Healthy Rivers Commission

of New South Wales

Occasional Paper

INTEGRATED WATER SERVICE PROVISION:
OPPORTUNITIES AND IMPLICATIONS
ON THE NSW NORTH COAST

by Stuart White and Sally Campbell,
Institute for Sustainable Futures

OCP 1007

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Integrated Water Service Provision

Opportunities and Implications on the NSW North Coast

For Healthy Rivers Commission

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With assistance from Andrea Turner, Tom Berry and Rohan England

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ABBREVIATIONS

ABS	Australian Bureau of Statistics
COAG	Council of Australian Governments
CTWSSP	Country Towns Water Supply and Sewerage Program
DCP	Development Control Plan
DLWC	Department of Land and Water Conservation
DPWS	Department of Public Works and Services
EIA	Environmental Impact Assessment
EPA	NSW Environment Protection Authority
ET	Equivalent Tenement
HRC	Healthy Rivers Commission
IWCM	Integrated Water Cycle Management (as being undertaken by DLWC)
IWRP	Integrated Water Resource Planning
kL/hh/a	kilolitres per household per annum
NHT	National Heritage Trust
SEO	Stormwater Extension Officer (program)
SEPP	State Environmental Planning Policy
STP	Sewage Treatment Plant
WSUD	Water Sensitive Urban Design

SUMMARY & CONCLUSIONS

This investigation aims to describe and analyse barriers to the integration of water services in the north coast region, and identify strategies to overcome them in the interests of river health. This work has revealed the following situation in terms of the existing provision of water services. The major pressures include escalating demands for water, fragmented management approaches, inconsistency in planning and financing of infrastructure, and development of centralised infrastructure which treats the water cycle in a linear way. These pressures combine to act as barriers to a more integrated approach.

In a business as usual scenario, the region is likely to experience escalating demands for water supply, sewage discharge and stormwater management resulting from population growth. Projections of water demand in the region are based on population growth and an understanding of changes in appliance efficiency that are already occurring. It is possible that there will be a 23% increase in demand for water over the next 25 years, resulting in some 8,800 tonnes of greenhouse gas emissions for pumping and treatment alone, equivalent to the stationary energy related emissions from 1,140 houses. The resulting increase in sewage flows would be approximately 17.5 ML/d, roughly equivalent to the sewage from Coffs Harbour.

Fragmented approaches to the provision of water services arise from decision-making structures that regard water supply, sewerage services and stormwater as three separate activities. There is also a disconnection between the objectives for river health that apply at a catchment level, and the local planning and infrastructure development.

The planning and financing of infrastructure for water service provision in the region has historically been supply-side focussed, based on the assumption that demand was an external variable with no opportunities for management and that meeting demand meant augmentation of supply in the form of new water sources, treatment plants and pipelines. Options for meeting total demand through investment in reducing average demand have not been appropriately assessed on equal terms.

Instead, centralised, linear infrastructure and a ‘predict and provide’ approach to water servicing remains the most common response to new residential areas and augmentation needs. This results in an increasing demand for water, treatment and discharge without reuse, and also high rates of infiltration and inflow. Infiltration rates can be as high as 17% in the region resulting in considerable increases in the cost of sewage treatment.

If the four barriers described above were overcome then water demand could be reduced, source substitution could be increased and new developments could be serviced differently. Applying integrated water resource planning (IWRP) across the region will allow these outcomes to be achieved. Integrated water resource planning is a process in which options to meet water related needs are evaluated on the basis of total lifecycle cost to the community. The outcomes of applying IWRP would be:

1. Reduction in demand for water by maximising the efficiency of water use, which is generally the least cost means of providing water related services;

2. Increased integration of the components of the water cycle making source substitution a more obvious choice. The reduction in demand achieved through efficiency increases the possibilities for more effective source substitution; and

3. New ways of providing water services, including new system configurations, which integrate water, sewage and stormwater services and operate on varying scales including localised treatment and reuse and rainwater supply. The application and viability of innovative technology, for example small diameter sewers with pre-treatment is also likely to be part of the new approach.

All three outcomes, reducing demand, increasing source substitution and alternative servicing options, have the potential to deliver significant savings to the region and can be implemented through a variety of mechanisms.

Reducing demand could be achieved through regulating the water efficiency of appliances and fixtures as well as by using development controls for efficient outdoor water use. Estimates are that efficient appliances, for example showerheads, tap flow regulators and washing machines alone can deliver savings of 35 kL/hh/a, or 14% of household use relative to the appliances commonly in use. Across the north coast region this would represent a saving of approximately 11 GL/a, approximately equivalent to the increase in demand expected from the next 20 years of growth.

