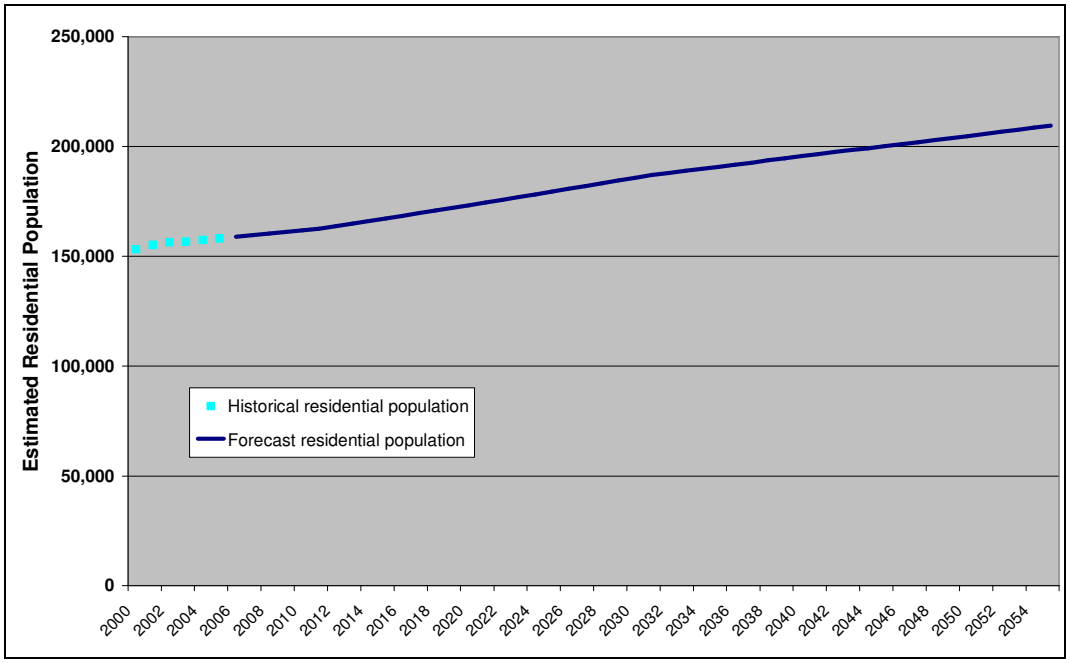


Figure 2-2: Gosford LGA Population Served with Water

Water demand is dependent upon drivers such as demographics, climate and sectoral growth. A summary of the demand drivers considered and overall impact to baseline demands is provided in Table 2-4.

Table 2-4: Impact of Demand Drivers

Driver	Expected Change	Demand Impact		
		Residential	Non-Residential	Per capita
Population and dwellings served	Increase	Increase	No change	No change
Non-residential Growth	Increase in line with residential growth	No change	Increase	No change
Household Size	Decrease, results in increased account formation	Decrease	No change	No change
Vacancy Rate	Decreasing household size with time. Assumption results in more water connections as less residents inhabit each dwelling.	Increase	No change	No change
Housing Mix	No change	No change	No change	No change
Market share of efficient fixtures and appliances	Increase	Decrease	Decrease	Decrease
Household income	No change	No change	No change	No change
Lifestyle	Increase in discretionary water use (residential baths, dishwashers and external, and non-residential external).	Increase	Increase	Increase
Tourism	Increase – below rate of population growth	No change	No change	No change
Climate change	Increase in temperatures, decrease in rainfall	Potential increase	Potential increase	Potential increase

2.3 Preliminary Option Assessment

For the purposes of assessment, the preliminary options identified were categorised as follows:

- Demand management: including both water conservation and source substitution options. These options address issues around water quantity, quality and reliability;
- Stormwater and catchment management activities. These options primarily address issues around catchment and receiving environment water quality; and
- Other water cycle management activities. These options primarily address system monitoring and management to improve knowledge of other issues.

The following sections discuss the process of assessing the options identified by the PRG in Table 2-2 and a series of other options developed by the Project Team. In each of the following sections, the specific issues identified in the concept study phase addressed by the proposed options are identified. The assessment of individual option performance informed the process of building scenarios.

2.3.1 Demand Management Measures

Assessment of water cycle management options requires consideration of the application of each individual option. For most water management options this includes assumptions regarding:

- Extent - the area or number of customers impacted by the activity;
- Efficiency - the water savings or gains associated with the activity; and
- Cost – including initial setup and on-going costs, to both the customer and water utility.

Further, it is recognised that many of the options are inter-related and, when combined, their benefits and costs require their interaction to be considered. For instance, the individual water savings associated with education and rebate programs targeting the same end uses of water (i.e. educating customers to have shorter showers and offering rebates to encourage the replacement of shower roses with more efficient ones) cannot be simply added together. Likewise, reclaimed water reuse approaches require consideration not only of water savings but also catchment advantages and disadvantages.

The Decision Support System (DSS) is the main tool used to assess potable water savings and associated costs of IWCM options, both on an individual basis, and when combined within a scenario. The DSS allows development of forecast water demands and wastewater flows, considering each option's impact on end water uses (i.e. the specific uses towards which water is put such as toilets, washing machines, outdoor use, etc) and hence, on the established baseline forecasts. By combining options into scenarios, a series of forecasts of water demand and wastewater flows can be generated.

In assessing options, the DSS tool allows for consideration of the capital and operating costs associated with each option and the savings in water and energy use (and resulting reduction in carbon generation) as a result of each option. The assessment considers the cost-benefit of each option from the perspective of the utility (in this case GCC), as well as customers and the community as a whole. This allows for the relative cost-benefit performance of each option under consideration to be determined.

There are two different categories of demand management measures that are assessed in the cost-benefit analysis:

1. *Water conservation measures* involve behavioural changes that reduce the consumer's consumption, including education measures and water efficiency fixtures.
2. *Source substitution measures* do not reduce the customer's consumption, but the demand is met by an alternative water source outside of the potable water supply system.

The assumptions used in the DSS to model the potable water savings as a result of implementing individual water conservation and source substitution options are set out in Table 2-5 and Table 2-6, respectively. Where information was available from GCC's existing conservation efforts, it has been used to set the basis for modelling the impacts of the measure. Where information was not available, assumptions have been made on the basis of the number of customers affected and the estimated volume of water used in the targeted end use/s. Numerical assumptions made are conservative.

A hydrological assessment of the impact of rainwater harvesting systems on water demands was undertaken using a multi-variable regression analysis to establish demand variability and a water balance simulation. The simulation estimates the impact of the rainwater tanks of different effective sizes on daily potable water demands. It does this by adopting the average demand forecast for the targeted end use/s, assuming a constant internal demand, estimating the daily external demand variation based on Gosford's water supply multi-variable regression coefficients over 35 years of climate data, and then completing a daily water balance using observed rainfall data. Within the water balance it is assumed that the working rainwater storage is 90% of the tank volume. The roof areas have been varied to represent single family, multi family and semi-detached residences. For more details on the technical background to the simulation, see Appendix B.

Based on this assessment, it is has been assumed that the typical installed household tank size for Gosford LGA adopted for the rainwater options is 5kL. Overall, the reductions are approximately 50% of potable water demand, however, this varied by the dwelling type and end-use application. It has been assumed that rainwater tank demand reductions are negligible under peak demand conditions because during dry periods it is unlikely the tanks would still contain rainwater.

The development of the capital and operating costs of each option detailed in Table 2-6 are set out in the Phase 2, IWCM Sub-Plan – Capex Report.

Table 2-5: Conservation Measures

Option	Description	Data	Assumed Market Penetration	Assumed Water Savings	Assumed Costs
Water Efficiency Labelling Scheme (WELS)	A mandatory water efficiency labelling scheme for toilets, washing machines, shower roses, taps, urinals and dishwashers was initiated in 2005.	Australian Government Department of the Environment and Heritage http://www.waterrating.gov.au/	Assumed to impact on residential customers only. Increase the uptake of efficient washing machines by 10%, low flow showerheads by 10% and efficient tap fixtures by participation of 5% for new accounts and 1% per year for existing accounts. For this study it has been assumed that the WELS scheme will have a negligible impact on toilets sales. This is because the current standard for toilets in Australia is the 6/3 dual flush toilet and that efficiency labelling for toilets is currently almost universal under the voluntary scheme.	Average use reduction of 10% for taps and dishwashers. Showerhead and washing machine savings vary with fixture/appliance types. All assumed to have an annual replacement rate of 8%. Washing machine savings vary with appliance type (annual replacement of 12%):	Cost to utility of $500 per year for enhancement of WELS promotional materials and $3,000 setup. Additional purchase cost to customer of $10 per tap kit and $10 for dishwashers which are assumed to have a 10 year lifetime.

Option	Description	Data	Assumed Market Penetration	Assumed Water Savings	Assumed Costs
Building Sustainability Index (BASIX)	The Building Sustainability Index applies to all new residential development and re-development. Gosford lies within the 40% target savings points area of NSW. The savings can be gained through landscaping, fixtures and alternative water supplies (e.g. rain and greywater).	NSW Department of Planning http://www.basix.nsw.gov.au/	Impacts new residential customers. For this study it is assumed that adequate points will be gained through using efficient taps/sinks, efficient showerheads and rainwater tanks. Taps/sinks impact 90% of new residential accounts.	Average use reductions of 10% for taps. Showerhead savings as per WELS. Efficient showerheads market share change varies for fixture type. Efficient toilets market share change of 10% increase in 4/3 L toilets (with resultant 10% decrease in 6/3 L) in new and replacement market shares. For rainwater tanks assumptions refer to Table 2-6	Cost to utility of $1,000 per year for administration. For rainwater tanks assumptions refer to Table 2-6
Public Education[2]	Public education campaigns on water issues, including funding of education programs in schools (ten grants per year of up to $5,000 per school), shopping centre displays and community forum. Sponsorship of major annual events, as per current initiatives.	As per Report by Technical Advisory Group to Board, 15 November 2006 & Council advice of 17/4/07.	50% of all customers will be influenced by the program. 10 school project grants have been approved, as at November 06.	1 to 5% reduction in all uses except outdoor use which achieves an 8% reduction for participating accounts. Stepped-up education program achieves an extra 2% reduction in outdoor use.	$100,000 setup (Y2005) $144,000/annum

Option	Description	Data	Assumed Market Penetration	Assumed Water Savings	Assumed Costs
Community IWCM Education[2]	An increased level of community education. Council would provide materials, training and technical assistance to implement a comprehensive ongoing community education program focussing on IWCM promotion and guidelines.	Council advice of 17/4/07.	50% of all customers will be influenced by the program.	As above except 10% external saving.	$100,000 setup (Y2008) $269,000/annum
Currently planned price increases	2006-2009 price increases in line with IPART approved figures. Council is currently considering an inclining block tariff and the assumed prices are subject to change.	IPART submissions Gosford City Council - S11033 (T.Thirlwell)	All customers (residential and commercial).	Price elasticity of -0.2 for outdoor and -0.05 for indoor.	$50,000 one-off cost to Council.
Enhanced conservation signal in water pricing - residential	Council will introduce the inclining block tariff for residential users in 2010. Price in the higher block will be approximately 50% more than in the lower block. An increase in revenue will be offset by a reduction in the fixed charge.	IPART submissions Gosford City Council (T.Thirlwell)	All residential customers, targeted at external water use. All customers will respond to pricing signal. Program to start in 2009/10.	Price elasticity of -0.2 for outdoor and -0.05 for indoor.	$50,000 one-off cost to Council.
Enhanced conservation signal in water pricing – residential and non-residential	In 2010, Council will introduce the inclining block tariff for residential users as described above and also include an inclining block in non-residential sectors. Price in the non-res sectors higher block will be approximately 40% more that in the lower block. An increase in revenue will be offset by a reduction in the fixed charge.	IPART submissions Gosford City Council - S11033 (T.Thirlwell)	All customers. Targeted at residential external water use and all non-residential water use. All customers are assumed to respond to pricing signal. Program to start in 2009/10.	Price elasticity of -0.2 for outdoor and -0.05 for indoor.	$50,000 one-off cost to Council.

Option	Description	Data	Assumed Market Penetration	Assumed Water Savings	Assumed Costs
Residential retrofit – taps and showers	Four year program, launched in April 2004. The program provides subsidies for the retrofitting of water efficient appliances, i.e. AAA showerheads, hose trigger nozzles and tap aerators.	From June 2004 – September 2006, 6723 retrofits were booked in total for both GCC and WSC. Program costs: $55,000 pa Source: Report by Technical Advisory Group to Board, 15 November 2006.	Replacement rate of 3% pa for four years for all types of taps and sinks. Replacement rate of 8% pa for all types of shower heads.	10% savings in average and peak conditions	$55,000/annum (based on 1,000 properties in 2006/07) Customer cost of taps and sinks $39 Cost to utility is $30 per showerhead
Residential washing machine rebate	Council to provide a $200 washing machine rebate to customers for water efficient washing machines, in line with current initiatives.	Program expected to issue 1,960 rebates per year (combined figure for GCC and WSC.) Program costs: $170,000 Source: Report by Technical Advisory Group to Board, 15 November 2006	Annual replacement rate assumed to be 12%.	Based on specific machine water demands ranging from 80 to 150L/use.	Costs vary between $600-$1,000, depending on machine type. Will cost Council $200 per rebate issued.
Residential toilets retrofit	High water use model assumed to be replaced within existing developed, as part of renovations or fitting replacements.	None available.	Annual replacement rate assumed to be 5%.	Based on specific flush size, ranging from 3 to 12L/use.	Installation costs vary between $300-$400 of which $35 are paid by the customer (assumption).
High water users audit	Top non-residential users are offered a free audit which includes indoor water conservation measures and development of an irrigation schedule, where applicable. Indoor water savings are realised through low-flow showerheads and taps, toilet water-displacement devices, and leak repair.	Data only available for drought management measures: 5% reduction in water usage by the top 15 water users. Program costs: $20,000 pa/council for both GCC and WSC.	High water users, as identified by Council, assumed as 1 % of non-residential customers per annum. Audit program to run for three years. Target indoor and outdoor use.	10% savings in all targeted water uses except for leakage. Temporary (3y life) 50% leakage saving applied.	Cost to customer of $2,000 per audit. Annual administration cost of $20,000 for the utility.

Option	Description	Data	Assumed Market Penetration	Assumed Water Savings	Assumed Costs
Permanent low level restrictions	Mandatory implementation of water use restrictions for external uses.	No specific data available.	Applies to 75% of new and existing accounts.	10% savings under both average and peak conditions.	Set up costs of $50,000. Annual administration costs of $20,000/yr.
Reticulation System Leakage Detection Program	Program aimed to identify and reduce the level of leakage in the water supply system.	Program began in January, 2004. Includes survey of entire reticulation network. Source: Report by Technical Advisory Group to Board, 15 November 2006	30% of system covered by (x5) pressure management areas. 50% reduction in pressure	29% reduction in leakage flows for areas treated.	Program establishment $10,000. $40,000 cost establishment per pressure management area. Annual on-going costs assumed at 2% of pressure management setup costs.
Enhanced Reticulation System Leakage Detection Program	Stepped-up program aimed to identify and reduce the level of leakage in the water supply system through increased market penetration.	Program began in January, 2004. Includes survey of entire reticulation network. Source: Report by Technical Advisory Group to Board, 15 November 2006	40% of system covered by pressure management areas (x8). 50% reduction in pressure. x10 district metering areas. 5% of total mains inspected and repaired per year.	29% reduction in leakage flows for areas treated.	Program establishment $10,000. Cost establishment per area $25,000 for district metering and $40,000 for pressure management. $300/km inspection cost and $500.km repair cost.
Metering Individual Dwellings in Multi-unit Development	Meters installed in all new units. Single meter box to facilitate meter reading.	No specific data available.	All new multi-family residential accounts	5% savings in shower, baths and taps under both average and peak conditions.	Utility additional cost of $10/y/unit. Customer $500/unit.

Notes:

1. BASIX currently overrides other planning provisions (such as DCPs), where the primary objective is to reduce consumption of mains-supplied potable water (NSW Govt., 2006). As such, some of the tabled options may require legislative change to be implemented.

2. The assumptions associated with this activity were modified at the request of Council following the PRG workshops. The combined modifications resulted in forecast scenario annual demand changes of up to approximately 1%.

Table 2-6: Source Substitution Measures

Option	Description	Data	Assumed Market Penetration	Assumed Water Savings	Assumed Costs
BASIX & DCP 165 – Rainwater Tanks[2]	BASIX & DCP165 residential related installation of rainwater tank systems with pump and top-up feed from the potable system. Roofwater used for general outdoor use, toilet flushing and cold water supply to the washing machine.	NSW Department of Planning http://www.basix.nsw.gov.au/	90% of new residential development. An allowance for major residential renovations has also been made based on 1/3 of major renovations (1 every 50 years) install a tank connected to outdoor uses and ½ of the properties also connecting to toilet and washing machines.	Approximately 50% for toilet use, washing machines, external use and leakage. 50% for targeted water uses in houses, 55% for semi-detached and 50% for units. 0% reduction on peak days. Refer to Appendix B.	Cost to single family residence customers of $3,000 for a 5,000 L tank and associated installation, $500 per pump and $20 per year pumping costs. Semi-detached ($2,400/dwelling) and unit customers ($2,100/dwelling) costs are reduced to reflect smaller tank sizes due to smaller consumption. Cost to utility of $100 per new account for inspection of installations Costs to customers based on annual repayments on capital outlay over 10 year pump life and 30 year tank/ plumbing life at 7% pa interest rate.
Mandatory Use of Rainwater Tanks on New Non-residential Development[2,3]	Mandatory installation of rainwater tank systems in new non-residential development as required in DCP165.	Assumed for scenario development.	95% of new development.	Scenario 1-3: 50% annual saving for toilet and external use. Scenario 4 (without 3rd pipe): 45% annual saving for toilet (without 3rd pipe), showers, dishwasher and external use (without 3rd pipe).	Costs to customer as per *BASIX & DCP165 – Rainwater Tanks*. Council administration additional $1,000/year.
Rainwater Tank Rebate[3]	Council provides a rebate	Rates of rainwater tank updake increasing. In	1% of total existing accounts,	Approximately 50% for toilet	Cost to utility $450 per

Option	Description	Data	Assumed Market Penetration	Assumed Water Savings	Assumed Costs
	for rainwater tank installation for the next 10 years.	2006/07, 1,624 tanks had been installed. Last two quarters (as at Nov 06) saw the rebates more than double from 273 to 785. Source: Report by Technical Advisory Group to Board, 15 November 2006.	annually.	use, washing machines, external use and leakage. 10% of participating accounts connect to internal end uses, in addition to outdoor uses.	installation and $20,000 annual administration costs, no setup costs because it is already established. Costs to customer as per *BASIX & DCP165 – Rainwater Tanks* plus 20%, less $450 rebate applied as upfront capital cost with straight line depreciation over life of tank and pump.
Rainwater Tank Retrofit for Renovations	All major residential alterations and renovations to install a 5KL rainwater tank.[4]	No specific data available.	0.3% of total existing accounts, annually.	Approximately 50% for toilet use, washing machines, external use and leakage.	$3,500 capital cost and $20 maintenance cost for customer.
Gosford CBD Reuse Project[4]	Supply of the Gosford CBD with recycled water via a water mining scheme to be treated at showgrounds. Water to be used for outdoor purposes, washing machines and toilet flushing.	Gosford Water Recycling Initiatives Study (KBR, 2006) 2 stage project.	Stage 1 (Demonstration phase): x3 high water use open space customers. Stage 2: all growth, x6,000 infill residential and x370 commercial customers.	Stage 1: 180ML/yr Stage 2: 100% reduction in targeted areas.	Stage 1: $4.95M Stage 2: $9.35M Annual O&M: 4% of capital value Customer Costs: $1,000/new res. account $3,000/non-res. account
Gosford CBD Extension[1,4] - West Gosford - Somersby	Piggy-back the Gosford CBD water mining scheme through progressive extension of the 3rd pipe system.	Gosford Water Recycling Initiatives Study (KBR, 2006)	West Gosford: x57 non-res. customers. Somersby: x28 non-res. customers.	West Gosford: 119ML/y (Y2055) Somersby: 147ML/y (Y2055)	West Gosford: $4.6M Somersby: $10.2M Annual O&M: 4% of capital value. Customer Costs: $3,000/ account

[4] Tank installations will vary from 1.5 to 5KL dependant on the size of the alteration. It is assumed that 5KL installations apply for major renovations.

Option	Description	Data	Assumed Market Penetration	Assumed Water Savings	Assumed Costs
Kincumber Water Reclamation Plant[3]	3rd pipe recycling project sourced from reclamation plant at Kincumber STP for tanker use and, open space and industrial purposes.	Gosford Water Recycling Initiatives Study (KBR, 2006) Council advice of 10/4/07.	Scenario 3,4: x13 non-res. customers. Tanker use.	75ML/yr (Y2055) Tanker savings: 25Ml/yr	$1.33M (2007-08) Annual O&M: 4% of capital value Customer Costs: $3,000/ account
Independent Water Mining Projects[3]	Various priority water mining projects.	Gosford Water Recycling Initiatives Study (KBR, 2006) Council advice of 10/4/07.	Terrigal: x8 non-res. Customers. .	Terrigal: 62ML/y (Y2055)	Terrigal: $3.3M Annual O&M: 4% of capital value Customer Costs: $3,000/ account
Community Stormwater Harvesting Projects[3]	Various priority stormwater harvesting projects.	Gosford Water Recycling Initiatives Study (KBR, 2006) Council advice of 10/4/07.	Tarragal Glen: x10 non-res.	Tarragal Glen: 16ML/yr (Y2055)	Tarragal Glen: $1.1M Annual O&M: 4% of capital value Customer Costs: $3,000/ account
WSUD/stormwater harvesting in key new developments	Council to identify opportunities to apply WSUD principles in large lots at time of DA.	No specific data available.	Target large lot developments (assume 20% of new non-residential development)	40% average outdoor water savings.	$10k establishment costs. Customer costs modified to approx. 1.3 times the annualised community costs applied in the identified stormwater harvesting projects (see above).