Savings can be delivered more quickly through retrofitting programs than the regulatory approach allows. The result of one north coast retrofit program was an average saving of 35 kL/hh/a. If 70% of connected properties (allowing for some to already be efficient) on the NSW north coast were retrofitted (158,000 houses), at a cost of $120/hh (approx. $19M over ten years) annual regional demand could be reduced by more than 5.5 GL, or almost 8%. This would offset the growth expected in the region over the next five to eight years and reduce annual greenhouse gas emissions by approximately 92,000 tonnes, equivalent to the stationary energy impact from over 11,000 households. An additional benefit accruing as a result of indoor retrofits is the reduction in volume of discharges to sewers, in this case approximately 15 ML/d, equivalent to the additional sewage discharge anticipated from population growth over the next 25 years. In practice, retrofitting would be implemented in areas where the avoided cost of water supply or sewage treatment is high due to pressing augmentation requirements.

Major opportunities to impact on the future demands for water, sewage discharge and stormwater management lies in greenfield and infill developments. The source substitution potential can deliver even greater water and energy benefits. An example is the substitution of potable water demands with rainwater and the substitution of toilet flushing demands with treated effluent. The rainfall in many areas in the north coast region means that appropriately designed source substitution with rainwater, combined with maximum efficiency and reuse of treated effluent, has the potential to reduce demand in residential dwellings by 80% or more, including, in some areas, up to 100%. Achieving this in greenfield and infill developments slows the growth in demand created by increased population. There is strong evidence that new water supply and sewage system servicing, including localised treatment and reuse at neighbourhood, estate or even household scale, may have similar or even lower lifecycle costs than centralised service provision (Clark and Tomlinson 1995, Booker 2000, Fane *et al.* 2002). Servicing of this kind in all new developments could save the region a total of $44m in avoided water supply costs over the next 25 years.

Whilst the benefits are sizeable, there are barriers within the current arrangements, which need to be overcome in order to move toward more integrated water servicing. Some of the barriers are described below along with appropriate responses. These responses are grouped as either: regulatory or economic; institutional support; or performance monitoring.

Regulatory responses to reduce demand

A reduction in the demand for water needs to be achieved in order to counter the impact of increasing population. Regulatory approaches designed to improve the water efficiency of water using equipment, and ensure best practice water efficiency in landscapes represent the most cost-effective and comprehensive means of improving efficiency over time, as development occurs and equipment is replaced. National regulation of the efficiency of products at point of sale, as exists in the United States, provides the best outcome. The NSW Government could assist in meeting this objective by taking leadership at a national level, through appropriate Commonwealth–State fora, in regulating the efficiency of water using appliances and equipment at point of sale, including showerheads, taps, urinals and washing machines. This would fulfil key components of the NSW Water Conservation Strategy, as well as commitments made by the ALP prior to the 1995 election. There is support within other States (Queensland, Victoria and Western Australia particularly) for this initiative.

Performance standards of this kind are less appropriate for other aspects of demand, such as outdoor water use. These water uses are better suited to a more localised, outcomes oriented approach such as the use of a points system for rating the efficiency of landscapes and irrigation systems or a requirement for a minimum volume of on-site detention. This approach allows householders to develop lawns and gardens in an efficient manner for example whilst providing flexibility and can also stimulate innovation. Planning controls, which establish targets for efficiency in new developments are consistent with the undertaking of the Government outlined in the NSW Water Conservation Strategy (point 11). The development of such an index system to assist councils (eg. the BASIX system being developed by PlanningNSW) helps to initiate the process of assessing a development for water efficiency prior to providing planning approval. This tool should be implemented by Government and then further developed to assist councils to extend the reach of the mechanism to additional water use categories, including the commercial and industrial sector, outdoor water use, cooling towers and to require dual reticulation in buildings, effluent reuse, separate metering of all units and roof water capture.

By using planning controls it is possible to require consideration of integrating water services at the development planning stage, thus presenting opportunities for innovative options to be developed. The mechanism of PlanFIRST, aims to provide a consultative process for establishing regional goals. As this process is further refined by PlanningNSW, the Government's undertaking to integrate over-arching water conservation principles into policy and legislation (NSW Water Conservation Strategy, point 7) should be acted upon. In this way PlanFIRST should require the consideration of water services on a regional basis and at the land release planning stage. This requirement will also need to be mirrored in the local planning processes, including in the approvals process for construction of water and sewage infrastructure, where historically there has been limited consideration of alternative strategies that may reduce the capital and operating costs or avoid the infrastructure item entirely.

The rezoning process also needs to require demonstration of these considerations using an integrated water resource planning framework. The regulation of appliances and plumbing products combined with appropriate planning controls can significantly reduce demand for water services, including the discharge of sewage. The use of greater levels of source substitution, and new ways of providing water services in greenfield and infill developments also addresses the fourth barrier of linear, centralised infrastructure provision.

Licensing of water extraction by water service providers, approvals for new capital works, and discharge licences for sewerage service providers currently provide only limited incentives to reduce demand for water use, to maximise substitution and to integrate water service provision through different means of servicing new developments. Establishing licence conditions that ensure that water service providers have encouragement to identify opportunities for investing in options that use less water and increase source substitution would provide a driver for sustainable water use and integration that is currently lacking. Similarly, although IPART does not currently have regulatory oversight of pricing for country town water suppliers, there is an opportunity for IPART to provide strong guidelines and support for these water service providers to utilise an IWRP framework as a means of reducing the cost of service delivery. This would provide strong signals regarding the need for these water service providers to undertake appropriate investigation of, and investment in, water efficiency and source substitution.

The second and third barriers to be overcome are the fragmentation of responsibility and this commonly relates to the existing programs, decision-making, planning and financing arrangements. Overall the systems need to provide a direct and clear connection between all aspects of water service provision and financial arrangements need to require customers to pay the real costs of the services they receive.

Establishing sustainable funding and economic incentives

The existing funding arrangement for stormwater services is an example of a funding model which does not lead to appropriate outcomes. The grant driven nature of funding results in short term programs and establishes a dependency between councils and agencies for funds. There is a clear need for a more strategic approach, and this could be achieved by a collaborative process between all the stakeholders, including the grant providers, to determine a means of using the funding as a transition to more sustainable, locally generated funds through for example appropriate stormwater pricing, which provides incentives for options which ensure greater integration of services. IPART could be requested to provide advice and assistance for developing options, which would include establishing the real cost of stormwater management and ensuring this is reflected in user charges.

One existing mechanism, which is not currently utilised fully in this regard, is Developer Contributions. Developer contribution plans typically are prepared separately for each aspect of sewage and water supply without any reference to stormwater. The plans are usually designed around the assumption that the traditional centralised water supply and gravity sewer system will be installed. These characteristics mean that innovative servicing options, with lower impacts on the system are not encouraged, as there is no effective way of providing economic incentives through the fixed contributions. An IPART revision to the guidelines for Developer Contributions in regional areas could include an explicit objective of encouraging integrated water service provision and establish the process for a more flexible approach which seeks to recover the real cost of individual developments.

One other major injection of funding for water service provision into the region is the Country Town Water Supply and Sewerage Program (CTWSSP). As addressed by the HRC in their inquiry into the Clarence and reflected in the NSW Government Statement of Joint Intent, this program is restricted to infrastructure based responses and the criteria need to be revised to provide funding for water efficiency and other non-structural solutions to water service provision. In addition this program, like grant based funding in general, needs to work strategically to establish sustainable operations, rather than establishing dependency relationships.

The transition phase between individual project funding and fully sustainable funding of water services needs to be used to strategically develop the capacity of councils in the application of an IWRP framework, i.e. grant based funding would be subject to the demonstration of an option being the preferred option under an IWRP framework. This comprehensive comparison of options is likely to contribute to a move away from centralised infrastructure responses and toward more innovative servicing due to the lower lifecycle costs as well as the use of demand side options. This approach recognises that backlog sewerage programs (the focus of CTWSSP) represent an opportunity comparable to new developments in terms of avoiding or deferring augmentation needs through demand reductions and different servicing options.

Supporting Change

The need for support for councils at a local level to implement changes such as those described above is recognised, including by the HRC in their directive strategies relating to environmental management by councils in the Statement of Joint Intent for the Hawkesbury Nepean River System. Furthermore, the NSW Government has undertaken to ensure that water conservation is supported throughout the whole community in the NSW Water Conservation Strategy (point 14). Institutional support must take the form of information and advice to councils (including as described above from IPART relating to pricing) and should be provided by the DLWC to assist councils in their Integrated Water Cycle Plan to ensure that all options are considered and compared in an appropriate manner.

The additional support of appropriately skilled personnel located in local areas is evidenced by some of the outcomes of the Stormwater Extension Officer (SEO) Program. A similar approach, but with longer-term commitments to funding, including jointly by councils, can ensure that responsibilities are better managed. Water Conservation Officers are required broadly across the region and their responsibilities must extend to technical input into analysing demand and the co-ordination of options addressing demand-side approaches. This approach has been successful in California, where such personnel form a backbone of institutional support for utilities in designing and implementing major water conservation programs.

Performance monitoring and indicators

Performance monitoring and indicators are essential both for the design and implementation of strategies for integrated water services, and also for the evaluation of programs and assessing progress relative to targets. For example, this investigation and previous studies confirmed that the most basic data in relation to the demand for water and discharge of sewage is not accurate or widely available. This limits the ability of water service providers to undertake a simple water balance. The lack of reliable data on infiltration and inflow to sewers has implications for the design and operation of sewage treatment plants that can run to millions of dollars. Water service providers would benefit from allocating sufficient resources to the collection of data and the maintenance of monitoring systems for bulk and customer metered demand, sewage flows and costs. Evaluating any water efficiency and source substitution programs is also important to ensure that program design is improved and that the best options are being implemented.