Notes:

1. BASIX currently overrides other planning provisions (such as DCPs), where the primary objective is to reduce consumption of mains-supplied potable water (NSW Govt., 2006). As such, some of the tabled options may require legislative change to be implemented. This issue is currently being addressed by DEUS.

2. DCP165 Water Cycle Management Guidelines is discussed further in Appendix F.

3. The assumptions associated with this activity were modified at the request of Council following the PRG workshops. The combined modifications resulted in forecast scenario annual demand changes of up to approximately 1%.

4. Requires confirmation of adequate wastewater to be mined in order to meet peak demands.

The estimated annual average water savings and indicative annualised costs per kilolitre of water savings for each option are tabled in order of water savings (Table 2-7).

Recognising that assumptions are required in order to estimate the performance of the demand management measures, the modelled water savings become targets based on the full implementation and market penetration assumed. In order to effectively manage the targeted savings in a demand management program, particularly in cases where customers are required to spend additional money, rigorous promotion, monitoring and re-evaluation will be required.

Table 2-7 indicates that the greatest long-term potable water savings are achieved through enhanced pricing[5], BASIX and rainwater tanks. In fact, the majority of the savings estimated through adopting BASIX are also associated with assumed rainwater source substitution.

Of the conservation approaches, enhanced water pricing achieves the highest water savings. Retrofit and rebate programs have generally not achieved substantial water savings. This is partly because WELS and BASIX influence appliance and fixture stocks. The savings associated with education programs are difficult to quantify and in this case include the savings associated with promotional efforts, such as household greywater diversion. However, it is generally recognised that education underpins all demand management efforts and is essential in achieving long-term behavioural change.

Source substitution efforts in existing developed areas are likely to provide modest savings, however at a relatively high cost.

It has been acknowledged that different water conservation approaches will interact and therefore the water savings expected from a combination of approaches cannot simply be estimated by the sum of individual conservation approaches. The tabled scenario results in Table 2-7: Individual Option Savings and Costs below, represents the combined options applicable to each scenario and allows for potential demand saving interactions.

The relative cost-benefit performance of each of the individual measures set out in Table 2-7 was used to inform the scenario building process as described in Section 2.4.

Table 2-7: Individual Option Savings and Costs

Measure Description	Community Annualised Cost[3] ($/kL)	Customer Annualised Cost[2] ($/kL)	Utility Annualised Cost ($/kL)	Average Water Savings (ML/a)
Inclining Block Tariff - Residential & Non Res	$0.00	$0.00	$0.00	1,333
Inclining Block Tariff - Residential	$0.00	$0.00	$0.00	1,245
BASIX Program - 40 Points	$2.77	$2.77	$0.00	1,213
Rainwater Tanks (new development) - Sc4	$2.78	$2.78	$0.00	1,181
Rainwater Tanks (new development) - Sc2	$3.06	$3.06	$0.00	1,047
Rainwater Tanks (new development) - Sc3	$3.13	$3.13	$0.00	1,021

[5] Pricing potable water savings are sensitive to assumed elasticises and it is recommended that price elasticises representative of the Central Coast be confirmed during development of the Strategy.

Measure Description	Community Annualised Cost[3] ($/kL)	Customer Annualised Cost[2] ($/kL)	Utility Annualised Cost ($/kL)	Average Water Savings (ML/a)
Currently Set Price Increases	$0.00	$0.00	$0.00	876
IWCM Education Program - Stepped Up	$0.50	$0.00	$0.50	561
Education Program - Current Initiatives	$0.30	$0.00	$0.30	502
Gosford CBD Water Mining Stage 2	$2.43	$0.30	$2.13	410
Permanent Low Level Restrictions	$0.05	$0.00	$0.05	410
WELS - Total Program Savings	$0.43	$0.42	$0.00	282
Water Loss Program - Stepped up	$0.40	$0.00	$0.40	231
Rainwater Tank rebate for existing development	$8.27	$3.29	$4.97	213
Gosford CBD Water Mining Stage 1	$2.79	$0.00	$2.79	180
BASIX - Total fixture savings	$0.12	$0.12	$0.01	153
Water Loss Program - Current Initiatives	$0.12	$0.00	$0.12	148
Residential Retrofit Program	$0.30	$0.17	$0.13	133
Extend Gosford Water Mining - Somersby	$5.51	$0.02	$5.50	90
Extend Gosford Water Mining - West Gosford	$1.59	$0.05	$1.54	85
Kincumber STP ReW Scheme	$1.95	$0.06	$1.88	71
Terrigal Water Mining	$3.32	$0.02	$3.30	57
Large Lot SW Harvest/WSUD	$4.77	$4.52	$0.26	48
Tankers	$3.34	$0.00	$3.34	25
Residential Toilet Retrofit	$3.07	$0.00	$3.07	24
Non-Residential Audit - Total Program Savings	$1.24	$0.54	$0.70	21
Metering individual dwellings in multi-unit development	$8.26	$6.50	$1.77	15
Tarragal Glen SW Harvesting	$3.88	$0.12	$3.76	14
Residential Washing Machine Rebate	$33.31	$25.12	$8.19	4
Planned Backlog Sewerage	-$44.67	-$1.88	-$42.79	-6
Extend Sewerage Coverage	-$59.87	-$1.48	-$58.40	-8
Traditional Scenario	$1.43	$0.47	$0.96	276
Scenario 1	$1.81	$1.34	$0.48	3,311
Scenario 2	$1.87	$1.05	$0.82	4,142
Scenario 3	$1.96	$1.10	$0.86	4,242
Scenario 4	$2.10	$1.05	$1.06	4,536

Notes:

Stand alone savings cannot be summed together to estimate total scenario savings, as interactions between measures must be considered.

2. Customer annualised costs are exclusive of any rates impact.

3. Community costs are a combination of customer and utility annualised costs.

2.3.2 Stormwater and Catchment Management Activities

The stormwater and catchment management options considered as part of this study, and their assumed benefits and costs are set out in Table 2-8.

Table 2-8: Urban Pollutant Reduction and Catchment Management Activity Benefits and Costs

Option	Description	Benefits	Costs
IWCM Education	The IWCM education material would include promotion of all IWCM initiatives.	Expected to enhance and sustain other IWCM initiatives.	Refer to Table 2-5.
WSUD	Urban catchment source flow and sediment control through techniques such as grass swales, buffer strips, cascades and infiltration techniques. Enacted through development controls for new development. Limited stormwater harvesting and management opportunities assumed within existing development areas. Refer also to Appendices A & B.	Best-practice pollutant reduction savings assumed (VSC 1999): • 80% retention of urban suspended solids • 45% retention of urban total phosphorus and nitrogen • 5-10% reduction in annual runoff • Peak discharge maintained at pre-development levels.	Costs are highly variable depending on the range and extent of WSUD activities undertaken. Assumed that $50,000 is spent annually for Scenario 2, 3 and 4.
Water Reclamation Plant at Kincumber STP	It is assumed that the water reclamation plant at Kincumber STP will treat sewage for non-potable reuse applications to a tertiary level with disinfection.	Reduced pollutant discharge. Refer to Section 2.5.5. Potable water savings. Refer to Table 2-6.	Refer to Table 2-5.
Improved wastewater treatment	Tertiary treatment at the Woy Woy and Kincumber STPs. Even though there does not appear to be significant drivers for high level treatment at these ocean outfall treatment plants, this option is assessed recognising sewage is a water resource and its potential strategic importance over a 50 year planning horizon.	Reduced pollutant discharge. Refer to Section 2.5.5. Provision of an additional water source suitable for non-potable reuse applications.	Treatment plant upgrades: Approx. $11.8M + add. $470k/yr for opex. Assumed to be implemented in 2020 as part of Scenario 4.
Planned sewerage backlog areas	It is assumed that Mooney Mooney and Cheero Point (249 lots) will be sewered in line with current plans: (anticipated completion date March/April 2008).	Increased sewerage coverage assumed to reduce catchment based loads from on-site systems and improve protection of public health. Increase in sewage generation estimated described in Table 2-6.	Assumed $10,000/lot and additional $500/lot/year on-going costs. $50/year per customer.

Option	Description	Benefits	Costs
Extended sewerage coverage	Provision of sewerage facilities (decentralised and/or transfer) at Little Wobby, Bar Point, Patonga Creek, Bensville, Empire Bay and South Kincumber (total 360 lots). Assumed to be implemented between 2010 and 2015.	Increased sewerage coverage assumed to reduce catchment based loads from on-site systems and improve protection of public health. Increase in sewage generation estimated described in Table 2-6.	Assumed $20,000/lot and additional $500/lot/year on-going costs. $50/year per customer.
Inflow and infiltration reduction program	Council to implement the Early Action Plan (22 areas, total 40km of mains) to reline and renew sewers with high rain derived inflow and infiltration (II) and associated house services. 2 year program starting 2007.	Wastewater flow reductions. Also, expected to reduce frequency and volume of sewage overflows. Assumed to reduce preventable II (assumed as 50% of total II) by 40%.	Program already established. $10,000/year administration costs. $20,000/year modelling costs. $300/m inspection costs. $700/m repair and renew costs. 20% costs to customers representing illegal connections and plumbing repairs.
Catchment management initiatives	A wide range of initiatives in line with CMA activities primarily aimed at reducing waterway extractions and pollutants entering the waterway. Initiatives include: • protection and rehabilitation of riparian zones (GCC/CMA) • revegetation using native plants (GCC/CMA) • implementation of the water sharing plan (Government) • implementation of treatment ponds(LWU) • improved farming practices (CMA) • improved on-site wastewater systems(LWU) • improved management of landfill sites (GCC/LWU)	Should reduce pollutants entering the waterways and assist manage extractions. For the purposes of this study (which seeks an urban water cycle management strategy) the benefits are recognised, but not quantified.	Costs are highly variable depending on the range and extent of activities undertaken. Assumed that $50,000 is spent annually for Scenario 2, increasing to $75,000 and $100,000 for Scenario 3 and 4, respectively. Maintenance costs are estimated to be 5% of capex expenditure annually.

Option	Description	Benefits	Costs
Stormwater Management & Flood Mitigation	Continuation of current initiatives including: Stormwater Management Plan; Floodplain Management Plans; flood mitigation works and Coastal Management Plans Incorporation of WSUD principles in DCPs.	Improved stormwater and coastal waters quantity and quality. Reduced flooding and impacts	Covered under catchment initiatives and WSUD budgets.

2.3.3 Other Water Cycle Management Activities

A range of general IWCM supporting activities are also proposed. Whilst not assumed to directly impact water savings and pollutant loads, the activities enhance or facilitate the IWCM options already identified. These activities are tabulated below.

Table 2-9: Other Activities and Associated Costs

Option	Cost Assumptions
Decisions to be made on the supply options for the development of the water supply system. This will be done as part of *WaterPlan 2050*.	Included in current *WaterPlan 2050* budget.
Increase in WTP capacity for each scenario was based on the modelled treatment capacity required by 2055.	Based on NSW Reference Rates Manual (2003), with a multiplication factor of 1.5 (refer to Appendix C)
Increase storage reservoir capacity by 20ML by 2045 for traditional scenario only. Costing has been based on steel reservoirs.	Based on NSW Reference Rates Manual (2003), with a multiplication factor of 1.5 (refer to Appendix C)
Increase in pumping capacity to meet the average annual increase for each scenario in peak day demand. It is assumed that only half of the volume equivalent to the projected increase in peak day demand will require pumping and that pumping capacity upgrades will occur on a 5-yearly basis.	Based on NSW Reference Rates Manual (2003), with a multiplication factor of 1.5 (refer to Appendix C)
Council to influence legislation and design guidelines to facilitate IWCM practices, including development of WSUD DCPs.	Included in current budget.
Urban water system energy audits, improved technology and operation.	Included in current budget.
Improved water management monitoring, data collection and assessment including: billing data capture & analysis (including consumption category); extent of installed rainwater & greywater on-site systems; GIS geocoding of consumption records; GIS location & number of dry weather overflows; GIS definition of properties served with town water, groundwater, on-site treatment & sewerage facilities; identification of reservoir zone and wastewater system boundaries; groundwater extractions	Additional $100k/a
Flooding risk management - drainage upgrades.	Included in current budget
Improved trade waste management, in line with current initiatives	Included in current budget
Estimate of energy savings and greenhouse gas emissions based on water, wastewater and energy savings. Reduction in greenhouse gas emissions.	$40/tonne CO_2 savings.

The impact of each of the options listed in Table 2-8 and Table 2-9 were estimated as part of the scenario assessment process (Section 3).

The outcomes of the individual option assessment were used to establish scenarios, as discussed in the following section.

2.4 Scenarios Established for Gosford LGA

The options identified to address Gosford's water cycle issues, were bundled into scenarios according to inputs from the PRG and the results of the preliminary option assessment.

2.4.1 Scenario Description

Five IWCM scenarios have been prepared through bundling together complimentary water cycle management options. The scenarios represent increasing levels of integration between the urban water services. They were developed to address the Gosford's water management issues considering Gosford's IWCM goals, the interaction of the identified water management options and the PRG's preferences. The scenarios are summarised in Table 2-10.

The *Traditional Scenario* represents a traditional approach of separately managing urban water services to meet future needs. It includes increased potable water supply demand supplied by surface water sources, the details of which are covered in *WaterPlan 2050*. Wastewater management consists of secondary level treatment with ocean release. Stormwater management includes system detention basins and gross pollutant traps. Conservation approaches are limited to WELS, which is included in all scenarios.

Scenario 1 represents the current urban water cycle management practice extended into the future. Current practice includes sewer rehabilitation to reduce inflow and infiltration, on-site wastewater system management and best-practice trade waste management is included. Stormwater initiatives include flood mitigation works, litter/organics reduction, soil erosion controls and a WSUD DCP for new development. Demand management measures include BASIX, retrofit and education programs, high water user audits, and a rainwater tank rebate program.

Scenario 2 represents Council's currently planned urban water management activities. A water supply system leakage reduction program is planned. Water mining projects are being considered within Gosford CBD (Stage 1 and 2) and stormwater harvesting at Tarragal Glen, as per Figure 2-3. Conservation activities will be increased through enhanced water pricing, stepped-up education program, as well as increased retrofit and rebate programs. Increased levels of catchment management activities are anticipated in line with catchment action plans.

Scenario 3 allows for increased source substitution through high priority reclaimed water and stormwater harvesting opportunities in specified areas, as identified in Figure 2-3.

Scenario 4 extends the application of non-potable reclaimed water reuse to include targeted areas identified in Figure 2-3. The inclining block tariff is extended to include non-residential customers and individual meters installed at new units. Scenario 4 also includes extension to the provision of sewerage services and tertiary treatment at STPs.

Table 2-10: Adopted IWCM Scenarios

Water Management Option	Traditional Scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Sewage Collection and Treatment					
Improved STP treatment				✓	✓✓
Improved trade waste management		✓	✓	✓	✓
Infiltration and inflow reduction program		✓	✓	✓	✓
Sewerage backlog and extension	✓	✓	✓	✓	✓✓
Smart sewers (low inflow and infiltration)			✓	✓	✓
Conservation					
Government Initiated Programs (WELS & BASIX)	WELS	✓	✓	✓	✓
Community IWCM education		✓	✓✓	✓✓	✓✓
Fixture retrofits and rebates		✓	✓✓	✓✓	✓✓
Rainwater tanks in new developments		✓	✓	✓	✓✓
Enhanced pricing			✓	✓	✓✓
High water user audits		✓	✓	✓	✓
Leakage reduction program	✓	✓✓	✓✓✓	✓✓✓	✓✓✓
Source Substitution					
Stormwater harvesting and reuse			✓	✓✓	✓✓
Promotion of on-site greywater recycling		✓	✓	✓	✓
Recycled water use through a "third pipe" system			✓	✓✓	✓✓✓
Urban stormwater					
Current initiatives		✓	✓	✓	✓
Water Sensitive Urban Design DCPs		✓	✓	✓	✓
Current flood mitigation works in key areas	✓	✓	✓	✓	✓
Catchment					
Current catchment initiatives		✓	✓	✓	✓
Improved catchment activities			✓	✓	✓
Improved monitoring, legislation, system efficiency, design and funding			✓	✓	✓

Note: Increasing number of ticks represents an increasing intensity and application of the water management option.

The *Traditional Scenario* and *Scenario 4* provide the foreseeable boundaries to the envelope in terms of water resource management possibilities. The benefit of assessing the Traditional Scenario is it provides a "base-case" from which the impacts of the integrated scenarios are measured. If the Traditional Scenario is not included in the assessment, the changes in water demands, wastewater flows and urban pollutant loads due to the implementation of an integrated approach cannot be calculated.

Appendix C provides an outline of individual water management issues and scenario inclusion of options to address these issues. Each of the scenarios result in different outcomes in terms of water demand, wastewater flows and urban pollutant load impacts. These are discussed further in the following section of the report.

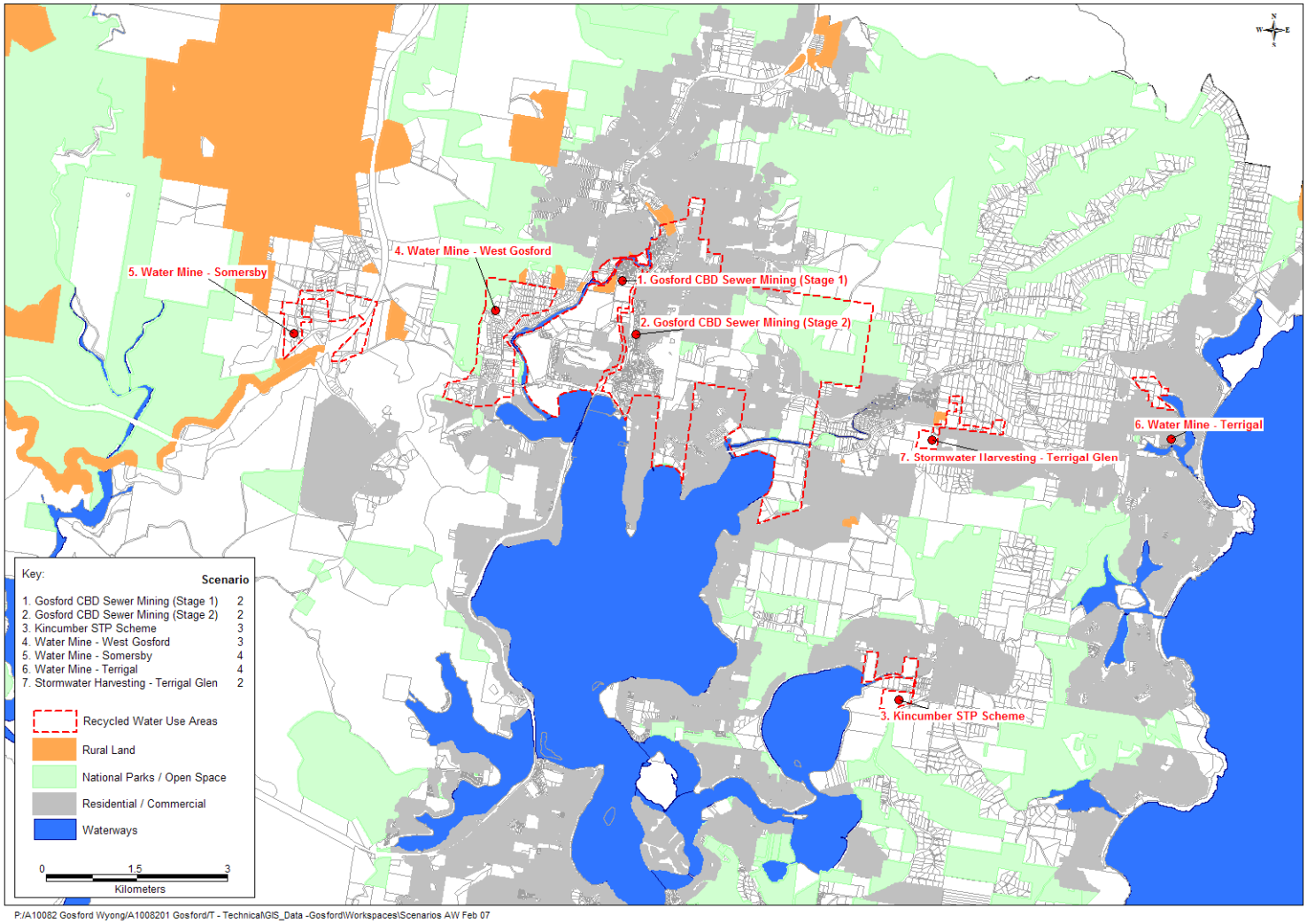


Figure 2-3: Scenario 2, 3 and 4 Reclaimed Water Areas

2.5 Scenario Modelling

The scenarios can be modelled in terms of their impact on the following:

- Potable water demands;
- Wastewater flow generation;
- Proportion of demand management achieved by water conservation and source substitution; and
- Urban pollutant loads.

Each of these characteristics are discussed in the following sections.