Table 2: Summary of strategies described

Outcome	Strategy	Implementation Issues	Application	Responsibility
Increased appliance efficiency	Regulation of appliance efficiency (e.g. max flow rates)	Transitional period required followed by increasing effectiveness as appliance are replaced Low cost	Plumbing fixtures, appliances	Commonwealth Government
	Development Planning Controls	Medium cost Compliance not certain without bonds	New developments and redevelopments (Greenfield and infill)	State Government (SEPP) or Local Government (DCP)
	Educational Programs	Low level of impact expected if operating in isolation Best used in conjunction with other programs	Supports other programs, particularly those with low compliance levels	All stakeholders
	Incentives (e.g. rebate on sale of front loading washing machines)	Need to change behaviour if possible	Sales of new appliances	Appliance retailers, water suppliers and energy authorities have worked together previously
	Retrofits	Higher cost Not secure without regulation of appliances	Areas with pressing augmentation needs	Water Supply Authority or Local Council
Increasing effluent reuse	Raintanks to capture stormwater and provide supply	Cost comparison on the basis of cost/kL necessary	Areas where on-site detention is most useful	Issues pertaining to who should pay for economic incentives for this alternate supply which is also useful for on-site detention. Councils could require a minimum volume
	Application of water quality cascade for reuse within the home	Dual reticulation in new developments is likely to be cost neutral when compared with the headworks costs offset	New developments as retrofitting is likely to be expensive	Developers, Local Councils can provided incentives
	Substitution of lower quality water demand	Effluent need only be treated to the quality level at which it is required	Sub-surface irrigation for example	Various

Table 3: Summary of strategies described, cont.

Outcome	Strategy	Implementation Issues	Application	Responsibility
More integrated servicing of new developments	Localised sewage management	Found to be cost neutral compared with centralised systems. Approval process is currently not supportive of this approach which can require more than two parties to be involved. Model approval process required to support Councils	All new developments and unsewered areas	Developers, Local Councils can provided incentives Change to EIA Process could be considered by PlanningNSW
	Local scale reuse	Substiution of genuine demand is fundamental Principles of scale must be utilised to ensure cost-effectiveness and prevent negating of environmental benefits	Irrigation, outdoor water use, indoor toilet flushing etc	Developers, Local Councils can provided incentives. Statewide targets could be established
Reduce infiltration and inflow to sewers	Compliance monitoring of new sewer installations	Compliance monitoring should be carried out. Developer contributions should be used to cover this cost	Required to ensure high quality installation	Local Councils and service providers
	Pressurised or vacuum technology	Likely to be cost neutral when scale of system and required maintenance is considered	All new sewers as this prevents infiltration and inflow	Developers, may be required by Local Councils or legislation
	Smoke testing for illegal connections	Low cost	Frist step to reducing infiltration and inflow	Local Councils and service providers
	Diagnosis and repair of existing systems	Could be costly	All older style sewers	Local Councils

1 INTRODUCTION

1.1 Purpose of this Report

The Healthy Rivers Commission (HRC) commissioned this report to inform its Independent Inquiry into the North Coast Rivers. The inquiry commenced in April 2002 and will use information from this study in formulating its *Findings and Draft Recommendations Report*, to be released in November 2002 for public comment. The Commission will prepare a *Final Report* in 2003.

Investigations of other areas in NSW, including in the Hawkesbury–Nepean (HRC 1998), Georges River/Botany Bay system (HRC 2001) and in the Clarence River system (HRC 1999), indicate that the increased integration of water service provision could deliver significant benefits. For example, HRC has recommended that the water cycle, "including water supply, stormwater and sewage, should be managed in an integrated way" (HRC 2001, p 14). Furthermore, the Clarence Inquiry cited the benefits to river health of an integrated approach using water use efficiencies as the foundation. These benefits include the reduction or deferral of supply augmentation, reduced sewage effluent, reduced energy usage and provision of environmental flows.

Building on previous work, this report sets out to demonstrate that opportunities exist for increasing the integration of the provision of water services in the North Coast Rivers Inquiry area. Investigation of the current situation highlighted opportunities for integration generally and some local examples of where some level of integration occurs. Using data from these opportunities and examples, this report describes, and quantifies, the estimated benefits and costs expected from implementing changes to achieve integration across the whole north coast region. The implementation process is then explored and strategies are identified to facilitate the changes required. Consideration is given to the impacts of these changes on existing Government policy and programs.

1.2 Methodology

The methodology for this investigation is shown in Figure 1-1. The Institute for Sustainable Futures drew on experience in least cost planning for water utilities and combined this with a literature review of planning documents from the region, statistical publications and reports pertaining to recent and proposed changes in legislation to undertake this investigation. A number of key stakeholders in the study area were contacted and a convergent interviewing process was used to help establish what structures and processes presented barriers to a more integrated approach to the provision of water services.

These inputs were synthesised to provide the body of the report, a major case study on Ballina and a number of other study examples. Together these provide insight into both existing practice and opportunity for change. Local level information from within and outside the study area was used to identify options for increased integration including varying levels of demand management[1], source substitution[2] and alternative servicing[3]. As illustrated in Figure 1-1, these options were used for two purposes.

[1] Demand management involves programs seeking to reduce the demand for water from various end uses (See Appendix B). Also referred to as demand side options.
[2] The demand for water from centralised water supply systems can be substituted with water from other sources including rainwater ranks or highly treated sewage.
[3] Alternative servicing is used to refer to the potential to supply water services (water supply, sewage and stormwater management) through innovative means, which do not rely on the centralised supply and sewerage/stormwater systems.