2.5.1 Potable Water Demands

Potable water demands and wastewater flow projections for each scenario have been prepared using the DSS model based on the assumptions outlined in Sections 2.2 to 2.4.

Per capita potable water demands provide an indication of potable water savings for each scenario and are set out in Figure 2-4.

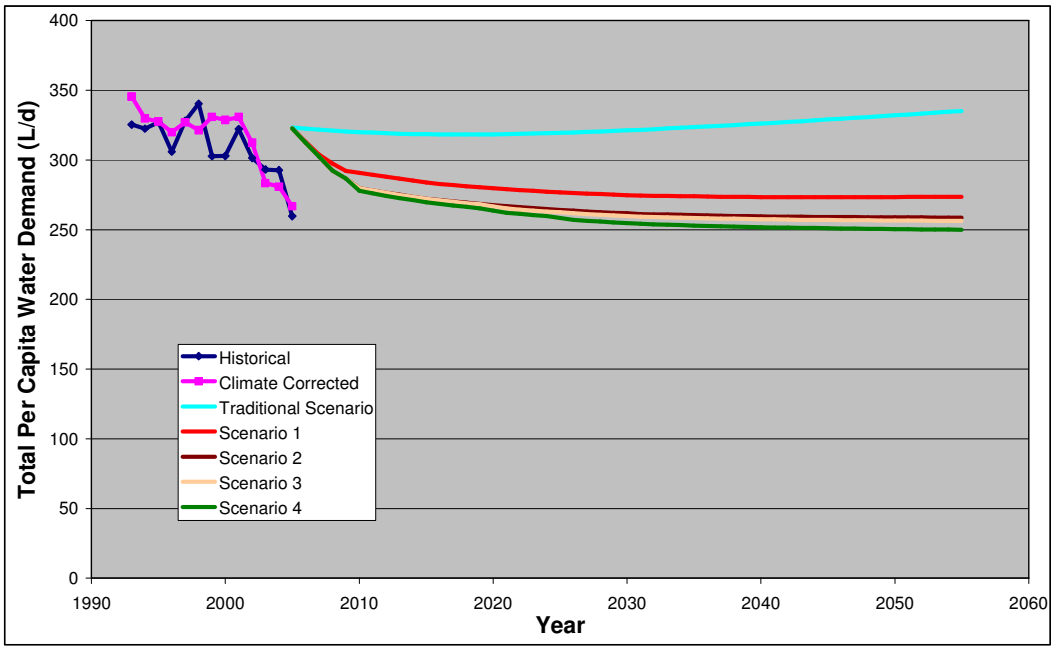


Figure 2-4: Forecast Per Capita Water Demands[6]

All five forecasts start in 2005 with a higher per capita demand than the observed and climate corrected per capita demand for the same year. This is because there were mandatory

[6] Assumptions associated with demand estimates are outline within Table 2-5: Conservation Measures and Table 2-6: Source Substitution Measures.

restrictions in place in 2005, as a drought response measure, not as a long-term demand management approach. [7]

The integrated scenarios (Scenario 1-4) have lower per capita demands because of the increased use of demand management options such as water efficient appliances, education and source substitution such as rainwater tanks.

Forecast potable annual and peak day demands are provided in Figure 2-5 and Figure 2-6, respectively.

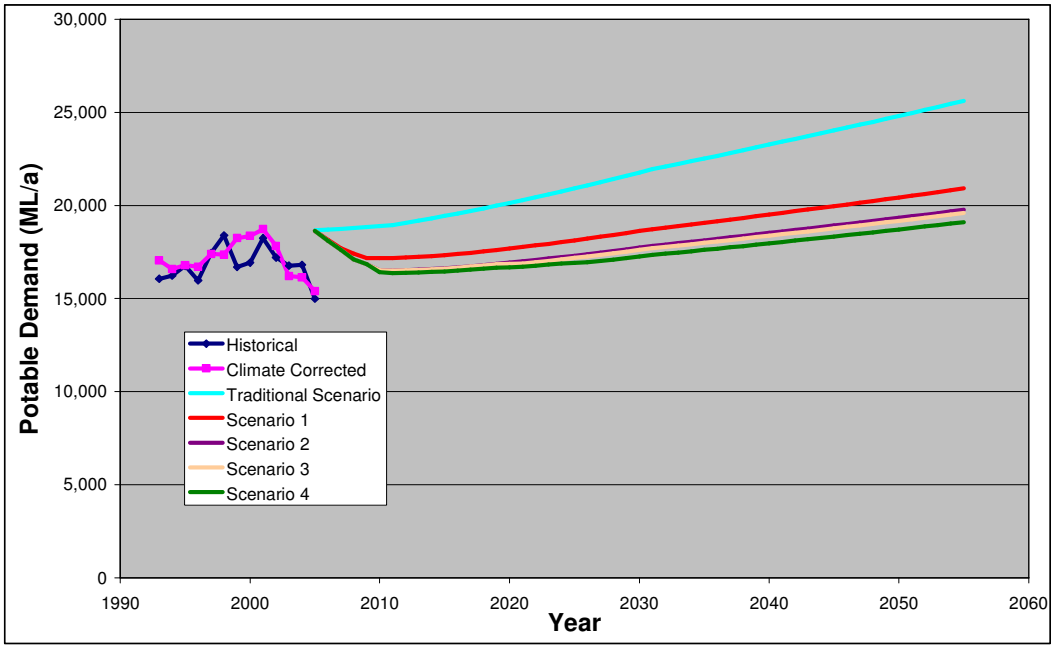


Figure 2-5: Forecast Annual Potable Water Demands[8]

[7] Historical demand assessment, including climate correction of demands, was carried out for the information made available for the study (up to 2005). Refer to the *Concept Study* for further details. Year 2007 observed per capita demands are currently at 200L/d (GCC, email dated 30/3/07).

[8] Assumptions associated with demand estimates are outline within Table 2-5: Conservation Measures and Table 2-6: Source Substitution Measures.

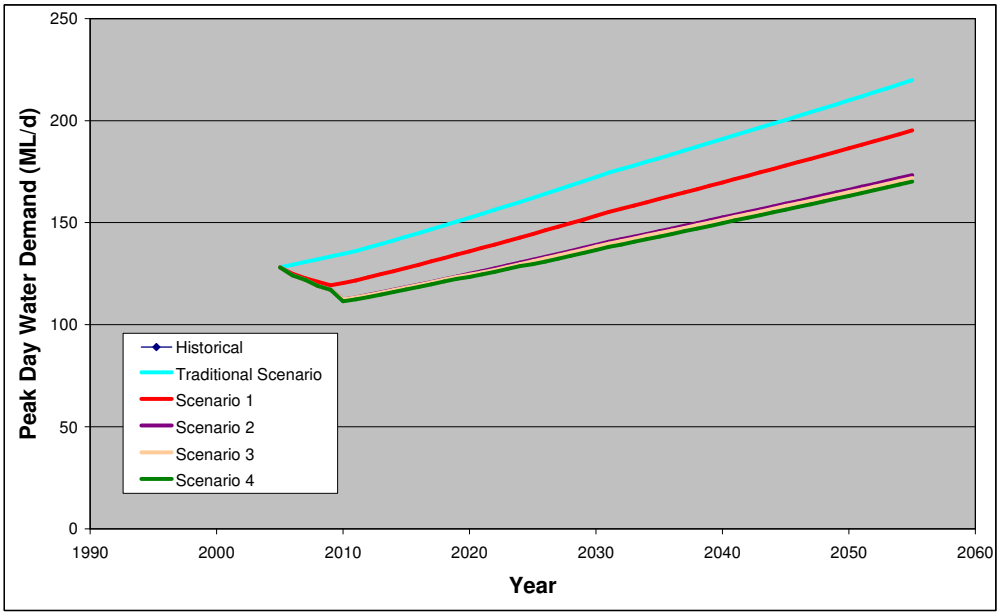


Figure 2-6: Forecast Peak Day Potable Demands[9]

The demand forecasts indicate increasing potable water savings with increasing levels of integration. The highest saving between the Traditional Scenario and Scenario 1 is primarily associated with the influence of BASIX on new development, the impact of the currently set water usage price path and the source substitution activities GCC has already initiated. Further water savings are made in Scenarios 2 to 4, primarily through source substitution approaches.

[9] Assumptions associated with demand estimates are outline within Table 2-5: Conservation Measures and Table 2-6: Source Substitution Measures.

2.5.2 Wastewater Flows

The forecast total annual wastewater flow is plotted in Figure 2-7.

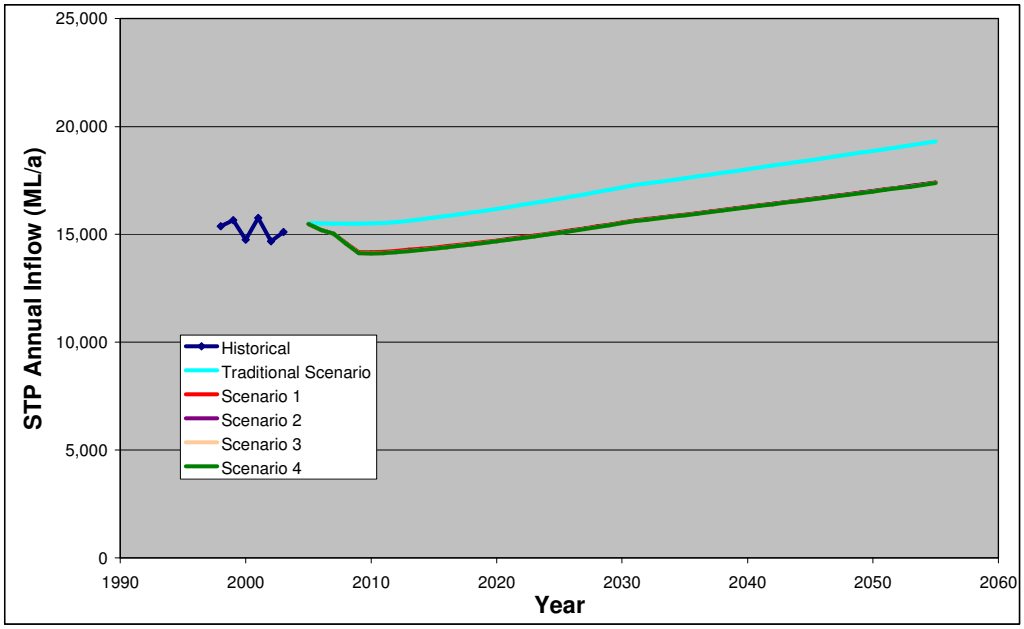


Figure 2-7: Forecast Annual Wastewater Flows

Internal water usage efficiency gains provide the main reduction in annual wastewater flows.

2.5.3 Reclaimed Water Demands

The forecast total annual reclaimed water demand is plotted in Figure 2-8.

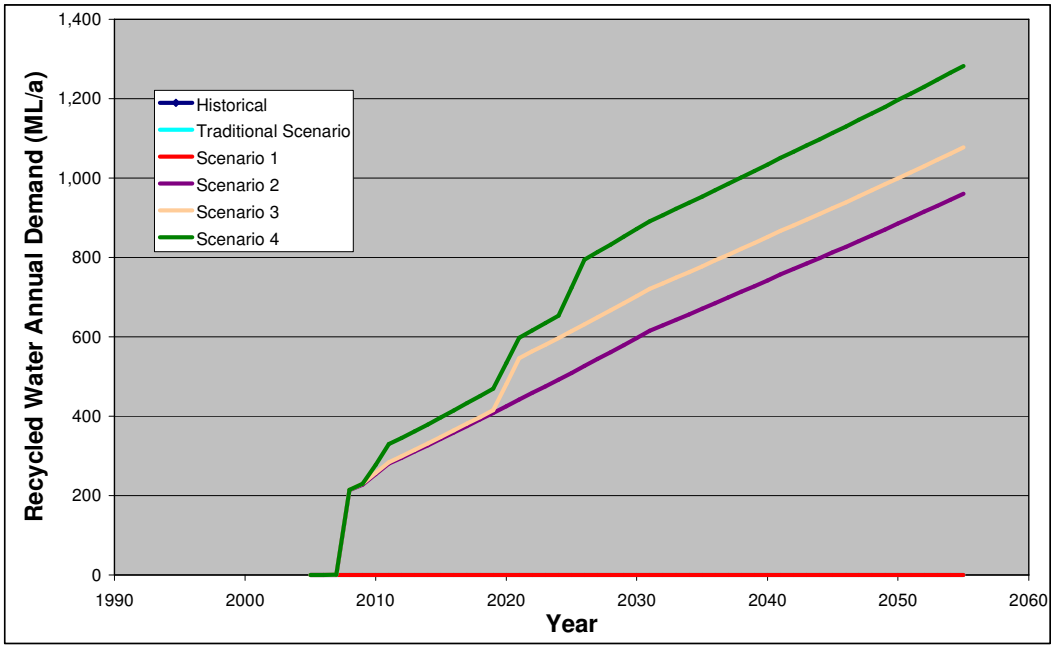


Figure 2-8: Forecast Annual Reclaimed Water Demands[10]

The forecast reclaimed water demands represent target demands as per the assumptions detailed in Table 2-6. The forecast also assumes that adequate reclaimed water is available for all assumed uses.

[10] Assumptions associated with demand estimates are outline within Table 2-5: Conservation Measures and Table 2-6: Source Substitution Measures.

2.5.4 Conservation and Source Substitution

The estimated performance of demand management in 2055 is shown in Figure 2-9. The figure is a water balance breakdown of the Year 2055 water demands by scenario and demand management approach, along with wastewater generated.

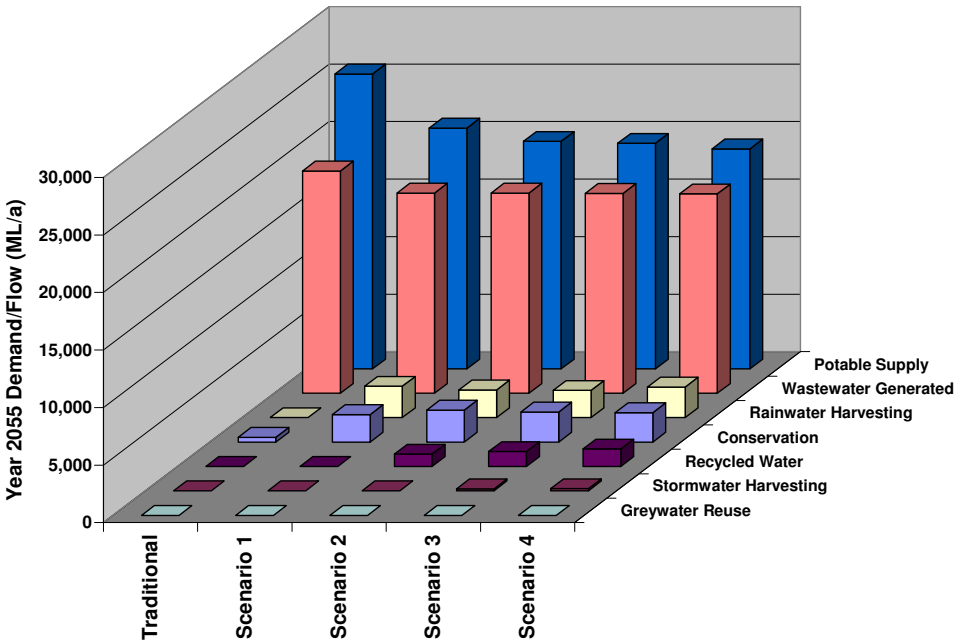


Figure 2-9: Forecast Urban Water Supply and Wastewater

The Year 2055 potable water savings compared against the Traditional Scenario are plotted in Figure 2-10. This displays the forecast impact of the demand management by 2055.

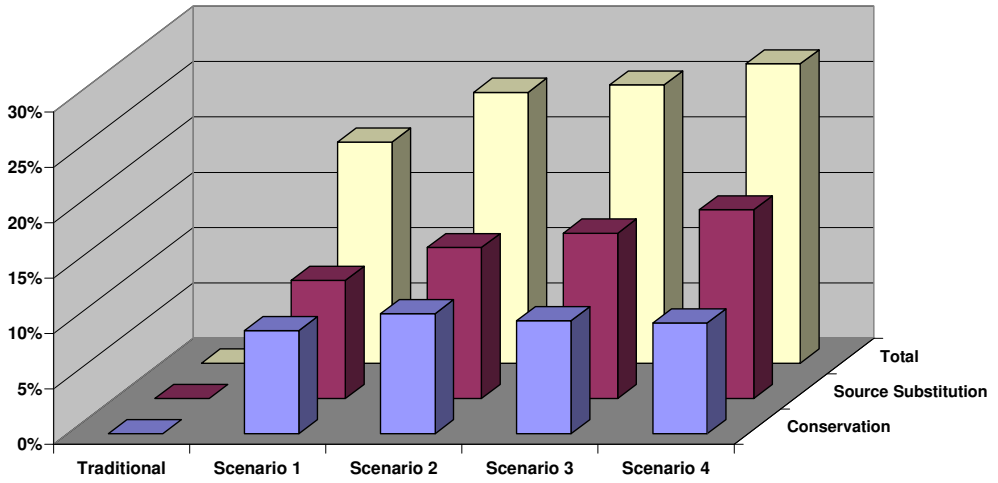


Figure 2-10: Forecast Potable Water Savings

As the level of integration increases in the scenarios, levels of source substitution and conservation increase (Figure 2-10). There is a large increase in savings between the Traditional Scenario and Scenario 1 to 2, because the current and planned initiatives put in place by Council are extensive. The increases in savings in the more highly integrated scenarios are not as significant as this first increase, because the majority of the viable measures are already adopted in the current and planned initiatives. Figure 2-11 highlights the development type breakdown of the targeted water savings in Scenario 2.

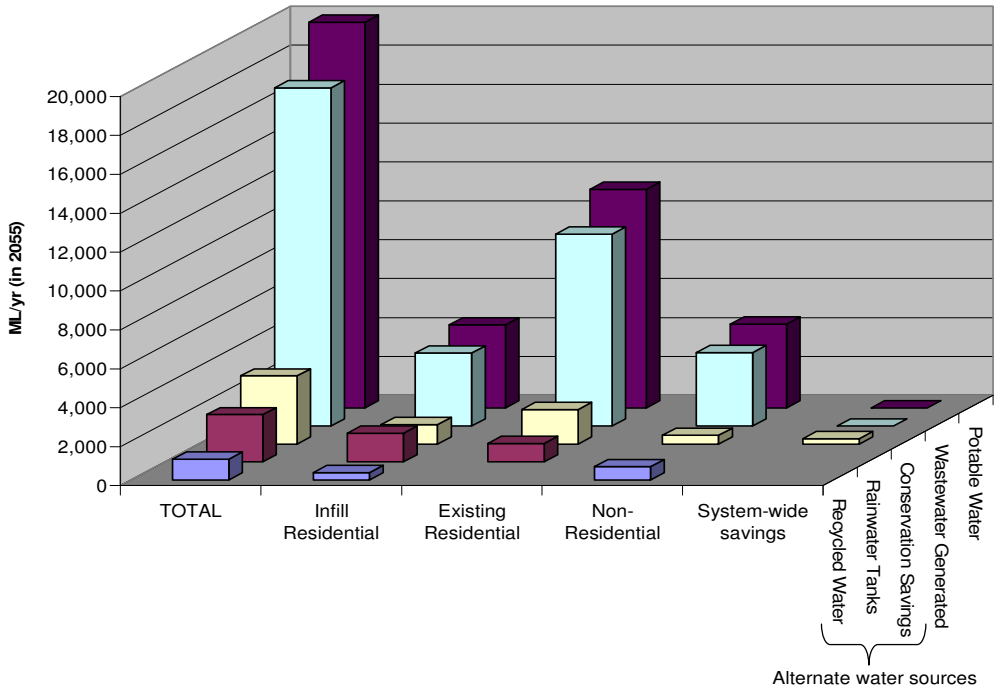


Figure 2-11: Scenario 2 Customer Category Breakdown of Demands

The majority of savings are from the residential sector because the residential consumption is much higher than the non-residential consumption in GCC. Infill development shows higher source substitution than existing development. The main reason for this related to the Gosford CBD recycled water scheme, while existing residential areas dominate the water conservation savings.

2.5.5 Urban Pollutant Loads

Urban pollutant load reductions are anticipated with increasing levels of water cycle integration primarily through a combination of improved wastewater treatment and WSUD. Catchment management activities will also impact on the pollutant loads entering waterways. Year 2055 annual pollutant loads generated from the following LGA sources have been modelled to compare the environmental outcomes of the scenarios:

1. Urban area stormwater runoff;
2. Catchment runoff; and
3. STP loads.

A MUSIC (Model for Urban Stormwater Improvement Conceptualisation) model was used to estimate the total suspended solids (TSS), total nitrogen (TN) and total phosphorous (TP) annual loads generated from the urban land zones. For the scenarios that incorporate WSUD in in-fill areas, a reduction in pollutant loads in line with best-practice pollutant reduction savings (VSC 1999) is assumed:

- Total suspended solids reduction of 80% of typical urban loads;
- Total nitrogen reduction of 45% of typical urban loads; and
- Total phosphorous reduction of 45% of typical urban loads.
- Further details of the MUSIC modelling approach are provided in Appendix E.

The treated wastewater loads released to the environment are based on anticipated annual long-term performance (TSS – 20mg/L; TN 15mg/L; and, TP 10mg/L), typical for secondary treatment plants, at both Kincumber and Woy Woy STPs. Improved treatment performance is anticipated with water mining and recycling projects and is reflected in total discharged loads through flow reductions to the STPs. Scenario 4 assumes typical tertiary treatment suitable for non-potable reuse at both plants (TSS – 0mg/L; TN 5mg/L; and, TP 0.5mg/L) On this basis Table 2-11 summaries the estimated total STP loads.

Table 2-11: Assumed Y2055 Annual Average Treatment Plant Performance

Parameter	All Scenarios	Scenario 1	Scenario 2	Scenario 3	Scenario 4
TSS (t/a)	364	319	319	319	0
TN (t/a)	273	239	239	239	80
TP (t/a)	182	160	160	159	8

The following three figures plot forecast Year 2055 urban pollutant loads (combined impact of the WSUD program and the upgrading of treatment at STPs) for each scenario.

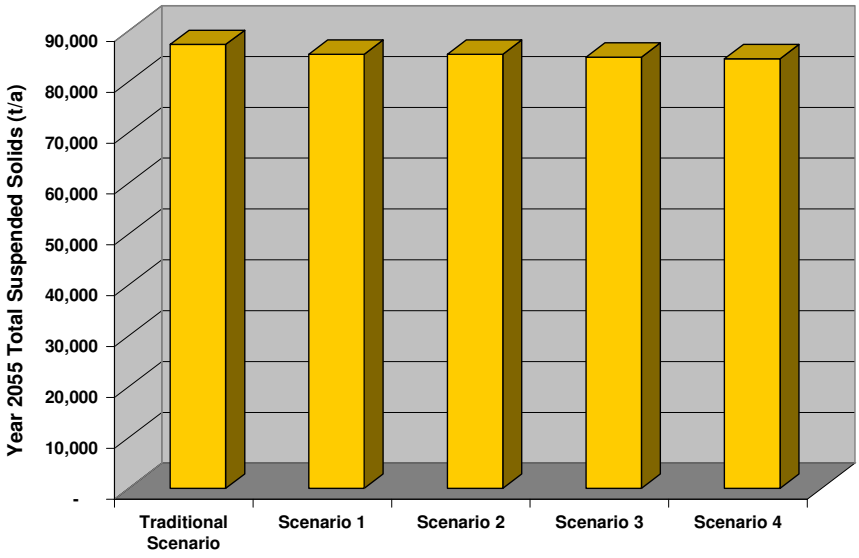


Figure 2-12: Forecast Urban Pollutant Loads – Suspended Solids

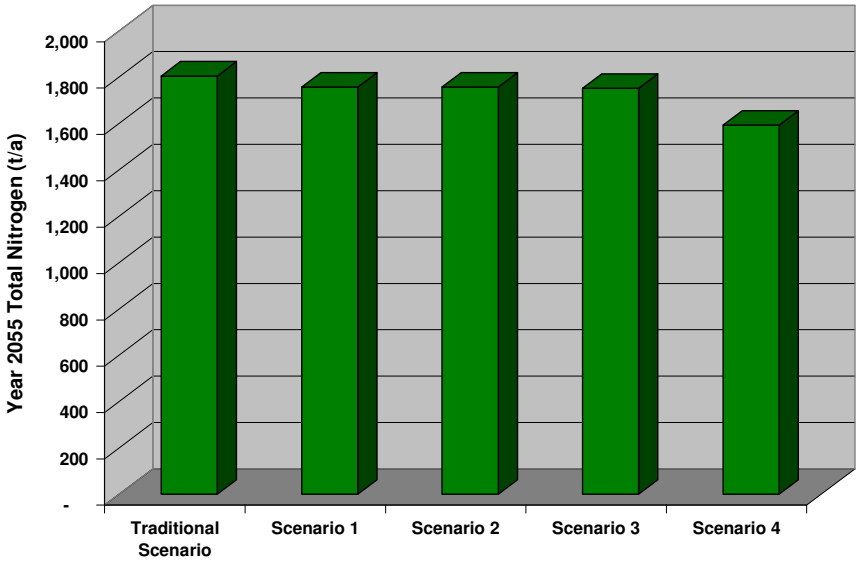


Figure 2-13: Forecast Urban Pollutant Loads – Total Nitrogen

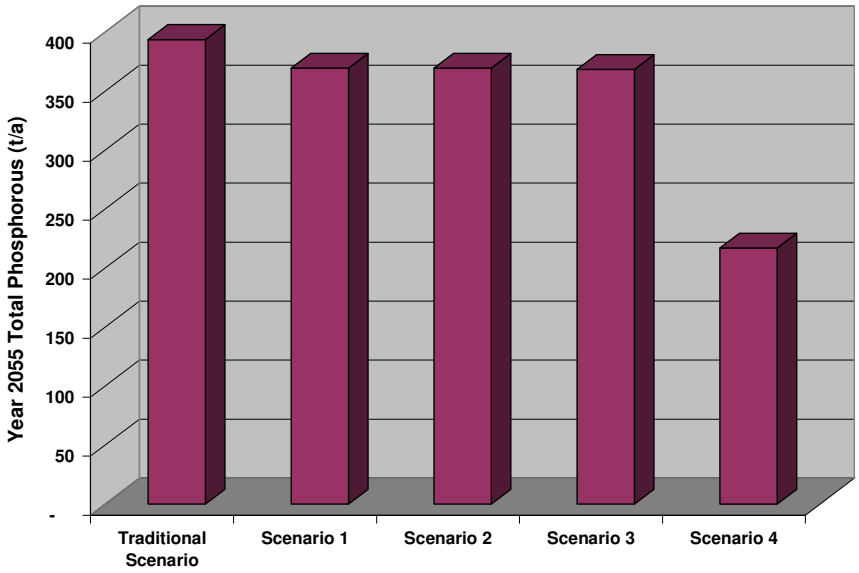


Figure 2-14: Forecast Urban Pollutant Loads – Total Phosphorous

It should be noted that the current nutrient balances have been estimated at the LGA area level. That is, they represent typical levels of nutrient generation on a gross scale. No allowance has been made for processes impacting the fate of the pollutants such as sedimentation, assimilation, denitrification and phosphorous adsorption.

It is recognised and generally accepted that urbanisation has had a negative impact on receiving waterways within Gosford LGA, and that further development is likely to continue to contribute negatively to the environment, unless specific action is taken. Based on the urban pollutant forecasts, it is anticipated that with increasing levels of integration, there will be a reduction in pollutant loads. WSUD, rainwater tanks and stormwater harvesting are also expected to have a minor influence on total urban runoff and evapotranspiration. However, these forecasts do not allow for localised benefits, which may be significant on a case by case basis.

3 SCENARIO COMPARISON

This section outlines comparison of the IWCM Sub-Plan scenarios with identification of a local IWCM scenario.

3.1 Approach to Scenario Comparison

The following approach to scenario comparison and selection was adopted:

1. The characteristics of each of the local IWCM Scenarios (see Section 2.5) were used to compare the relative performance of each scenario in terms of the TBL;

2. The interactions and limitations of each local IWCM Scenario with *WaterPlan 2050* considerations were recognised;

3. Feedback from the PRG in terms of a recommended local IWCM Scenario;

4. The adopted strategy will be subject to on-going monitoring and evaluation.

3.2 Stakeholder Comparison of Scenarios

A third and final PRG workshop was held 9 March 2007 to define the PRG's assessment of each scenario and provide input to the Strategy. This meeting was attended only by PRG members representing the Gosford LGA.

Participants were provided with a briefing paper (see Appendix A) and a presentation with description of each of the scenarios to facilitate assessment. The briefing information and presentation also outlined the changes in the project process, and during the development of the IWCM strategy for the Central Coast.

As part of the workshop process, and in consideration of the similarity in the outcomes of integrated scenarios, the PRG made a series of recommendations to be considered in the development of the Strategy, and highlighted the need for on-going monitoring, assessment and review (where as appropriate) of the initiatives included in the adopted scenario.

3.3 Integrating Local and Bulk Water Scenarios

WaterPlan 2050 has been developed on the assumption that future water demands for the Gosford-Wyong water supply system will be reduced by approximately 14% (by 2051) due to the implementation of water saving measures (refer Section 6.5, *WaterPlan 2050*). For a scenario to be recommended for consideration in the finalisation of *WaterPlan 2050*, it should demonstrate a saving from current baseline projections of at least 14%.

The future water demands for Gosford were combined with the future water demands for Wyong developed under the Wyong IWCM Sub-Plan, to estimate system wide demands. The Wyong future water demands were developed using similar assumptions and methodology as used for Gosford as outlined in Section 2. The system-wide future water demands and the comparison against the *WaterPlan 2050* assumptions are shown in Figure 3-1.

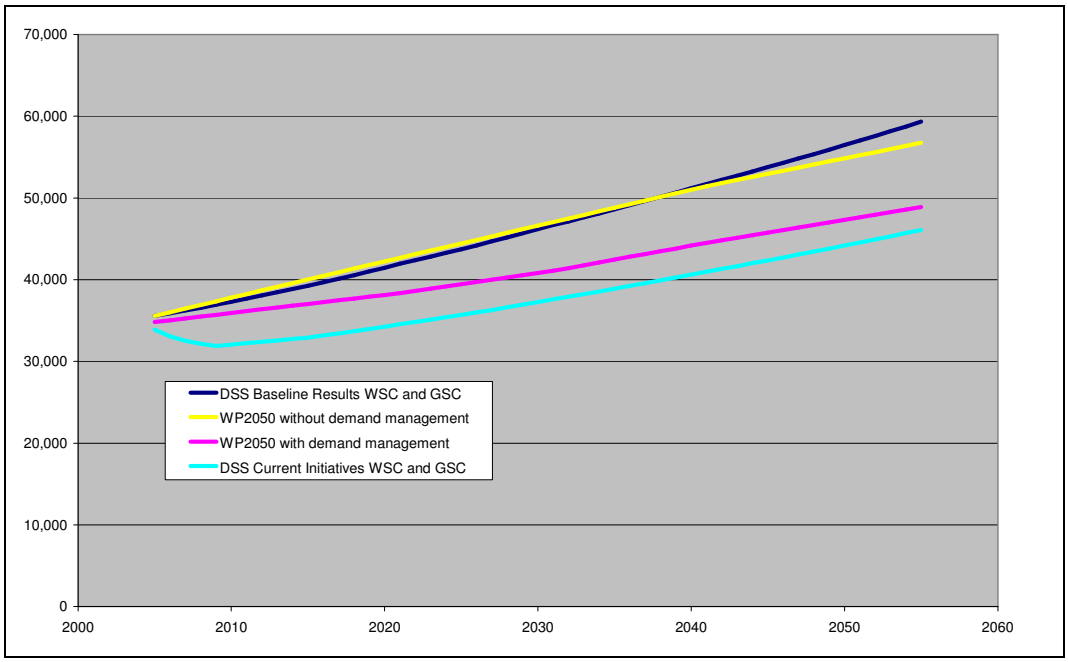


Figure 3-1: Central Coast System-Wide Future Water Demands

It is important to note, that although there appears to be a significant difference between the '*WaterPlan* 2050 forecast with demand management' and the 'DSS Current Initiatives WSC and GSC', for the purposes of bulk water supply planning, the differences are not significant and the *WaterPlan 2050* forecasts provide appropriate conservatism.

All the integrated scenarios (that is, Scenario 1 to 4) provide sufficient demand management outcomes to meet the assumptions set out in *WaterPlan 2050* in terms of the bulk water supply. Hence, any of the integrated scenarios would be appropriate to be considered with the *WaterPlan 2050* bulk water supply scenarios.

3.4 Recommendations

The information assembled and developed in this report, together with *WaterPlan 2050* provides the basis for GCC's contribution to the development of the Central Coast's IWCM Strategy. The Sub–Plan information includes:

1. Summary of water cycle management issues facing Gosford.

2. Description of options to address the issues including: targeted extent of application, timing, costs and key benefits. The options provide a suite of approaches which can be called on, should the effectiveness of the planned initiatives fall short of targets.

3. Description and assessment of a traditional scenario and four integrate scenarios to assist in the development of GCC's future water services management.

4. Capital works and operational expenditure plans for each of the scenarios.

5. PRG stakeholder recommendations.

PRG recommendations for consideration in the development of *WaterPlan 2050* and the Strategy are tabled within Appendix A. As recognised by the PRG, the development of options considered in this study has been made using information available at the time of the study. The potential exists for other integrated options to be identified in the future. For instance, the Woy Woy Peninsula is likely to yield integrated solutions to address localised flooding, groundwater extraction and stormwater quality issues. Additional integrated options may also be presented when considering the combined GCC and WSC IWCM Strategy.

3.4.1 Scenario Adoption

It is acknowledged that this sub-plan is a part of *WaterPlan 2050*, with this in mind, this strategy has identified a number of scenarios which satisfies the original water saving target set within *WaterPlan 2050*. No single strategy has been selected by the PRG group.

This strategy shows that Scenario 1 reaches the water saving targets set by *WaterPlan 2050* for the least cost to GCC. Gosford City Council and the DEUS have expressed a preference for Scenario 1.

4 THE NEXT STEPS

This section outlines generic implementation, monitoring and review recommendations applicable to whichever integrated local IWCM scenario (Scenario 1 to 4) is adopted.

4.1 Implementation

The local IWCM scenario will be implemented through incorporation in the over-arching *WaterPlan 2050 – IWCM Strategy for the Central Coast.*

Implementation of the over-arching strategy, including the local IWCM scenario resulting from this Sub-Plan, will require on-going support from GCC, the community and relevant government agencies.

Some of the activities contained within the scenario will require intermediate steps to facilitate their implementation, including the following:

- Development of water supply design standards that recognise the conservation and source substitution impacts;
- Development of a wastewater treatment strategy to further consider opportunities for recycling and process requirements to allow unrestricted non-potable reuse and in line with future environmental needs. This will include process requirements in light of current standards;
- Further development of a non-potable reuse policy to recognise and opportunistically implement commercial and industrial reuse; and
- Implementation and possible refinement of the Water Cycle Management DCP (DCP 165). Guidelines for the consideration of the development of an IWCM and WSUD DCP have been included in Appendix F.

4.2 Monitoring and Review

The *Concept Study* identified the water management issues for Gosford LGA and this Sub-Plan has identified a series of options and subsequent scenarios for addressing the issues. However, ongoing monitoring and review is required in order to ensure that the issues are resolved and that any new issues are identified and addressed over time. Monitoring the performance of the urban water systems will facilitate adaptive and flexible decision making in the future.

Through the assessment of a wide range of options, and the development of a series of scenarios, this Sub-Plan provides a reference for an adaptable approach to future issues such as technological, policy and regulatory changes. Also, should any of the options included in the adopted scenario not perform as well as anticipated, alternatives have been documented in this report.

The local IWCM scenario is sensitive to a number of key assumptions. The monitoring of these assumptions will form the basis for understanding how and when the IWCM scenario should be revised. These key assumptions and their recommended monitoring protocols are set out in Table 4-1. It should be noted that DEUS recommends the review of the IWCM Sub-Plan at least every 5-6 years. The next IWCM review is expected to commence in 2012.

This sub-plan describes scenarios beyond those adopted and allows for the adoption of these further scenarios at a later date if monitoring shows performance targets are not being met.

Table 4-1: Implementation Key Sensitivities and Monitoring Actions

Key Sensitivities of Scenarios	Key Monitoring Actions
Customer response to pricing increases. Price signals may be insufficient to cause changes in customer behaviour. Customers may not reduce their use of water as forecast.	Water consumption records, drawn from customer billing information, should be monitored and climate-corrected quarterly following the introduction of price increases with the aim of quantifying the savings achieved.
Effectiveness of BASIX. As a relatively new regulatory regime, the actual impact of BASIX on consumption is not well understood. Enforcement of the regulation is generally only possible during development approval processes.	Tag customers impacted by BASIX in the customer database such that actual data on their consumption can be tracked on a quarterly basis to determine the on-going success of BASIX.
Effectiveness of the existing and planned recycled effluent initiatives. The schemes currently in place and planned for the GCC LGA are relatively new. The long-term potable demand substituted by these initiatives may vary from the theoretical replaced consumption assumed.	Tag customers utilising these schemes and monitor quarterly both their potable and treated effluent consumption. Reconcile against historical consumption records.
Population growth. The rate of population growth may differ from that assumed in the forecast. Demand forecasts are sensitive to changes in growth rates and dwelling types.	Annually track changes in growth rates and dwelling composition.
Climate change. Initial modelling of mid-range climate changes applied to Gosford's demand responses suggests demand forecasts may increase by 5%.	Track climate change modelling at the international and national level and revise forecasts as new information comes to light.

These monitoring initiatives should be incorporated into the overall strategy for monitoring and review within *WaterPlan 2050 – IWCM Strategy for the Central Coast.*

The local IWCM Scenario will provide the framework for the sustainable management of GCC's local urban water services into the future. For successful implementation, it requires on-going support by Council, the community and relevant government agencies.

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APPENDIX A - PROJECT REFERENCE GROUP

To assist in developing the IWCM Sub-Plan, a PRG was constituted during the Concept Study phase (see Table A-1). Initially, the group included representatives from both the Gosford and Wyong LGAs. However, during the GCC Sub-Plan phase, the group was reduced to include only those stakeholders who represented Gosford LGA interests.

Table A-1: Project Reference Group Members

Name	Representing	Attendance		
		Workshop 1	Workshop 2	Workshop 3
Jacob Strickling	Community Representative		Yes	
Roy Lyne	Community Representative	Yes		Yes
Ray Rauscher	Wycare Incorporated	Yes	Yes	
Margaret Pontifex	Bushcare / Landcare / Rural Community	Yes	Yes	Yes
George Freeman	Department of Energy Utilities and Sustainability	Yes	Yes	Yes
John Bourke	Department of Energy Utilities and Sustainability	Yes	Yes	Yes
Leah Wheatley	Department of Energy Utilities and Sustainability	Yes	Yes	
Ana Corpuz	Department of Energy Utilities and Sustainability			Yes
Rebecca Shrivener	NSW Premiers Department	Yes	Yes	
Leoni Baldwin	NSW Premiers Department	Yes		Yes
David Hoey	Department of Natural Resources	Yes	Yes	Yes
David Green	Department of Natural Resources			Yes
Rod Williams	Gosford City Council	Yes	Yes	
Stephen Glenn	Gosford City Council	Yes	Yes	Yes
Greg Flynn	Gosford City Council		Yes	
Gary Chesnut	Gosford City Council	Yes	Yes	Yes
Dan Waters	Gosford City Council	Yes	Yes	Yes
Peter Sheath	Gosford City Council			Yes
Pam McCann	Gosford City Council			Yes
Rick Brocklehurst	Gosford City Council			Yes
VicTysoe	Gosford City Council	Yes	Yes	Yes
Colleen Worthy-Jennings	Gosford City Council		Yes	
Chris Holstein	Gosford City Council		Yes	
David Green	Hunter Central Management Authority		Yes	Yes

		Attendance		
Trudy Green	Hawkesbury Nepean Central Management Authority			Yes
Neville Pavan	Hawkesbury Nepean Central Management Authority	Yes	Yes	
Ken Grantham	Wyong Shire Council	Yes	Yes	
Ahmad Mostafa	Wyong Shire Council	Yes	Yes	Yes
Garry Casement	Gosford Wyong Council Water Authority	Yes	Yes	Yes
Russell Beatty	MWH Australia	Yes		
Adam Joyner	MWH Australia		Yes	Yes
Kate Smolenska	MWH Australia	Yes	Yes	Yes
Paul Byrne	MWH Australia	Yes	Yes	
Susan Love	MWH Australia	Yes	Yes	Yes

Prior to each workshop, invitees were issued briefing papers setting out the objectives of the workshop and relevant project information to assist invitees prepare for the workshop. Similarly, following each workshop, meeting notes were compiled and issued to participants. Copies of these workshop briefing papers and the resulting meeting notes are included in the following pages.