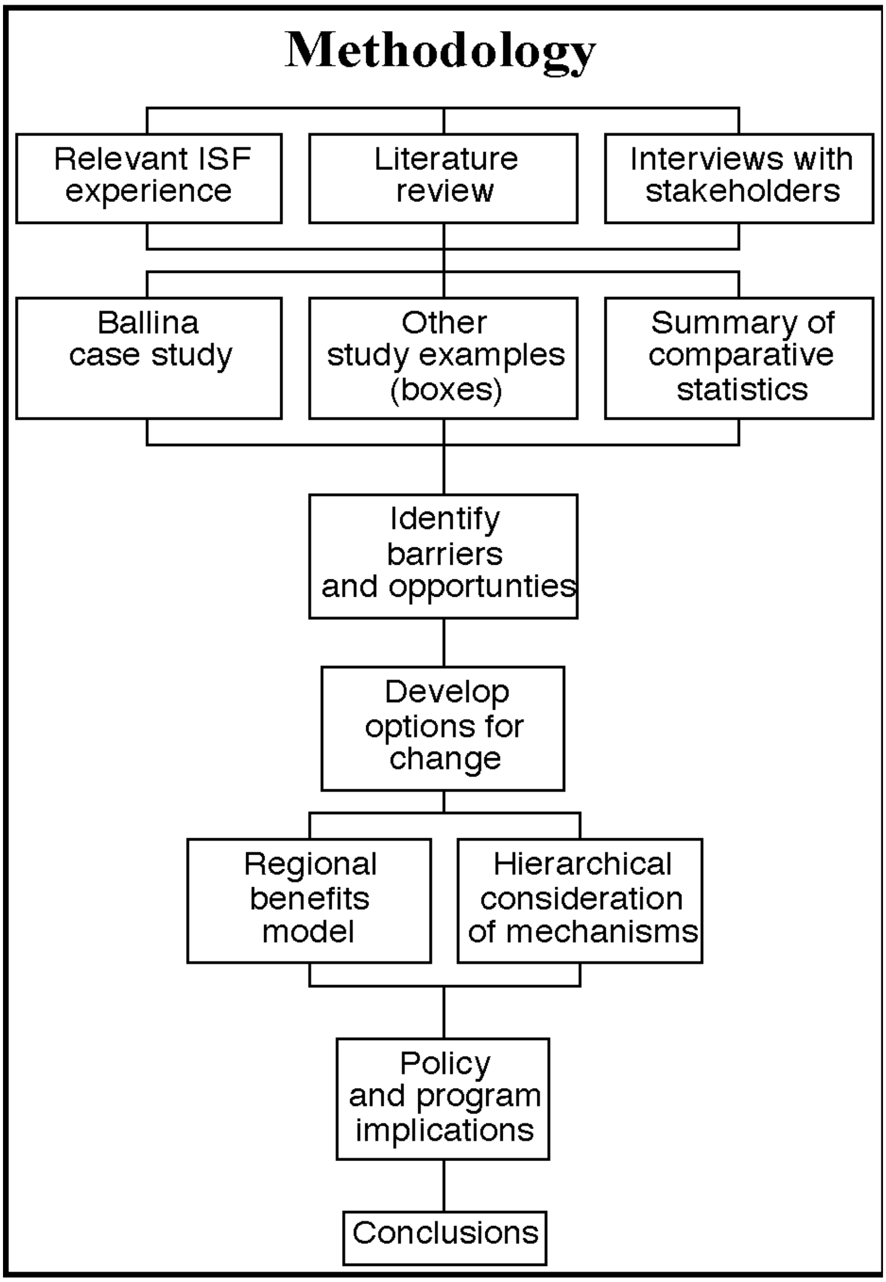

Figure 1-1: Methodology Flow Chart

Firstly a model was developed to extrapolate from local examples to a regional scale, the typical costs, potential savings and environmental benefits resulting from a range of localised options. The extrapolation was based on comparative data[4] modelling of flow volumes and emissions (water and energy/GHG) from the case studies, study examples and other literature.

Secondly, measures to facilitate change were described hierarchically to compare their impacts. The implementation of the changes were considered in light of the implications the changes would have on existing plans, policy and programs at local/regional levels, State-wide levels and nationally.

Conclusions were prepared which provide detail of how the change strategies for the increased integration of water services on the NSW north coast would be most cost-effectively implemented, taking into account the total costs to the community.

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[4] 2000/01 NSW Water Supply and Sewerage Performance Comparisons (See Appendix C).

1.3 Structure of the report

This report describes firstly the existing situation (Section 2), secondly the possibilities for a more integrated approach (Section 3) and thirdly the policy implications of and steps for proceeding from the existing situation toward the more integrated scenario (Section 4).