Gosford and Wyong Integrated Water Cycle Management Study
IWCM Option Multi-criteria Ranking

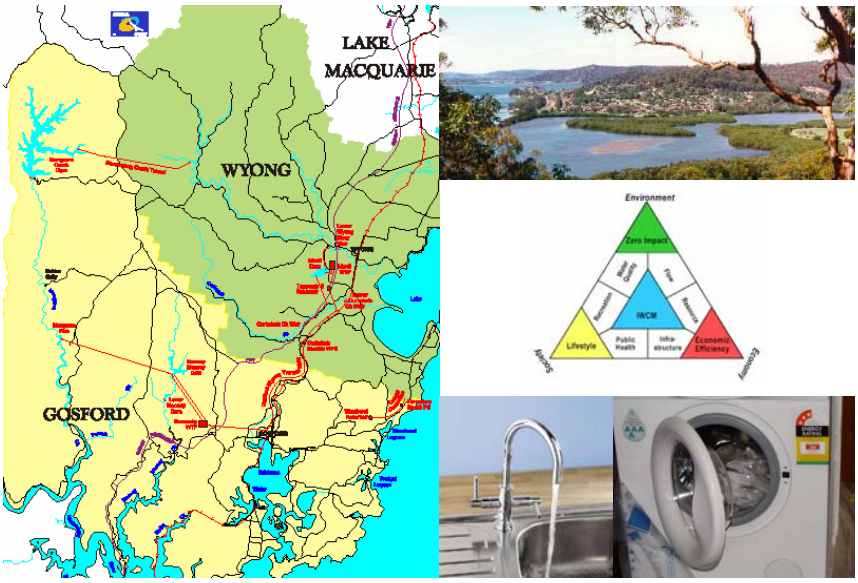
MWH

IWCM Option	Overall Rank			
	Equal Weight	Environmental	Social	Economic
Urban Development				
Efficiency controls on showerheads and tapware	7	14	8	4
Landscaping/native planting controls	36	38	43	35
Mandatory use of rainwater tanks for new development	13	11	12	15
Adopt higher BASIX standards	36	38	38	39
Water Sensitive Urban Design DCPs	1	1	3	1
Enhanced erosion controls during and after construction	57	57	59	57
Community IWCM education (promotion/guidelines)	3	4	4	2
Recycled water use through a "third pipe" system	7	8	6	10
On-site greywater recycling	42	55	37	37
Stormwater harvesting	25	25	25	26
Sewer mining	51	51	45	53
Decentralised treatment cluster systems	69	69	69	70
Smart sewers (low inflow and infiltration)	57	58	59	55
Stormwater treatment ponds/wetlands	31	28	31	33
Traditional detention basins	59	59	57	60
Water quality treatment detention basins	43	43	41	50
Gross pollutant traps	55	53	54	55
On-site detention	67	67	68	65
Rural properties to have treated tank drinking water	53	56	51	45
Include plumbing in new dev't to allow use of greywater	43	49	41	43
Develop DCPs for water recycling dual plumbing for large users, commercial, industrial and open space	5	5	6	8
Localised industrial treatment of sewerage for reuse	17	17	16	22
Stormwater reuse	20	20	17	24
Ban sink incinerators	22	23	24	14
Existing Development				
Residential retrofit of showers and tap flow regulators	16	19	14	13
Dual flush toilet retrofit	23	21	18	26
Washing machine rebate	18	24	13	23
High water user audits	2	2	1	3
Community IWCM education (promotion/guidelines)	10	13	11	7
Enhanced conservation signal in water pricing	28	29	29	25
Shared equipment and access funding sources for IWCM activities	29	35	28	19
Rainwater tank retrofit program	6	7	5	12
Rainwater tank rebate	4	3	2	5
Retrofit of recycled water system to key users	11	12	9	11
Retrofit of recycled water system to all areas	45	47	36	52
Sewer mining	39	46	35	39
Retrofit of on-site greywater recycling	60	62	58	59
Retrofit of Water Sensitive Urban Design to key areas	38	37	40	46
Stormwater harvesting in key areas	21	27	19	21
Community rainwater tanks for general use	24	21	22	28
Stormwater treatment ponds/wetlands	35	30	39	38
Localised industrial treatment of sewerage for reuse	19	18	21	20

Stormwater reuse	33	33	27	34
Detention basins with low flow release	63	64	64	63
Gross pollutant traps	56	54	56	57
Litter/organics to stormwater reduction (bins, street clean, bags)	30	25	31	31
Rehabilitation of existing watercourses	27	16	30	32
Flood mitigation works in key areas	68	68	67	68
Treatment process upgrade and return flow	47	51	45	39
Agricultural reclaimed water reuse	33	31	34	29
Improved monitoring of water cycle facilities (incl. on-site and groundwater)	32	32	33	30
Improved trade waste management	48	42	50	46
Active system leak detection and repair	12	15	15	6
Infiltration and inflow reduction program	39	41	47	35
Pressure reduction program	26	34	26	16
Catchment Areas				
Protect and rehabilitate riparian zones	15	6	23	18
Establishment of buffer zones alongside significant streams	14	9	20	17
Improved monitoring of farming practices	45	36	48	48
Erosion and weed controls	54	47	55	54
Revegetation for dryland salinity	49	45	49	49
Improve on-site systems	52	49	52	51
Improved management of contaminated and landfill sites	41	40	44	42
Community education/enhanced land care programs	9	10	10	9
Increase storage capacity within catchment	73	72	73	73
Return of recycled effluent to point of extraction	66	66	65	67
Remove disused weirs	65	61	66	66
Purchase competing licences	61	59	63	61
Implement macro water sharing plan	50	44	53	44
Indirect Potable Water Reuse	62	63	62	62
Aquifer Storage and Recovery (ASR)	70	70	70	71
Stormwater harvesting at catchment scale	63	65	61	64
Supply-side Management				
Increased off-stream storage	71	71	71	69
Increased river extraction	72	73	72	72
Groundwater extraction	74	74	74	74
Desalination plant	75	75	75	75

TOP 10

BOTTOM 10



Gosford City Council

Gosford IWCM Strategy Sub-plan Project Reference Group

Workshop 3: IWCM Scenario Assessment Briefing Paper

9 March 2007

1. Introduction

Council has embarked upon the preparation of an Integrated Water Cycle Management (IWCM) sub-plan to explore options for sustainably managing the provision of water supply, sewerage and stormwater services. This paper is a briefing note to the Project Reference Group (PRG) for the final of three planned workshops to assist in the preparation of the strategy. The previous workshops covered:

1. PRG Workshop 1 – IWCM Goals and Options.

2. PRG Workshop 2 – IWCM Scenario Building.

The objectives of this workshop are to:

1. Define the PRG's assessment of each integrated scenario.

2. Discuss the next steps in developing an integrated strategic plan.

2. Background

The development of the IWCM sub-plan was initiated adopting the Department of Energy, Utilities and Sustainability (DEUS) IWCM guidelines and included consideration of bulk supply and local integrated opportunities. However, due to Council's bulk supply strategic planning efforts being fast-tracked with the current drought, the IWCM process has now been split into two parts:

1. IWCM sub-plans (of which there will be two, one each for Gosford and Wyong).

2. *WaterPlan 2050*.

These plans will be agglomerated into a single strategic water planning tool to be known as *WaterPlan 2050 – IWCM Strategy for the Central Coast*. This is to be developed separately after the completion of *WaterPlan 2050* and the two IWCM sub-plans.

WaterPlan 2050 has focused on identifying surface water sources and bulk (or large scale) alternative water sources such as groundwater and stormwater harvesting to ensure that the growing population of the Central Coast has sufficient water to meet their needs for the next 50 years. Many aspects of sustainably managing the water supply, sewerage and stormwater system have been considered as part of *WaterPlan 2050* and the objectives and focus of the plan coincide with many of the IWCM study objectives.

The two Central Coast councils, in consultation with DEUS, have defined the interface between these two studies (Figure 1). The IWCM sub-plan with cover a 50 year strategy and will be produced separately for both Gosford and Wyong councils. These sub-plans will focus on identifying and assessing (against the triple bottom line) water efficiency and local sewage, stormwater and greywater recycling options that could be put in place in each local government area.

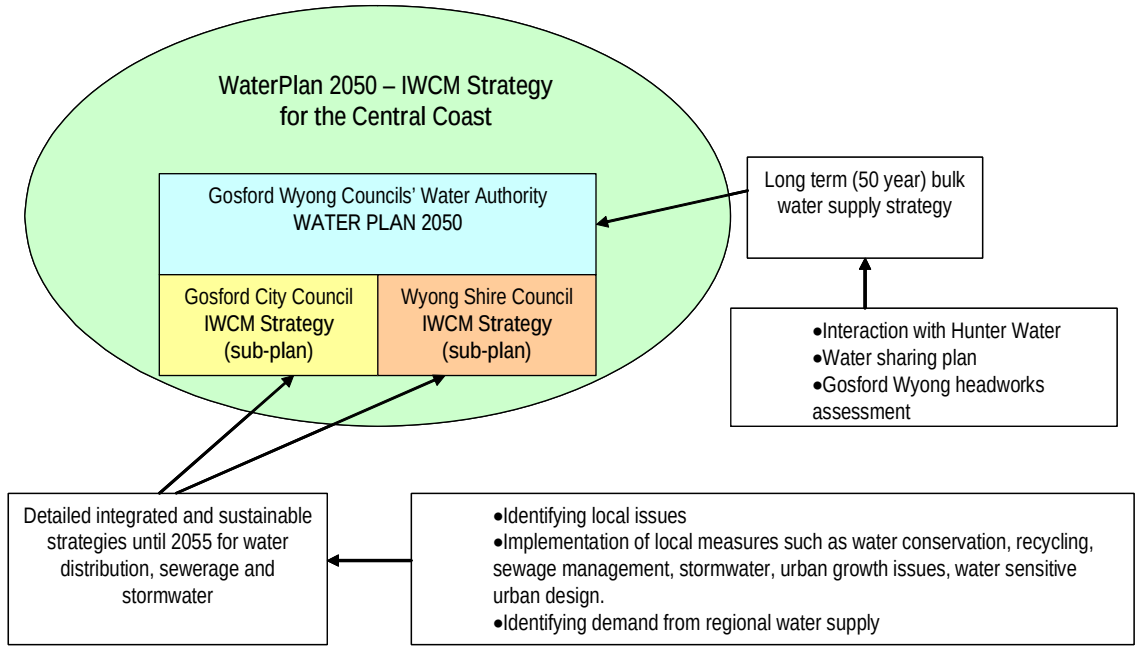


Figure 1: Interaction between WaterPlan 2050 and IWCM Studies

The IWCM sub-plans will identify the preferred options for development of local urban water services (water supply, wastewater and stormwater) in Gosford City Council. As part of this process, your involvement (as a representative of the local community or an agency with an interest in Gosford's water cycle management) is sought to assist in the development and assessment of the integrated local urban water service options through participation in the PRG.

When complete, the IWCM sub-plan will contain the following:

1. A summary of the water cycle management problems facing Gosford City Council.
2. Five scenarios illustrating the possible ways that the local urban water services can be provided in the future.
3. An economic, environmental and social assessment of the costs and benefits of each of these five scenarios.
4. A capital works plan for implementing each of the possible scenarios.
5. The technical engineering reports utilised in developing the five scenarios.

The process for developing the IWCM sub-plan will include:

1. Consideration of the Concept Study findings and baseline forecasts (completed in November 2006).
2. Development of options and assessment criteria for decision making (completed in February 2007).
3. Detailed options assessment and development of IWCM scenarios (completed in February 2007).
4. Triple bottom line assessment and comparison of the IWCM scenarios (to be completed at PRG Workshop 3, 9th March 2007).

For more information on the IWCM process and initiatives refer to: http://www.deus.nsw.gov.au/Water/.

For more information on WaterPlan 2050 refer to:
http://www.gwcwater.nsw.gov.au/main/our_system/water_plan_2050.

3. Scenario Development

In previous PRG workshops, water cycle management issues, options to address the issues, and criteria for assessment of options were identified. Urban water cycle management options have now been assessed and five different pictures of the future of Gosford's local urban water services (known as scenarios) have been developed. The five scenarios were developed through reviewing the issues identified throughout the IWCM process (PRG Workshop 1) and considering identified potential solutions (PRG Workshop 1). The long list of options was tested by the PRG using a ranking tool based on environmental, social and economic criteria. Based on the PRG's consideration, suitable options were identified for bundling into scenarios (PRG Workshop 2).

The integrated scenarios incorporate combinations of various demand management measures and an increasing movement towards the integration of water supply, sewerage treatment and stormwater management through cumulative inclusion of rainwater, stormwater, greywater and reclaimed water use. The scenarios are described below.

The *Traditional Scenario* represents a traditional approach of separately managing urban water services to meet future needs. It assumes increased supply and water supply facilities in order to meet potable water supply demands. Wastewater management consists of secondary level treatment with ocean release. Stormwater management includes system detention basins and gross pollutant traps. Conservation approaches are limited to WELS, which is included in all scenarios.

Scenario 1 represents the current urban water cycle management practice extended into the future. Current practice includes sewer rehabilitation to reduce inflow and infiltration, on-site wastewater system management and best practice trade waste management. Stormwater initiatives include litter/organics reduction and soil erosion controls. Demand management measures include retrofit programs, education, high water user audits and a rainwater tank rebate program.

Scenario 2 represents Council's currently planned urban water management activities. A water supply system leakage reduction program is planned. Water mining projects will be implemented within Gosford CBD. Stormwater initiatives include flood mitigation works and a WSUD DCP for new development. Conservation activities will be increased through enhanced water pricing, stepped-up education program, mandatory rainwater tanks in new residential areas, as well as retrofit and rebate programs. Increased levels of catchment management activities are anticipated in line with catchment action plans.

Scenario 3 allows for increased source substitution through identified high priority reclaimed water and stormwater harvesting opportunities.

Scenario 4 extends the application of non-potable reclaimed water reuse to include targeted areas. The inclining block tariff is extended to include non-residential customers and individual meters installed at new units. Scenario 4 also includes extension to the provision of sewerage services and tertiary treatment at STPs.

The measures included in each scenario are set out in Table 1.

Table 1: Scenario Elements

Water Management Option	Traditional Scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Sewage Collection and Treatment					
Improved STP treatment				✓	✓✓
Improved trade waste management		✓	✓	✓	✓
Infiltration and inflow reduction program		✓	✓	✓	✓
Sewerage backlog and extension	✓	✓	✓	✓	✓✓
Smart sewers (low inflow and infiltration)			✓	✓	✓
Conservation					
Current government initiated programs	WELS	✓	✓	✓	✓
Community IWCM education		✓	✓✓	✓✓	✓✓
Fixture retrofits and rebates		✓	✓✓	✓✓	✓✓
Mandatory rainwater tanks in new developments			✓	✓	✓✓
Enhanced pricing			✓	✓	✓✓
High water user audits		✓	✓	✓	✓
Leakage reduction program	✓	✓✓	✓✓✓	✓✓✓	✓✓✓
Source Substitution					
Stormwater harvesting and reuse			✓	✓✓	✓✓
Promotion of on-site greywater recycling		✓	✓	✓	✓
Recycled water use through a "third pipe" system			✓	✓✓	✓✓✓
Urban stormwater					
Current initiatives		✓	✓	✓	✓
Water Sensitive Urban Design DCPs			✓	✓	✓
Current flood mitigation works in key areas	✓	✓	✓	✓	✓
Catchment					
Current catchment initiatives		✓	✓	✓	✓
Improved catchment activities			✓	✓	✓
Improved monitoring, legislation, system efficiency, design and funding			✓	✓	✓

4. Scenario Benefits and Costs

Each scenario has the following general benefits and costs, which can be used to assess their relative performance, and hence, identify a preferred scenario:

- Water savings;
- Pollution loads; and
- Costs to install and costs to operate.

Preliminary findings of the technical assessment are summarised in Table 2 (figures are subject to change). Savings on the annual amount of water extracted from the river for town supply are anticipated through combinations of conservation activities, such as education, pricing and water efficient fixtures, as well as source substitution, such as rainwater, greywater and recycled effluent.

The estimated annual average water savings and indicative annualised costs per kL of water savings for each measure are tabled below.

Table 2: Individual Option Water Savings Assessment

Measure Description	Community Annualised Cost ($/kL)	Customer Annualised Cost ($/kL)	Utility Annualised Cost ($/kL)	Average Water Savings (ML/a)
Inclining Block Tariff - Residential & Non Res	$0.00	$0.00	$0.00	1,333
Inclining Block Tariff - Residential	$0.00	$0.00	$0.00	1,245
BASIX Program - 40 Points	$2.77	$2.77	$0.00	1,213
Mandatory Infill Rainwater Tanks - Sc4	$2.67	$2.67	$0.00	1,202
Mandatory Infill Rainwater Tanks - Sc2	$3.26	$3.26	$0.00	972
Mandatory Infill Rainwater Tanks - Sc3	$3.26	$3.26	$0.00	972
Currently Set Price Increases	$0.00	$0.00	$0.00	876
IWCM Education Program - Stepped Up	$0.20	$0.00	$0.20	561
Education Program - Current Initiatives	$0.11	$0.00	$0.11	502
Gosford CBD Water Mining Stage 2	$2.43	$0.30	$2.13	410
Permanent Low Level Restrictions	$0.05	$0.00	$0.05	410
Rainwater Tank rebate for exisiting development	$5.11	$2.04	$3.07	345
WELS - Total Program Savings	$0.43	$0.42	$0.00	282
Water Loss Program - Stepped up	$0.40	$0.00	$0.40	231
Gosford CBD Water Mining Stage 1	$2.79	$0.00	$2.79	180
BASIX - Total fixture savings	$0.12	$0.12	$0.01	153
Water Loss Program - Current Initiatives	$0.12	$0.00	$0.12	148
Residential Retrofit Program	$0.30	$0.17	$0.13	133
Extend Gosford Water Mining - Somersby	$5.74	$0.02	$5.73	87
Extend Gosford Water Mining - West Gosford	$1.67	$0.05	$1.62	81
Siletta Rd SW Harvesting	$3.40	$0.04	$3.36	62
Terrigal Water Mining	$3.50	$0.02	$3.48	54
Large Lot SW Harvest/WSUD	$4.77	$4.52	$0.26	48
Kincumber STP ReW Scheme	$8.04	$0.06	$7.98	37
Residential Toilet Retrofit	$3.07	$0.00	$3.07	24
Non-Residential Audit - Total Program Savings	$1.24	$0.54	$0.70	21
Smart Meters - Individual Unit Meters	$8.26	$6.50	$1.77	15
Terrigal Glen SW Harvesting	$3.88	$0.12	$3.76	14
St Huberts Water Mining	$2.21	$0.03	$2.19	11
Residential Washing Machine Rebate	$33.31	$25.12	$8.19	4
Planned Backlog Sewerage	-$6,033.79	$1.88	-$6,035.67	-6
Extend Sewerage Coverage	-$7,838.95	$1.48	-$7,840.43	-8

Notes:

1. Stand alone savings cannot be summed together to estimate total scenario savings, as interactions between measures must be considered.
2. Annualised costs are presented and customer annualised costs are exclusive of any rates impact.

Figure 2 is a breakdown of the Year 2050 water demands by scenario, along with generated wastewater.

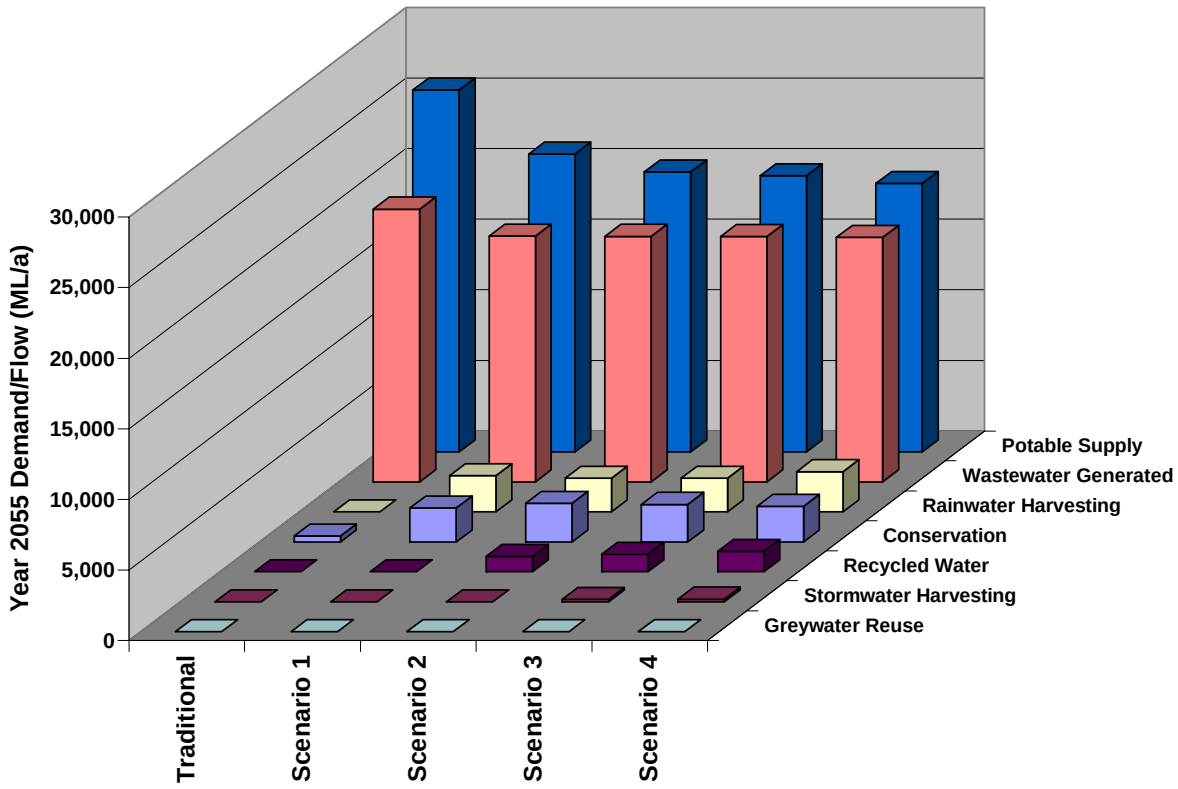


Figure 2: Urban Water Supply and Wastewater Forecast by Scenario

The potable water savings for each scenario are plotted in Figure 3.