The study area is described in Section 2. A number of maps are included to illustrate the report scope. Four major issues are then described: escalating demand (Section 2.2), fragmented approaches (Section 2.3), decision-making and planning outcomes (Section 2.4) and typical, centralised infrastructure approaches (Section 2.5). These major issues are illustrative of a lack of integration and/or serve as barriers to a more integrated approach. Two detailed examples, a case study on water services in Ballina and a description of demand management are provided in Appendices A and B respectively. Details of other study examples are given in boxes in the report. The case study and examples serve to provide typical costs and illustrate potential savings on a local scale and are referred to throughout the report.

Section 3 describes a new approach to the provision of water services. This is the description of what integrated water service provision would entail. This more desirable approach is dependant upon integrated water resource planning (described in Section 3.1). The three key approaches described are reducing demand for water (Section 3.2), encouraging source substitution (Section 3.3) and innovative servicing of new developments (Section 3.4). For each approach, the range of possible mechanisms are described and compared in terms of their impacts. The costs and benefits associated are described with each measure and summarised in Section 3.5. Economic and environmental factors have been considered including demand reductions, reduced flow volumes to sewers, energy and greenhouse gas implications of reduced treatment volumes and the cost savings of augmentation deferral.

The strategies are then complemented by Section 4, which considers what changes need to occur in order to best utilise existing structures, policies and programs to move toward a more integrated approach. This section includes the advice pertaining to policy change to facilitate greater integration and deliver the maximum benefits to the community.

2 THE CURRENT SITUATION AND IMPLICATIONS

The north coast rivers region is typical of water service provision in NSW. The responsibilities are divided and the outcomes vary. There are areas where steps toward integration have been taken and many where opportunities are numerous. Section 2 describes some aspects of both barriers and opportunities including escalating demand, fragmented approaches, planning outcomes and linear infrastructure. These aspects combine to illustrate the need to make changes to achieve a more cohesive management of the water system.

2.1 Background

The study area includes some 29 local Government areas (LGAs) (listed in Appendix D) and is some 500km long from north to south and 160km from east to west. Figure 2-1 shows the LGA boundaries in the inquiry area. The eleven catchments in the area are also illustrated in Figure 2-2. The Clarence River catchment has already been the subject of an HRC Inquiry and is therefore excluded from the scope of the North Coast Rivers Inquiry. However, since there are some LGAs which are not completely inside the Clarence Catchment (eg. Coffs Harbour, Tenterfield etc.), for the purpose of this study all 29 LGAs have been included in order to consider the whole region, being all the coastal river catchments north of the Hunter. These overlaps are shown on Figure D-1 in Appendix D.

A variety of industries exist in the area including grazing, dairy, tea-tree, cane growing, timber, fishing and tourism and the landform ranges from forest through floodplains to coastal zones. All rivers are relied upon for a variety of purposes throughout the region, which in some cases impact significantly on their health.

River health is an issue of growing concern for all stakeholders. Catchment Management Boards have identified priority actions to improve the health of the catchments, as documented in the Catchment Blueprints. These snapshots serve to supplement existing studies. The EPA's assessment of catchment health in 1996 for example revealed that both the Richmond and Brunswick catchments had "exhibited poor water quality across a range of environmental values" (Sinden and Wansbrough, 1996, p.ix). The same investigation revealed that sediment loads and nutrient loads (particularly in times of high flows) were of particular concern. This is just one example of a study highlighting the poor water quality present in parts of the study area.

Population growth projected for the study area could cause significant detrimental impacts on river health. The increased environmental expectations, from both the community and from regulators, and growing population necessitate a better way of managing water resources.