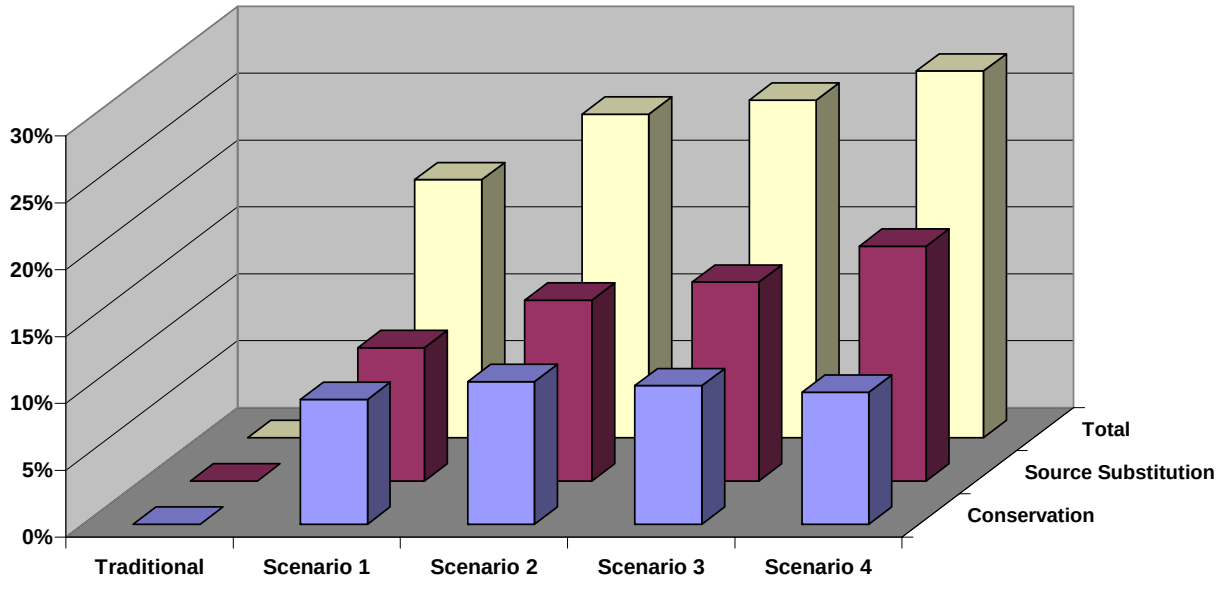


Figure 3: Potable Water Savings

Annual pollutant loads emanating from the urban area have been estimated for urban runoff (based on land usage) and reclaimed water loads (Figure 4). Urban pollutant reductions are anticipated through a combination of improved wastewater treatment and water sensitive urban design.

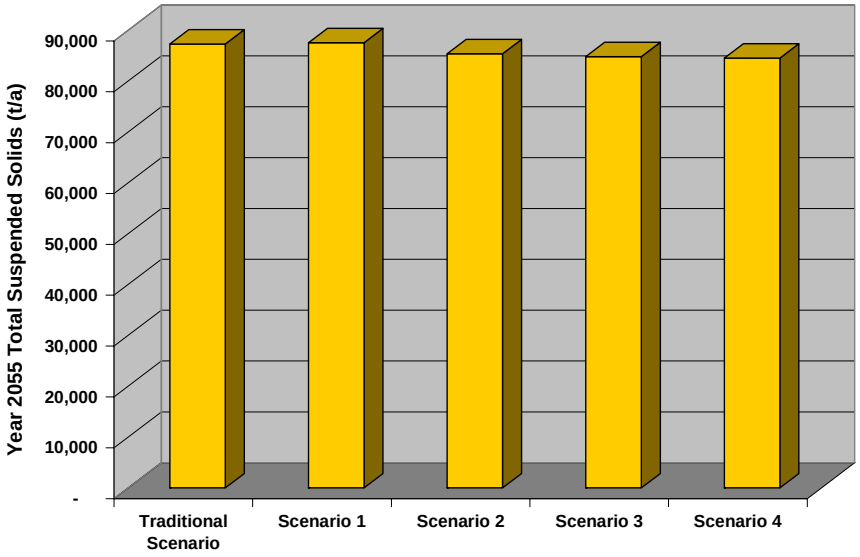


Figure 4: Forecast Urban Pollutant Loads – Total Suspended Solids by Scenario

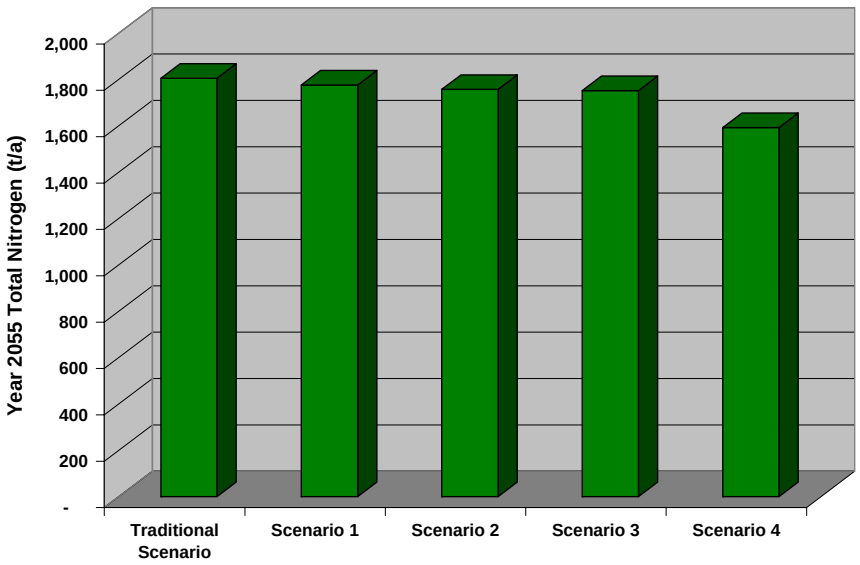


Figure 5: Forecast Urban Pollutant Loads – Total Nitrogen by Scenario

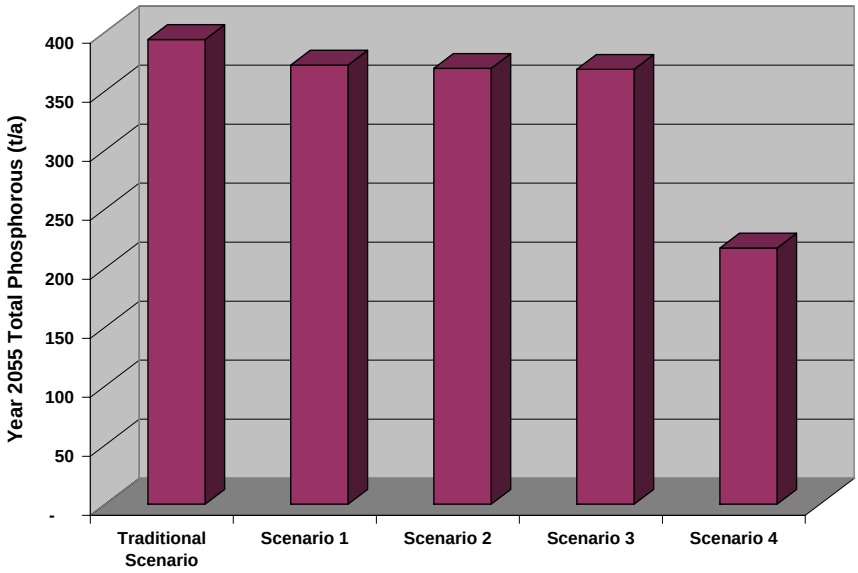


Figure 6: Forecast Urban Pollutant Loads – Total Phosphorus by Scenario

Indicative and comparative cost estimates for each scenario will be provided at the PRG workshop on 9th March.

5. Scenario Assessment

Assessment of the IWCM scenarios will be based largely on the criteria developed in PRG Workshop 2. Although not identical, there was considerable overlap between the criteria developed by the PRG and the criteria adopted in assessing the *WaterPlan 2050* scenarios. The PRG criteria attempt to balance the social, economic and environmental considerations and are set out in Table 3.

Table 3: Scenario Assessment Criteria

Environmental	Social	Economic
Maintains water quality and minimises negative impact on biodiversity. Prevents long-term depletion of water resources. Is an energy and resource efficient option, and minimises green house gas emissions.	Aids in securing the reliability of water supply. Reduces individual water demand (L/per person/per day). Encourages and promotes society's acceptance of alternate water sources (reuse of grey water, treated water, stormwater, etc).	Minimises long-term costs of urban water cycle infrastructure. Maintains an affordable water supply ($/ML). Includes economic incentives to use alternative sources of water.

A multi-criteria analysis decision tool will be presented in the workshop to assist the PRG to score and rank the scenarios. Some scores can be directly quantified based on the project team's estimates of scenario benefits and costs, others are less tangible and will require group consensus. The decision tool can also be used to test the sensitivity of individual assessment criteria. There will also be opportunity to discuss the results, including any other issues raised by PRG members.

It should be noted that the PRG's assessment will provide a relative ranking of the IWCM scenarios without the benefit of direct consideration of water supply-side factors. Water supply-side factors will be considered by WaterPlan2050 and when combined with IWCM scenario considerations, allow the development of a preferred IWCM strategy to be included in *WaterPlan 2050 – IWCM Strategy for the Central Coast*.

6. Where to from here?

Following this workshop any required adjustments to the preferred scenario will be made and the IWCM sub-plan will be finalised. The outcomes of the IWCM sub-plan will be incorporated by GCC into *WaterPlan 2050 – IWCM Strategy for the Central Coast*. This final plan, when drafted, will be placed on public display and comments will be received and considered by GCC in finalising *WaterPlan 2050 – IWCM Strategy for the Central Coast*.

7. Workshop Program

The program for Workshop 3 is provided in the attached agenda. Please arrive in time for the 9:30am start. We look forward to meeting you and working with you during the development of Gosford's IWCM sub-plan. If you have any questions prior to the workshop, please contact Peter Sheath at Gosford City Council on (02) 4325 8129.

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Meeting Notes

Gosford City Council Integrated Water Cycle Management Sub-Plan
Project Reference Group Workshop 3

Venue: The Erina Centre (Erina Fair Shopping Centre, Karalta Road, Erina)
Time: 9:30am - 1:00pm, 9 March 2007

Client Name: Gosford City Council

Project Name: Gosford City Council IWCM Strategy Study **MWH Project No:** A01008201

Facilitator: Susan Love

Attendees: refer to attached attendance list

Item		Action
1.0	**Welcome and Introductions**	
	Peter Sheath (GCC) provided the welcome and thanked the attendees on behalf of GCC and reinforced Council's commitment to the project.	
	Susan Love (Que Sera Consulting) reiterated the PRG terms of reference.	
1.1	*Apologies*	
	Refer to attendance list attached.	
2.0	**IWCM Process Changes**	
2.1	*Water Plan 2050 and the Gosford & Wyong IWCMs*	
	Garry Casement (GWCWA) explained the role of WaterPlan 2050, its aims and the key options that have been investigated for bulk water supply for the Central Coast. Garry outlined the uncertainties and issues associated with the work done for WaterPlan 2050. He also outlined the next steps for the project, which will be to combine the outcomes of the GCC and WSC IWCM sub-plans and WaterPlan 2050 to complete the overarching IWCM Strategy for the Central Coast.	
	John Bourke (DEUS) commented that this final review of the overall outcomes will be critical to determining if all the intended water uses (e.g. for recycling) can be met at a regional scale.	
2.2	*Revised IWCM Objectives*	
	Adam Joyner (MWH) recapped the objectives of the IWCM process and the planning objectives for long-term water resource planning for the Central Coast.	
	The objectives of the IWCM sub-plan are to help the Gosford community and GCC to address their immediate urban water challenges and to decide how their urban water services will be provided sustainably in the future by investigating local scenarios for urban water services provision; and providing input to WaterPlan 2050 – IWCM Strategy	

for the Central Coast.

George Freeman (DEUS) emphasized that the process and its outcomes is subject to review at regular intervals (approximately 5years).

3.0 Workshop Objectives

3.1 Define the PRG's assessment of each integrated scenario

The workshop objectives were to:

- Present analysis of bundled scenarios
- Define PRG's assessment of each scenario and provide input into WaterPlan 2050 – IWCM Strategy for the Central Coast
- Discuss the next steps in developing an integrated strategic plan – WP2050

Kate Smolenska (MWH) recalled the work done by the PRG to date. Kate outlined the outcomes of PRG workshops 1 and 2, recapped the issues identified for Gosford LGA, discussed the long list of options and the assessment criteria developed by the PRG by which to assess the scenarios.

3.2 Discuss the next steps in developing an integrated strategic plan

Kate Smolenska (MWH) reiterated that the PRG's assessment of the scenarios would contribute to WaterPlan 2050 and the overall strategy.

4.0 IWCM Scenario TBL Outcomes

4.1 IWCM scenario descriptions

Adam Joyner (MWH) presented the scenarios and provided a description of each based on water conservation, source substitution, water supply, sewage and stormwater services (including catchment management).

4.2 IWCM scenario outcomes

Adam Joyner (MWH) described for the PRG the outcomes of the scenarios based on assessment of individual options (cost per kL saved) and overall scenario performance. Adam Joyner (MWH) described the impacts on water balance and pollutant loads for each scenario.

5.0 IWCM Scenario Comparison

5.1 Compare the benefits and limitations of the scenarios

A discussion was held about the value of the individual option costings in terms of water savings. It was recognised that the costs presented only reflected one way in which to assess individual options and that social and environmental factors need to be considered when seeking a triple bottom line (TBL) assessment.

Discussion was held as to Council's reporting responsibilities and IPART's role in assessing funding that would be made available for Council to implement IWCM scenarios. Pam McCann (GCC) pointed out that works above those that need to be undertaken to meet Council's minimum performance standard would have to be justified to IPART.

Ana Corpuz (DEUS) suggested that four separate scenarios with consistent outcomes could have been presented, each using different options. This resulted in discussion of IWCM process. George Freeman (DEUS) pointed out that IWCM in this context is focussed on actions that the water authority can take responsibility for. The IWCM process should inform other parts of Council if their areas of responsibility impact on the

water cycle and IWCM scenarios.

Roy Lyne (Community Representative) questioned the use of the inclining block tariff as a method for water conservation, pointing out that some larger households may be financially disadvantaged. It was agreed that any proposal to change water billing is subject to affordability considerations and review by IPART, which would address such issues.

It was discussed whether it is appropriate to separate the IWCM sub-plan process for Gosford and Wyong. Reasons for the segregation of the two sub-plans and the role of the overarching strategy, which considers the full Central Coast, were reiterated.

5.2 Further recommendations

It was recognised that a preferred scenario could not be recommended at this stage in the process and that it would be developed in light of WaterPlan 2050's findings.

As such, the PRG held a discussion about the information and recommendations that should go forward to the development of WaterPlan 2050 and the overarching document that would draw together outcomes of WaterPlan 2050 and the IWCM sub-plan for GCC.

Garry Casement (GWCWA) recommended that PRG's focus be directed to identifying the key options on which Council should focus in the next 5 to 10 years.

Margaret Pontifax (Bushcare / Landcare rep) expressed a view that GCC should be self-sufficient with respect to its water resources and that the restrictions on rainwater tank use should be carefully considered for infill development as these will differ for residents that use rainwater for drinking.

The PRG discussed the need to further identify and seek integrated water cycle solutions in problem areas to suit specific localised issues.

The key points to be recommended for consideration in the development of the IWCM strategy for the Central Coast were recorded and are attached with these notes.

6.0 The Next Step

It was recognised that the next steps for the IWCM process for GCC include:

- Completion of IWCM Sub-Plan including PRG feedback
- Incorporation of relevant IWCM Sub-Plan outcomes into WP2050
- On-going consultation for WP2050 IWCM Strategy for the Central Coast

7.0 Workshop Close

Susan Love (Que Sera Consulting) and Peter Sheath (GCC) thanked everyone who contributed to the outcomes of the IWCM sub-plan.

Gosford City Council Integrated Water Cycle Management Sub-Plan
Project Reference Group Workshop 3

Attendance List

Roy Lyne	Community Representative
Margaret Pontifex	Bushcare / Landcare
Richard Case	Central Coast Community Environment Network
George Freeman	Department of Energy Utilities and Sustainability (DEUS)
Ana Corpuz	Department of Energy Utilities and Sustainability (DEUS)
John Bourke	Department of Energy Utilities and Sustainability (DEUS)
Leonie Baldwin	NSW Premiers Department
David Hoey	Department of Natural Resources
David Green	Central Coast - Hunter - Central Rivers Catchment Management Authority
Trudy Green	Hawkesbury Nepean - Catchment Management Authority
Garry Casement	Gosford Wyong Councils Water Authority (GWCWA)
Pam McCann	Gosford City Council (GCC)
Rick Brocklehurst	Gosford City Council (GCC)
Stephen Glen	Gosford City Council (GCC)
Peter Sheath	Gosford City Council (GCC)
Dan Waters	Gosford City Council (GCC)
Gary Chesnut	Gosford City Council (GCC)
Ahmad Mostafa	Wyong Shire Council (WSC)
Susan Love	Que Sera Consulting
Adam Joyner	MWH
Kate Smolenska	MWH

Gosford City Council Integrated Water Cycle Management Sub-Plan
Project Reference Group Workshop 3

PRG Recommendations to the IWCM Central Coast Strategy

- Future demand estimates made as part of WP2050 and the IWCM sub-plan are very similar and provide confirmation of the estimates made to date. The traditional scenario fails to meet WaterPlan 2050 demand requirements and is a hypothetical case to be used for comparison. Scenario 1 to 4 are understood to meet the basic demand savings sought by WaterPlan 2050. Drought has resulted in many options already being implemented.
- The options that Council will choose to adopt will need to be determined based on appropriate goals and objectives as set by both WaterPlan 2050 and the IWCM sub-plan. It is envisaged that the IWCM process will put pressure on authorities to address key issues by adopting corresponding actions (best practice/good management).
- The IWCM strategy should focus on key options that should be prioritised for the next 5-10 years. It should consider cost effectiveness of localised options and look at short/med/long term benefits of projects in problem areas (e.g. sewer mine project can be costly but have long-term benefits of educating and increasing acceptance of water reuse). As part of the action plan for the IWCM strategy, specific issues should be identified at local level for further in-depth review and assessment of options.
- A focus on the water cycle should be maintained while considering economics, social and environmental impacts within the overall strategy. A “one size fits all” solution may not meet environmental needs because the environment extends beyond LGA boundaries.
- It is recommended that a combination of demand management, substitution and infrastructure are considered to solve WCM issues in long-term for Gosford LGA
- The IWCM strategy should continue to seek further opportunities for integrated project solutions (e.g. Porters Ck) and should prioritise improved monitoring of catchment impacts and quality.
- The water authority should aim to prevent significant expenditure in the future by investing now (e.g. kerb and gutter vs swales).
- Actions that are required as part the IWCM process, but do not fit into the water authority’s area of responsibility, need to be passed on to the relevant areas of council.
- Gosford LGA has different topography and rainfall patterns to Wyong LGA - this impacts the potential opportunities for action/option selection. These should be considered as part of the IWCM strategy.
- The final overarching strategy document (WaterPlan 2050 – IWCM Strategy for the Central Coast) should include high level direction - strategy document, subject to regular review of assumptions and outcomes.

PRG IWCM Sub-plan Recommendations for Development of Central Coast Strategy

The following table outlines the results of the final Workshop (PRG3) and outlines the expectations of stakeholders in the integration of the Gosford sub-plan into the overall Central Coast IWCM Strategy.

Table 5-1: PRG IWCM Sub-Plan Recommendations for Development of the Strategy

PRG Recommendation	Comment
Future demand estimates made as part of *WaterPlan 2050* and the IWCM Sub-Plan are very similar and provide confirmation of the estimates made to date. The traditional scenario fails to meet *WaterPlan 2050* demand requirements and is a hypothetical case to be used for comparison. Scenario 1 to 4 are understood to meet the basic demand savings sought by *WaterPlan 2050*.	The Traditional Scenario is not suitable for application. Scenario's 1 to 4 satisfy the demand savings sought in *WaterPlan 2050*.
The options that Council will choose to adopt will need to be determined based on appropriate goals and objectives as set by both *WaterPlan 2050* and the IWCM Sub-Plan. It is envisaged that the IWCM process will put pressure on authorities to address key issues by adopting corresponding actions (best practice/good management).	*WaterPlan 2050* and IWCM Sub-Plan goals and objectives are endorsed, supported by best practice.
The IWCM Strategy should focus on key options that should be prioritised for the next 5-10 years. It should consider cost effectiveness of localised options and look at short/medium/long term benefits of projects in problem areas (e.g. sewer mine project can be costly but have the long-term benefits of educating and increasing acceptance of water reuse). As part of the action plan for the IWCM Strategy, specific issues should be identified at local level for further in-depth review and assessment of options. The IWCM strategy should continue to seek further opportunities for integrated project solutions (e.g. stormwater harvesting in WSC at Porters Ck) and should prioritise improved monitoring of catchment impacts and quality. The water authority should aim to prevent significant expenditure in the future by investing now (e.g. kerb and gutter vs swales). Gosford LGA has different topography and rainfall patterns to Wyong LGA - this impacts the potential opportunities for action/option selection. These should be considered as part of the IWCM strategy.	Further prioritisation and development of options to be carried out in the Strategy.
A focus on the water cycle should be maintained while considering economics, social and environmental impacts within the overall strategy. A "one size fits all" solution may not meet environmental needs because the environment extends beyond LGA boundaries.	Water cycle and TBL focus to be maintained in the development of the Strategy.
It is recommended that a combination of demand management, substitution and infrastructure options are considered to solve water cycle management issues in long-term for Gosford LGA	*WaterPlan 2050* and the IWCM Sub-Plan provide a diversified management approach.
Actions that are required as part of the IWCM process, but do not fit into the water authority's area of responsibility, need to be passed on to the relevant areas of Council.	Include in the Strategy's Action Plan.
The final overarching strategy document (*WaterPlan 2050* – IWCM *Strategy for the Central Coast*) should include high level direction - strategy document, subject to regular review of assumptions and outcomes.	IWCM process is subject to regular review (every 5 to 6 years).

APPENDIX B – SOURCE SUBSTITUTION

Demand management approaches include replacement of traditional potable water supply with alternative water sources, known as source substitution. This appendix provides a summary of the key aspects of source substitution. Four source substitution options have been considered:

1. Rainwater harvesting – the collection, storage and distribution of rainfall from roof structures for water supply.

2. Reclaimed water – reuse of treated wastewater for non-potable water supply.

3. Greywater reuse – reuse of the greywater component of wastewater (non-toilet and kitchen wastewater) for non-potable water supply.

4. Water sensitive urban design (including stormwater harvesting) – the use of WSUD techniques and stormwater harvesting for water supply.

The application of source substitution is dependent on the quality of water available. Source substitution reuse applications are summarised in the *Australian Runoff Quality Guidelines* (EA, 2006). National reuse guidelines (NWQMS, 2005 & ARMCANZ, 2000) and greywater reuse guidelines (DOH, 2000 & DEUS, 2006) define the treatment requirements for different applications. NSW Health does not prohibit the use of rainwater for any purpose provided the tank is adequately maintained (EA, 2003). However the department does not recommend rainwater tanks for drinking purposes where a reticulated potable water supply is available (DOH, 2002). A summary of these requirements is set out in Table B-1.

Table B-1: Source Substitution Application and Treatment (ARMCANZ 2000)

Source	Application						Treatment
	Agricultural Non Food Crops	Non Contact Irrigation[1]	General Outdoor	Toilet Flushing	Washing	Sensitive Water Quality	
Rainwater	✓	✓	✓	✓	✓		Roof collection, first flush system
Reclaimed Water	✓						Secondary with detention
	✓	✓					Secondary with disinfection
	✓	✓	✓	✓	✓		Tertiary with disinfection and residual
						✓	Tertiary with disinfection
Greywater	✓	✓					Divert to garden without storage
	✓	✓	✓				Store, secondary treatment
	✓	✓	✓	✓	✓		Store, secondary treatment and disinfection
WSUD (including Stormwater Harvesting	✓	✓	✓	✓			Variable, WSUD approaches

1. Assumes no direct contact of water with food.

It is generally accepted that it is relatively easy to apply new urban water system servicing approaches to new developments. It is generally more difficult to retrofit household and commercial plumbing to allow for source substitution than it is to fit-out new premises. In fact, re-plumbing can be a constraint that limits internal source substitution uses. Houses with elevated flooring systems, such as Queenslander style houses, and weatherboard construction present far fewer problems for re-plumbing than slab and double brick homes.

Rainwater Harvesting Systems

Rainwater harvesting systems collect roof water via a first flush device, which is then stored in rainwater tanks. The rainwater system has separate plumbing and is assumed to be supplemented with town supply either via an air break top-up or a commercially available actuated valve with pressure sensor for control of rainwater and mains supply (Figure B-1).

Rainwater supply is generally assumed to be used for non-potable purposes where town water is available. It is becoming increasing acceptable to also connect rainwater tanks to the hot water system. In the Gosford IWCM scenarios, it is assumed that rainwater may be employed for outdoor usage, household washing machines and toilet flushing (Scenarios 1-3) and also hot water applications (Scenario 4).

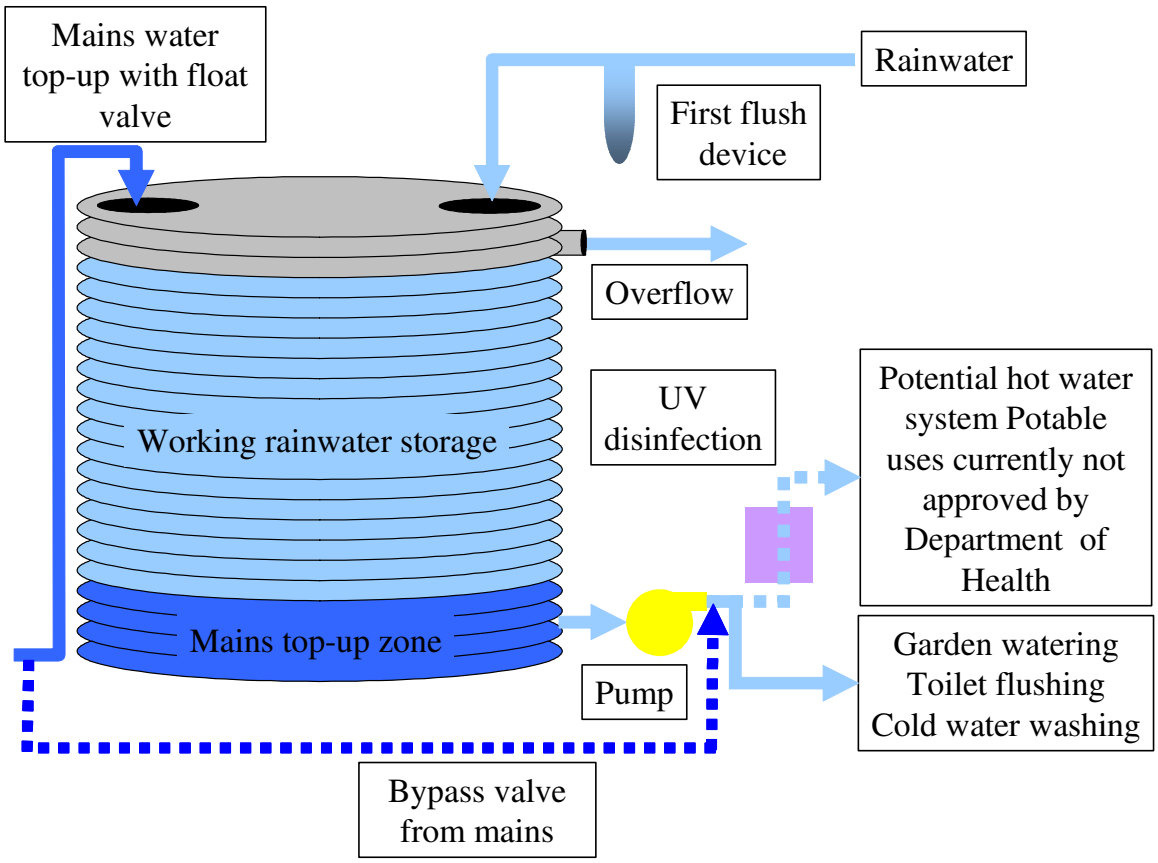

Figure B-1: Schematic of Rainwater Tank Operation.

Rainwater Tank Modelling

Rainwater systems can assist to reduce town supply average demands and may assist in controlling stormwater runoff. The systems' reliability is dependent on rainfall, roof catch area, storage volume and materials selection. On-going pump energy needs and non-centralised management require consideration.

A hydrological assessment of the impact of rainwater harvesting systems on water demands was undertaken using a multi-variable regression analysis to establish demand variability (Section 3.4, Concept Report) and a water balance simulation. The simulation estimates the impact of the rainwater tanks of different effective sizes on daily potable water demands. It does this by adopting the average demand forecast for the targeted end use/s (from the DSS end use model), assuming a constant internal demand, estimating the daily external demand variation based on Gosford's water supply multi-variable regression climate variable coefficients, and then completing a daily water balance using SILO daily rainfall data (1970-2006) based at Gosford City. Models were established for detached and semi-detached dwellings. A summary of key assumptions is tabled below.

Table B- 2: Key Rainwater Model Assumptions

Parameter	Assumed Value
Effective roof area	Detached - 220m^2 Semi - 150m^2
Initial Losses	2 mm
First flush loss	100 litres

The result of the hydrological assessment gives the percentage savings of the total residential potable demand for the different dwelling types and tank sizes, as set out in Figure B-2 and Figure B-3.

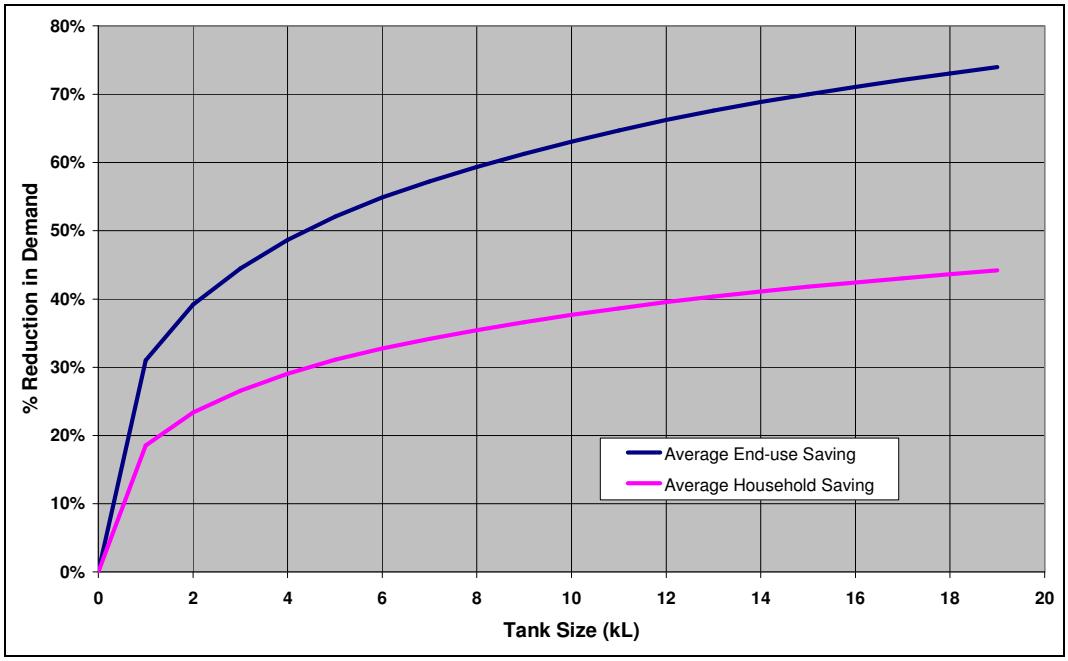

Figure B-2: Rainwater Tank Efficiency – Detached Dwellings

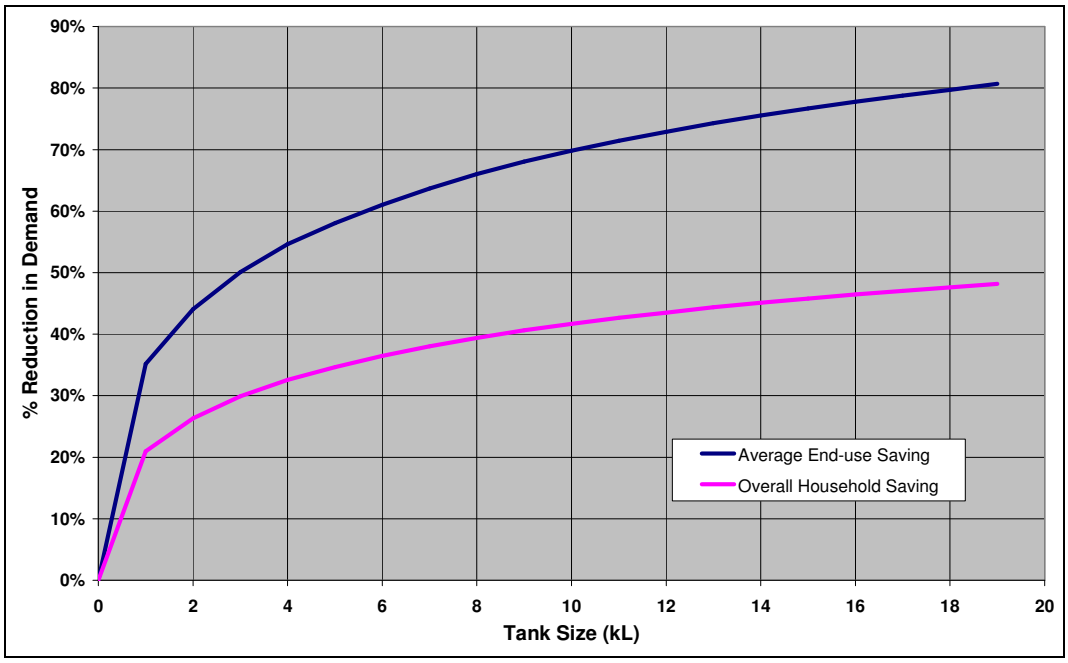

Figure B-3: Rainwater Tank Efficiency - Semi-detached Dwellings

It is has been assumed that the typical household installation tank size to be adopted for the rainwater options is 5kL and average savings in as plotted above. It has also been assumed that rainwater tank demand reductions are negligible under peak demand conditions.

Infill multi-family dwellings (units) are assumed to achieve the same percentage end-use savings as achieved in new detached dwellings through appropriately designed rainwater collection and storage systems.

Reclaimed Water

Reclaimed water is highly treated sewage used for non-potable applications. It may significantly reduce both average and peak town water demands. End use applications considered in this study include:

- Outdoor water usage
- Washing machine usage
- Toilet flushing
- Non-residential specific applications.

There can be a social reluctance to accept reclaimed water for washing clothes and this particular end-use may require further assessment for inclusion in forecasts.

A separate reticulation system is required for the reclaimed water. This is most easily applied in new development areas, where the household plumbing can also be setup in advance and use of reclaimed water can be promoted as part of the new area. Water mining (sometimes known

as sewer mining) approaches, where sewage is treated directly from the sewerage system, and improved treatment at existing STPs approaches have been considered.

The main disadvantages of reclaimed water use include:

- High capital and on-going costs;
- Relatively high installation costs to the householder;
- Potential for public health issues through associated pathogens, including potential for cross- connections and contamination of drinking water supply; and
- Providing adequate storage to ensure seasonal demand requirements can be catered for.

A detailed assessment of reclaimed water reuse opportunities was recently completed for Gosford City Council (KBR, 2006) and the highest ranked recycling options have been included in this study.

Greywater Reuse

Greywater includes wastewater from bathtubs, showers, wash basins, washing machines and laundry tubs. Greywater can be used as a non-potable source substitute. Its applications are restricted by the level of treatment provided. Typical household greywater systems include collection, storage and distribution facilities, including pumps and pipes to irrigation areas, as well as treatment facilities. Excess greywater is diverted to the sewer. Household diversion (without storage) of greywater to gardens is now permitted without Council approval.

Greywater source substitution can significantly reduce potable water usage, both average and peak demands and is a reliable source of water. It also results in reduced sewage generation. The main disadvantages of greywater use include:

- Dependence on householder management and maintenance;
- Relatively high installation and on-going costs to the householder;
- Potential for public health issues through associated pathogens; and
- Maximum irrigation application rates (to avoid over accumulation of salts and nutrients) dependent on soil capacity, crops and flushing schedules.

For this study, greywater applications through promotion mechanisms only are recognised, however, rainwater and reclaimed water source substitution are assumed to have a greater market penetration and impact on forecasts than greywater.

Water Sensitive Urban Design and Stormwater Harvesting

WSUD stormwater related practices include (refer to Figure B-4):

- Site layout incorporating open space networks, housing layout and streetscape design;

- Increased permeable areas through layout and pavement selection; and
- Flow control and sediment based treatment practices such as grass swales, buffer strips, cascades and infiltration techniques.

The techniques attempt to replicate pre-development hydrology and improve urban landscape, reduce pollutant export, retard storm flows and reduce irrigation requirements. Whilst WSUD is not a source substitution method *per se*, it does seek to use to make the most of stormwater for irrigation requirements both at the allotment and subdivision levels, and in this sense maybe used to replace potable water needs.

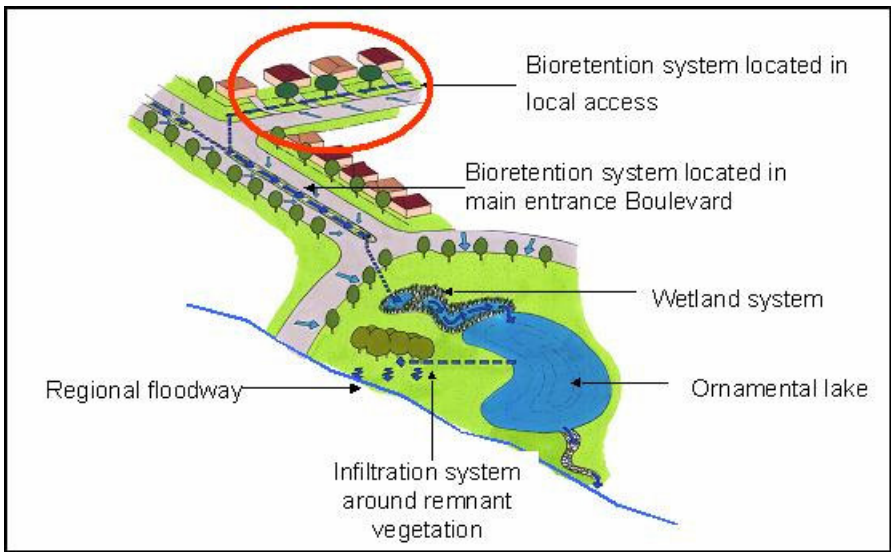

Figure B-4: Typical New Development WSUD Features

The benefits of WSUD include:

- Can reduce potable water supply demands through replacement of irrigation water.
- Improves stormwater quality by reducing peak flow rates and associated scour.
- Improves stormwater quality by detaining pollutants and biological uptake.
- Encourages aquifer recharge.
- Aquifer recharge returns stream flows to a more natural flow pattern.
- Improves local environment biologically and aesthetically.

Limitations include:

- Best suited new release areas and open spaces, however aspects can be retrofitted in existing development.
- Site characteristics may limit application.

- Maintenance requirements can be higher at the local level, but lower on the catchment level.

A detailed assessment of stormwater harvesting opportunities was recently completed by Council (KBR, 2006) and the highest ranked stormwater harvesting options have been included in this study. The runoff quality benefits associated with WSUD have also been considered.

APPENDIX C – WATER MANAGEMENT ISSUES AND OPTIONS

Audit Category	Issue	Description	Potential Management Options	Traditional	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Comment
Broader Catchment	Climate change through global warming and greenhouse gas emissions	Predicted increase in temperatures and reduction in rainfall expected to result in higher water consumption and reduced reliability of existing surface water supplies.	Decreased reliance on surface water supply through a portfolio of water resources and demand management savings.		✓	✓	✓	✓	Also WP2050
		Production of greenhouse gasses through energy use in the treatment and transfer of water and wastewater contributes to global warming and climate change.	Reduce treatment and transfer energy use through improved technologies, process and efficiency.			✓	✓	✓	Also WP2050
		Waterway ecological impacts including prospect of sea level rise.	Increased safety margins in system design and management.	✓	✓	✓	✓	✓	Also WP2050
			On-going review of climate change implications.	✓	✓	✓	✓	✓	Also WP2050

Audit Category	Issue	Description	Potential Management Options	Traditional	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Comment
Catchment	Nutrients and water quality	Urban and rural runoff includes elevated nutrient levels with potential ecological impacts such as eutrophication, cyanobacteria outbreaks and algal blooms. Loss of community amenity in waterways.	Establishment of buffer zones and rehabilitation of waterways.			✓	✓	✓	Also CAP
		Potential impacts associated with urban expansion and infill development such as increased sediment loads, erosion, roadway pollutants.	Improved land management in both rural and urban areas.			✓	✓	✓	Also CAP
		Community concerns regarding water pollution.	Reduction in nutrients in treated wastewater releases to waterways.	✓	✓	✓	✓	✓	Also CAP
			Controls on soil erosion.	✓	✓	✓	✓	✓	
			Adoption of water sensitive urban design principles to reduce contaminant loads.			✓	✓	✓	
			Improved monitoring. Trade waste audits and surveillance. Community education.			✓	✓	✓	Also CAP

Audit Category	Issue	Description	Potential Management Options	Traditional	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Comment
Catchment	Environmental flows	Potential changes to low flow allocation as per Water Sharing Plans – will be further investigated as part of *WaterPlan 2050*.	Increase waterway extractions.						WP2050
			Assessment of water sharing process.						WP2050
Catchment	Acid sulphate soils	Ecological impacts during construction activities.	Understand where acid sulphate soils exist.	✓	✓	✓	✓	✓	
		Degradation of sub-surface infrastructure.	Development controls in susceptible areas.	✓	✓	✓	✓	✓	
			Improved materials and design.	✓	✓	✓	✓	✓	
Catchment	Salinity	Salinity hazard indicated to be low in Gosford LGA.	Monitor water table and water quality for impacts.						CAP monitoring
		Irrigation induced water table rise may create problems.	Monitor soils, particularly in reuse areas or areas proposed for new development.			✓	✓	✓	With reuse applications
Catchment	Soil erosion	Increased nutrient and sediment loads in waterways. Sources include building sites, land clearing and decline in riparian vegetation.	Controls on soil erosion during construction and agricultural use.		✓	✓	✓	✓	
		Unstable riverbank sites.	Establishments of buffer zones on local streams and waterways.			✓	✓	✓	Also CAP

Audit Category	Issue	Description	Potential Management Options	Traditional	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Comment
Catchment	Suitability of soils for effluent and reclaimed water application	Some soils in the LGA area may not be suitable for receiving reclaimed water.	Monitoring of reuse and onsite applications.			✓	✓	✓	With reuse applications
			Careful assessment of potential recycling projects.			✓	✓	✓	With reuse applications
Catchment	Urbanisation – population growth	Uncertainty in population growth numbers.	Confirmation between all relevant State Government agencies and Council to finalise projections and potential land areas for accommodating future growth.	✓	✓	✓	✓	✓	Adopt current forecasts. Check sensitivity in WP2050.
Water Resources	Water demands and water use	Expected increase in the permanent residential population will increase water demands.	Demand management initiatives including source substitution.		✓	✓	✓	✓	
		Currently no pricing tiers exist to encourage conservation.	Review pricing, consider inclining block tariff.			✓	✓	✓	
		Different attitudes within the community to water conservation.	Education.		✓	✓	✓	✓	