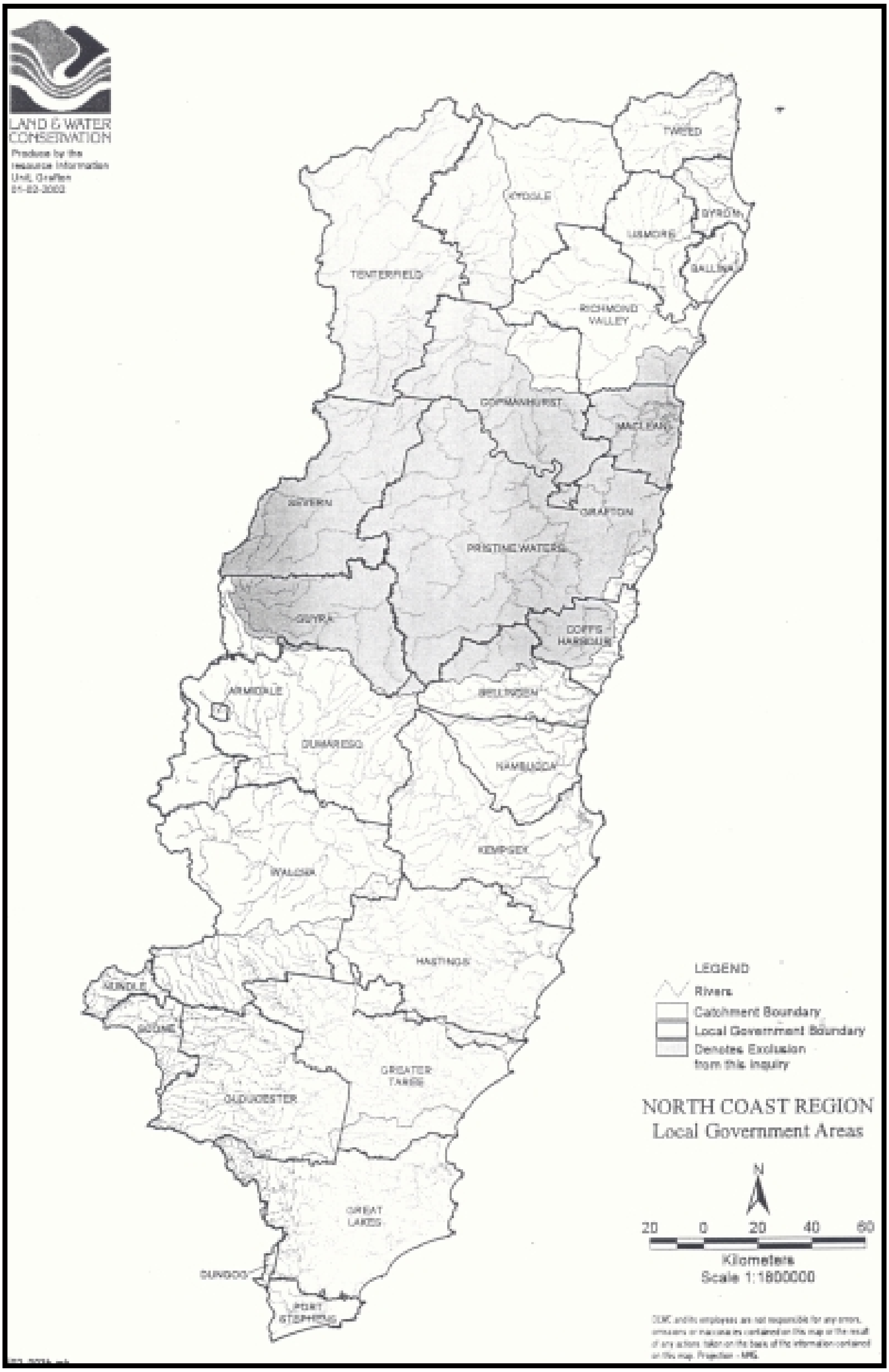

Figure 2-1: Map of Study Area – LGA boundaries

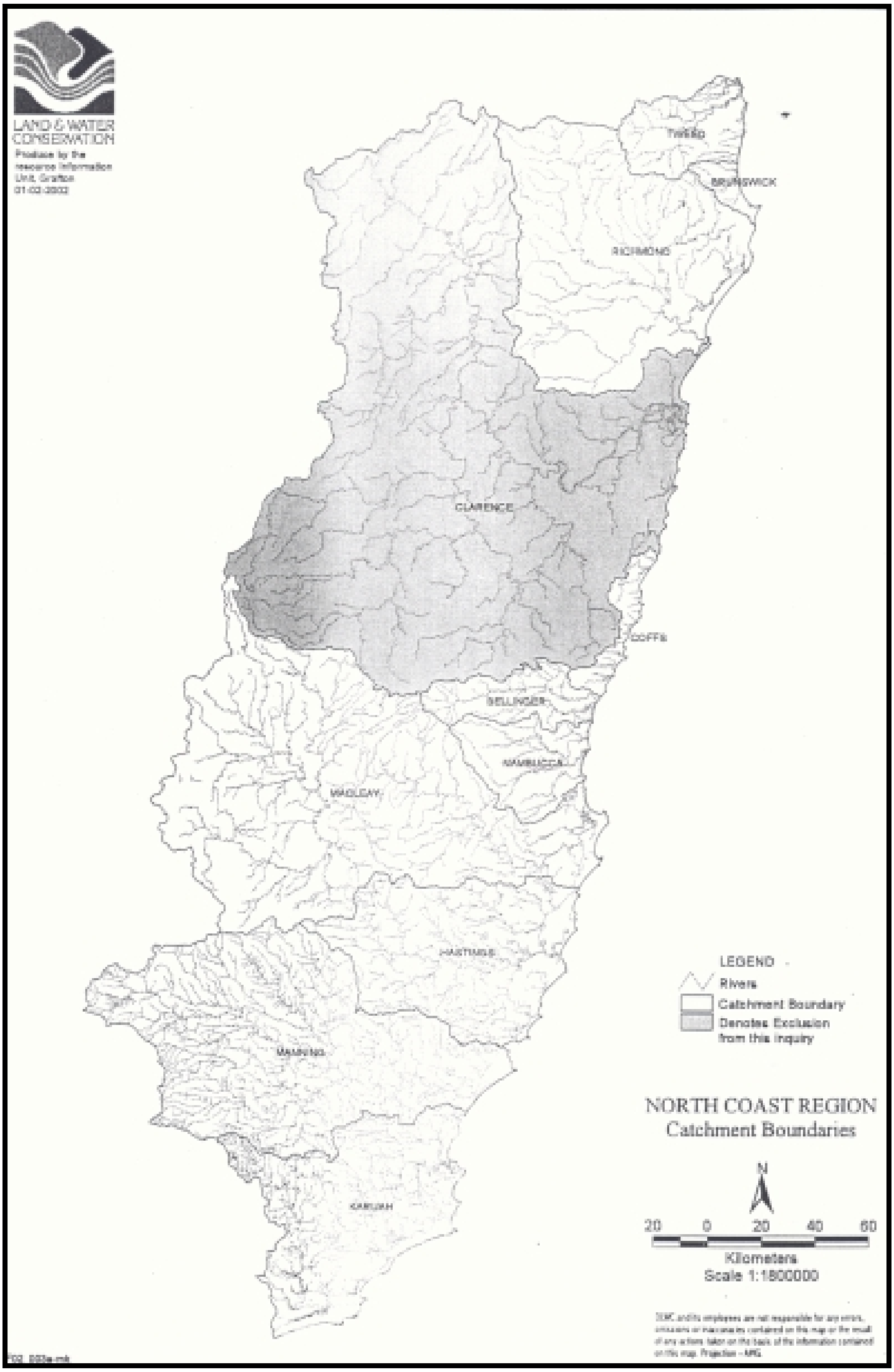

Figure 2-2: Map of Study Area – Catchments

2.2 Escalating demand

Integrating water services has been shown to deliver benefits both in this report and in other studies. The escalating demand projected in the north coast region is both a further reason to integrate water services and a barrier to some of the higher order integration steps, which deliver the most benefits, for example source substitution. Section 2.2 projects water demand in the region and explains some of the implications.

2.2.1 Projections of Population

The HRC investigation into North Coast Rivers has identified that the rapidly increasing population in the area will have major implications for river health. This area is second only to metropolitan Sydney in terms of the rate of population growth anticipated. More