Audit Category	Issue	Description	Potential Management Options	Traditional	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Comment
Water Resources	Water Supply System – future planning for long-term sustainability	Decisions to be made on the supply options for the development of the water supply system. This will be done as part of *WaterPlan 2050*.	As per Department of Commerce Reports, although Council to advise if further decisions have been made as part of the *WaterPlan 2050* development.						WP2050
		Current water shortages and high level restrictions indicate reliability of supply is a current concern.	Supply side options to be addressed by *WaterPlan 2050*.						WP2050
		Reliability of consumption, production and UFW data.	Review of data is required to ascertain more accurate records.		✓	✓	✓	✓	
Wastewater	Wastewater System and Treatment	Water reuse currently at 1% of available water for recycling (DEUS, 2005). Increased recycling schemes may provide opportunities for increased environmental flows and potable water substitution.	GCC has undertaken a comprehensive review to assess the performance of both STPs including, operating costs, influent and effluent criteria, customer complaints and EPA licence breaches.			✓	✓	✓	

Audit Category	Issue	Description	Potential Management Options	Traditional	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Comment
		Sewer overflows are higher than the state median.	Management Options are outlined in the report (Strategic Process Review of Wastewater Treatment, MWH April 2006).			✓	✓	✓	
		Operational improvements, especially during wet weather are recommended				✓	✓	✓	
Wastewater	On-site wastewater treatment systems	Progression of the sewering of Mooney Mooney and Cheero Point areas.	Completion of the On-site Sewage Inspection Enforcement Program;		✓	✓	✓	✓	
			Revision the On-Site Sewage Management Strategy, including an evaluation of the Strategy actions to date and completion of a draft DCP for on-site sewage management systems;		✓	✓	✓	✓	
			Extend reticulated sewer where appropriate.					✓	
Stormwater	Urban stormwater	Water-borne pollutants entering local creeks and waterways.	Water sensitive urban design for both quality and local flooding issues. Water quality improvement ponds/wetlands.			✓	✓	✓	

Audit Category	Issue	Description	Potential Management Options	Traditional	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Comment
		Localised flooding, exacerbated by urban expansion.	Continued improvement to existing drainage system, using WSUD principles to incorporate water quality		✓	✓	✓	✓	
		Numerous site specific issues including sediment loads during construction, bank erosion and water pollution.	Identification of retrofit WSUD opportunities with the development areas.				✓	✓	
		On-going management of infrastructure.	Community education and assistance in stream management.		✓	✓	✓	✓	Also CAP
		Ensuring flows for environmental purposes.	Rainwater harvesting to reduce runoff volumes.			✓	✓	✓	Consider with stormwater reuse
		Pumping station sewage overflows	Consideration of existing estuary management and stormwater management plans.		✓	✓	✓	✓	
		Pollution from septic systems	Complete backlog areas and on-site management program		✓	✓	✓	✓	

Audit Category	Issue	Description	Potential Management Options	Traditional	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Comment
		urban litter and pollutant loadings, which are exacerbated with tourists	Implementation of WSUD and flood management measures			✓	✓	✓	
Stormwater	Flooding	As the land available for future development is highly limited within GCC LGA, land susceptible to flooding issues is being considered for future development. Pressures are now being placed on Council to allow development in problem areas.	Restrict development to outside of flood prone areas			✓	✓	✓	
		Increased urban development is considered to be a primary pressure on existing drainage systems.	Address future works and allocate funding	✓	✓	✓	✓	✓	Apply flood plans
		Funding appears to be a significant issue with regard to flood management.	Develop criticality plan to address upgrades and retrofits			✓	✓	✓	
		Older urban development are in need of drainage upgrades	Incorporate water quality considerations in retrofit and upgrade works	✓	✓	✓	✓	✓	Apply SMP

Audit Category	Issue	Description	Potential Management Options	Traditional	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Comment
		Water Sensitive Urban Design is currently not considered as a complimentary option to traditional drainage works to reduce the impact of urbanisation on flooding.	Incorporate Water Sensitive Urban Design into new development proposals via planning provisions.			✓	✓	✓	
		In fill development will further exacerbate the flood issues that currently exist within the GCC LGA by increasing the impermeable areas, resulting in increased runoff and higher peak flows adding pressure to the existing drainage system (which was designed for less flows and lower peak stormwater discharges).	Ensure planning provisions result in Infill development having a minimal impact on increased runoff			✓	✓	✓	
Water Cycle Management	Water recycling	1% of available effluent is currently recycled.	Third pipe reuse systems for potable water replacement in new developments.			✓	✓	✓	
		Most reclaimed water is used for irrigation purposes rather than high value replacement of potable uses.	Supply of reclaimed water to existing users as a substitute for existing potable uses.			✓	✓	✓	

Audit Category	Issue	Description	Potential Management Options	Traditional	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Comment
		Risk of long-term potential reuse impacts such as accumulation of phosphorous and salts.	Assess supply of reclaimed water, including from industrial sources, as a new water source.			✓	✓	✓	
		Pricing of reclaimed water to recover costs and encourage efficient application.	Monitor and assess irrigation reuse applications.			✓	✓	✓	
			Adopt sustainable application rates and practices.			✓	✓	✓	
			Ensure high standard of treatment, practice and application to meet public health requirements.			✓	✓	✓	Also WP2050
			Integrated strategic assessment of reclaimed water reuse.			✓	✓	✓	WP2050
			Indirect and direct potable reuse.						WP2050
			Completion of *WaterPlan 2050*						WP2050

APPENDIX D – URBAN POLLUTANT RUNOFF ESTIMATES

Urban pollutant reductions are anticipated with increasing levels of water cycle integration primarily through a combination of improved wastewater treatment and WSUD. Year 2055 annual pollutant loads generated from the LGA's urban areas have been modelled using MUSIC software to compare the environmental benefits of the IWCM scenarios.

MUSIC

MUSIC is the Model for Urban Stormwater Improvement Conceptualisation, developed by the Cooperative Research Centre (CRC) for Catchment Hydrology. MUSIC simulates both quantity and quality of runoff for catchment areas from 0.01 km^2 to 100 km^2. Modelling time steps can range from 6 minutes to 24 hours to match the range of spatial scale.

MUSIC is designed to simulate stormwater systems in urban catchments. The model's algorithms are based on the known performance characteristics of common stormwater quality improvement measures.

The majority of stormwater runoff in urban catchments is generated from the impervious surfaces. Base flow, influenced by sub-surface soil moisture and groundwater levels, is less dominant in urban catchments as is evident from the "flashy" nature of urban stormwater hydrographs. The algorithm adopted to generate urban runoff is based on the rainfall-runoff model (Figure D-1) developed by Chiew & McMahon (1997).

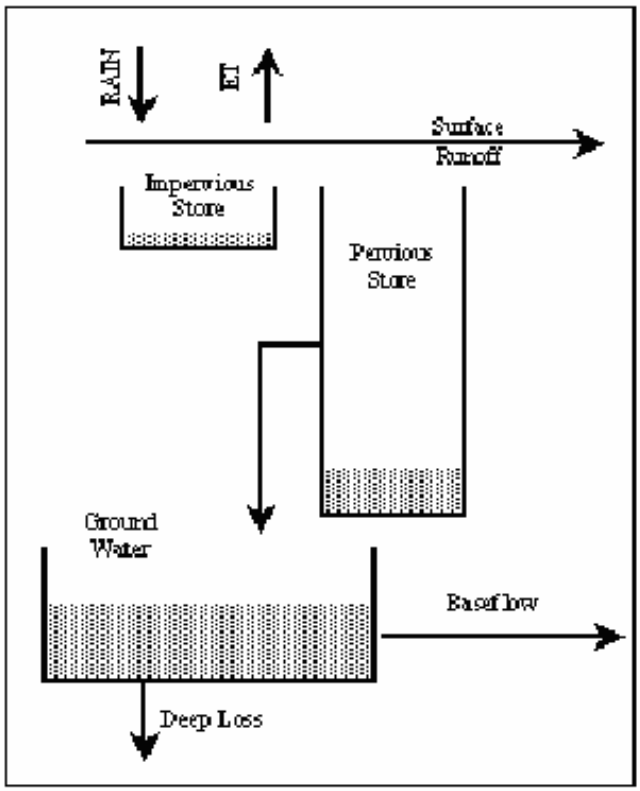

Figure E-1: MUSIC Rainfall-Runoff Model

MUSIC Version 3.01 was used to estimate the runoff pollutant loads for the Gosford IWCM. The LGA was sub-divided into landuses, based on the GIS data provided by Council. For each type of landuse, a set of parameters was established to enable an annual pollutant generation rate (i.e. kg/ha/yr). The annual runoff coefficients determined by MUSIC are primarily influenced by the percentage of impervious area adopted. Relatively small changes in the impervious area included in a MUSIC model can result in significant changes to the results.

Any remediation works or existing WSUD measures have not been included in the initial load calculations, therefore the data presented should only be used as a relative guide to hot spots within the Gosford LGA.

Assumptions

Pollutant loads calculated for the Gosford rainfall catchments were estimated using MUSIC and were based on land use zonings provided by GCC. MUSIC models were built to estimate annual runoff and loss (evapotranspiration). The annual runoff coefficients determined by MUSIC are primarily influenced by the percentage of pervious area adopted. The assumed percentage pervious area according to each land zoning category is provided in Table D-1.

Table E-1: Assumed Pervious Area

Land Category	Area Pervious	Land Category	Area Pervious
Residential (Urban)	55%	National Parks	100%
Open Space	90%	Tourist	95%

Land Category	Area Pervious	Land Category	Area Pervious
Rural	95%	State Forests	100%
Future Residential	55%	Pre – Development Case	100%
Rural Residential	90%	River/Estuary	n/a
Industrial	20%	Lakes	n/a
Institutional	20%		

In order to assess the potential for WSUD approaches for redevelopment, it has been assumed that 30% of the total residential area within the LGA area (equivalent to approximately 17.5km^2) will be subject to infill development, the majority of which will be within the CBD, with the remainder in Kincumber, Broadwater, Woy Woy, Erina Creek, and Terrigal. It has been assumed that no greenfield development will occur in the LGA.

To model the impact on pollutant generation rates in areas of infill development (i.e. higher density development), the pervious area for residential land uses was decreased from 55% to 45%. This resulted in an increase in pollutant generation rates, as tabulated below.

Table E-2: Impact of Infill Development on Pollutant Generation Rates

Type of Development	% Pervious	Suspended Solids (kg/ha/yr)	Total Phosphorus (kg/ha/yr)	Total Nitrogen (kg/ha/yr)	Flow (ML/ha/yr)
Residential	55%	1,380	2.89	21.3	7.7
Infill Residential	45%	1,550	3.36	23.7	8.46
Percentage Increase		12%	16%	11%	10%

Table D-3 shows the percentage change in pollutant loads, based on best-practice water quality improvements. For the scenarios that incorporate WSUD in infill development areas, a reduction in pollutant loads in line with best-practice pollutant reduction savings (VSC 1999) is assumed to be:

- Total suspended solids reduction of 80% of typical urban loads.
- Total nitrogen of 45% of typical urban loads.
- Total phosphorous of 45% of typical urban loads.

Table E-3: Impact of Infill Development on Pollutant Generation Rates, Subject to Best Practice

Type of Development	% Pervious	Suspended Solids (kg/ha/yr)	Total Phosphorus (kg/ha/yr)	Total Nitrogen (kg/ha/yr)	Flow (ML/ha/yr)
Residential	55%	1,380	2.89	21.3	7.7
Infill Residential with WSUD	45%	310	1.85	13.0	8.46*
Percentage change		-78%	-36%	-40%	10%*

*Losses due to infiltration will result in a reduction in the annual flow. This has not been quantified.

The modelling assumptions applied to each scenario are:

- Traditional: The case likely to result from the traditional approach of undertaking separate water supply, sewerage and stormwater investigations.
- Scenario 1: Adoption of WSUD DCPs for all infill development, i.e. new infill development of 17.5km^2 subject to WSUD by the Year 2050.
- Scenario 2: As per Scenario 1.
- Scenario 3: As per Scenario 2, but with WSUD retrofits being implemented to an assumed area of existing residential development equivalent to 5km^2.
- Scenario 4: As per Scenario 3.

Evaluation of the impact of the scenarios on the STP-sourced nutrient loads is based on percentage reduction of total loads tabulated in Table 2-11. Total STP flows have been based on DSS flow estimates with an assumed split of 27% and 63% for the Woy Woy & Kincumber plants, respectively.

As per the scenarios defined in Section 2.4, the Kincumber STP third pipe system would be implemented as part of Scenario 3 and 4.

Method

The methodology used to determine the impacts of development and the IWCM scenarios provides comparison of the pollutant loads on a LGA-wide basis, as influenced by the activities relevant for each scenario.

The typical loads used to calculate the impact of development for Gosford LGA are tabulated below. These loads were applied to corresponding land use areas for the current scenario, and for the scenarios defined in the section above.

Table E-4: Gosford LGA Urban Runoff Landuse Based Pollutant Loads

Parameter	Open Space	Rural	Rural Residential	National Parks	Tourist Areas	Residential	Industrial Commercial Institutional	Infill Residential
Flow (ML/yr)	5.07	4.7	5.07	4.32	4.32	7.7	10.3	8.46
TSS (kg/yr)	875	801	875	207	207	1,390	2,070	1,550
TP (kg/yr)	2.44	2.3	2.44	0.262	0.262	2.9	4.22	3.36
TN (kg/yr)	17.7	14.8	17.7	3.69	3.69	21	29.7	23.7

Outcomes

It should be noted that the current nutrient balances have been estimated at the LGA area level. That is, they represent typical levels of nutrient generation on a gross scale. These should not be confused with catchment nutrient exports, where nutrient inputs are subject to processes such as assimilation, denitrification and phosphorous adsorption before leaving the catchment.

It is recognised and generally accepted that urbanisation has had a negative impact on receiving waterways within Gosford LGA, and that further development is likely to continue to contribute negatively to the environment, unless remedial action is taken to minimise the impact.

Figure 2-12, Figure 2-13 and Figure 2-14 plot forecast Year 2055 urban pollutant loads for each scenario based on the assumptions outlined above.

The projections developed in this section of the report are to be used to assist assessment of the scenarios and to develop the urban water service key infrastructure requirements and costs associated with each of the scenarios.

APPENDIX E – GUIDANCE ON WSUD PLANNING INSTRUMENTS

Some of the activities contained within the recommended scenario for Gosford LGA will require intermediate steps to facilitate their implementation. GCC has recently released a development control plan for Water Cycle Management (DCP 165). This section provides general information for consideration in the development of WSUD planning tools in integrated water cycle management and its implementation.

BASIX and Development Control Plans

In 2004, the NSW Government introduced the State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004 (the BASIX SEPP), which was subsequently amended by the State Environmental Planning Policy (Building Sustainability Index: BASIX) Amendment Policy 2005 (the Amending SEPP).

The BASIX SEPP applies to all types of housing including single dwelling, dual occupancy villas, townhouses and apartments and alterations and additions of these buildings. However, the SEPP does not apply to non-dwelling development. In the case of mixed use buildings, the residential dwelling component of the building only is subject to the SEPP.

Applicants are able to choose from a wide range of possible commitments within the BASIX tool, to meet the NSW Government's sustainability requirements. Alternatively, the applicant may apply to the Department of Planning for a BASIX certificate based on commitments other than those offered by the BASIX tool, via an 'Alternative Assessment' application.

To avoid duplication, the BASIX SEPP (see clauses 4, 8 and 9) makes provisions to make environmental planning instruments (EPIs) and DCPs ineffective to the extent that they aim to achieve the same objectives as BASIX. Clauses 8 and 9 state that competing provisions of an EPI or DCP are of no effect, to the extent to which they aim:

- To reduce consumption of mains-supplied potable water, or reduce emissions of greenhouse gases, in the use of a building to which BASIX applies, or in the use of land on which the building is situated, or

- To improve the thermal performance of a building to which BASIX applies.

When determining an application for development consent for development to which BASIX applies, a consent authority or certifying authority must not give consideration to any other provision dealing with these matters or impose any conditions upon consent in relation to these matters. These provisions are intended to ensure that if BASIX applies to a proposed development, BASIX will be the only system for assessing the development's greenhouse gas emissions, consumption of mains-supplied potable water and thermal performance.

However, the SEPP does not affect provisions which offer applicants an incentive to adopt commitments over and above those required to pass BASIX (see clause 4 of the SEPP). In addition, provisions of an EPI or DCP which have more than one purpose, including a purpose that conflicts with BASIX, continue to have effect to the extent to which they seek to address the

alternative purpose. However, consent authorities should consider whether other measures are available for fulfilling the alternative purpose.

It is important to note however, that these overriding provisions only apply to the residential component of mixed-use buildings to which BASIX applies.

General Guidance for Consideration for an IWCM/WSUD DCP

Table F-1 sets out some general guidance for the purposes of developing or refining a DCP. This guidance does not replace the need to prepare any such DCP in accordance with the *Environmental Planning and Assessment Act 1979* or the need for further investigation studies to identify more locally applicable standards.

Given that BASIX has been through a series of amendments, and that such amendments may reasonably be expected to continue, GCC may decide to review the current DCP 165 to ensure it captures all of GCC's desired IWCM and WSUD aims, including any provisions that would currently be in competition (and hence, unenforceable) with the BASIX SEPP. Although this decision may reduce the need to continually review the DCP, it would also result in the need for the consent authority to be vigilant in identifying competing provisions and ensuring that these are not considered as part of the development consent process. However, for the purposes of the information provided in Table E-1, it has been assumed that the DCP will not include provisions competing with those of the BASIX SEPP.

Table F-1: General Guidance for Consideration for an IWCM/WSUD DCP

Aspect	Guidance
Definitions	Gosford IWCM: The holistic management of drinking water, stormwater run-off and harvesting, sewage treatment and recycling and waterway health. WSUD: The integration of water cycle management into urban planning and design.
Purpose	To achieve: Water efficiency in development via source substitution to minimise the impact of development on the natural water cycle in terms of both flow (quantity and timing) and quality to add value, while minimising development costs.
Application	All new development and redevelopment across the LGA except where provisions are in competition with the BASIX SEPP.
Requirements – Stormwater Management	A stormwater management plan (SMP) to be developed for all new development. SMP to demonstrate: Reduced stormwater discharge using retention and detention approaches to mimic pre-development hydrologic conditions; Stormwater runoff does not pollute receiving waters through pollutant source management and stormwater treatment; WSUD techniques to allow for infiltration and address on-site detention and drainage design; Preservation of natural water courses and drainage channels; Compliance with GCC flooding policies; and Consideration of operation and maintenance of stormwater controls proposed.

Aspect	Guidance
Requirements - IWCM	An integrated water cycle management plan (IWCMP) to be developed to guide the future direction and development of water cycle related areas within the GCC LGA. IWCMP to demonstrate consideration of: Existing water cycle of the land and its surrounds; Water saving devices of at least WELS 3 star rating for showerheads, toilets, tap aerators, tap equipment, clothes washing machines and dishwashers; Efficient processes, techniques and equipment for all other water using activities; and Potable water substitution and internal recycling opportunities.
WSUD techniques	Types of techniques include (but are not limited to): Grassed or vegetated swales – primary treatment and conveyance function; can provide secondary treatment benefits; Filtration trenches – primary treatment and conveyance and detention options; can provide secondary treatment benefits; Bio-retention systems – secondary treatment, conveyance, detention and retention functions (through infiltration); can provide tertiary treatment benefits; Wetlands – tertiary treatment system, storage, detention, possible reuse options; Rainwater tanks – using stormwater as a resource – detention, retention, a substitute for drinking water in garden irrigation, car washing, toilet flushing, etc; Greywater reuse – collect from households, primary treatment on site, reuse for external irrigation or internal toilet flushing options; Rain gardens, rooftop greening, urban forests – provide natural vegetated features of aesthetic value and provide treatment function by filtering stormwater; and Any combination of these and other techniques for the best possible outcome.
WSUD Guidelines	Design and certification to be undertaken by appropriately qualified engineering, surveying or environmental professionals. WSUD Engineering Procedures: Stormwater, Melbourne Water, 2005 Australian Runoff Quality Guidelines, Engineers Australia, 2006 Best Practice Environmental Management Guidelines, CSIRO, 2006 Other guidelines as appropriate for NSW.
Treatment Guidelines	NSW Guidelines for Urban and Residential Use of Reclaimed Water (1993) Guidelines for Industry: The Utilisation of Treated Effluent by Irrigation (1995) NSW Code of Practice, Plumbing and Drainage (2nd Edition) (1999) National Water Quality Management Strategy: Guidelines for Sewerage Systems – Use of Reclaimed Water (2000) Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (2006) Directives from NSW Health in relation to treatment and end-use requirements

Aspect	Guidance
WSUD targets	Catchment source flow and sediment control through techniques such as grass swales, buffer strips, cascades and infiltration techniques. Best practice pollutant reduction savings for WSUD assumed (VSC 1999): 80% retention of urban suspended solids 45% retention of urban total phosphorus and nitrogen 5-10% reduction in annual runoff Peak discharge maintained at pre-development levels.
IWCM targets	New non-dwelling premises demonstrate 20% reduction in mains-supplied potable water demand.
Costs	Only administration costs are borne by Council.