than 675,000 people now live in the LGAs in the study area[5]. By 2026 this total is expected to be more than 875,000 (see Figure 2-3) representing an increase of almost 30% in the coming 25 years.

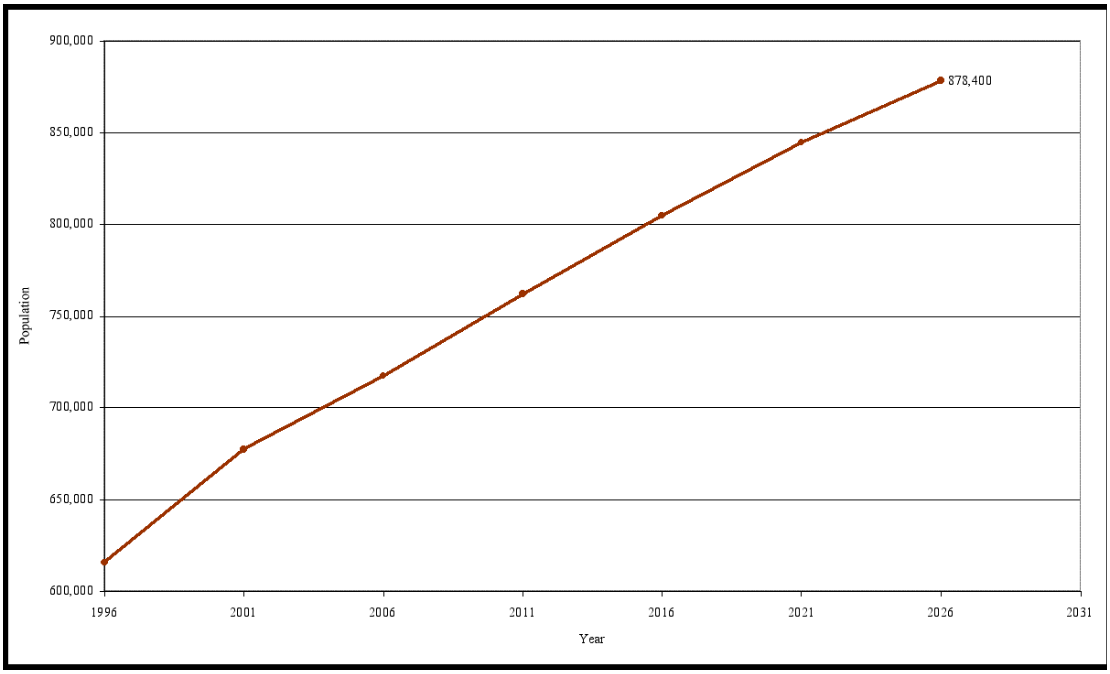

Figure 2-3: Population Growth Projection for the Study Area 1996–2026

Source: PlanningNSW(2002)

Accommodating those additional people is a major issue in the area, particularly since the growth rate in some areas (eg. within the Mid-North Coast region) is anticipated to be of the order of 1.5% per year over the next ten years. This is due to the fact that the growth is not uniformly expected over the whole region. As shown in Figure 2-4, the growth in the Mid-North Coast and Richmond-Tweed Regions is expected to far exceed that of LGAs in the other regions. This variability of growth implies differing pressures and this necessitates different responses to managing water services.

[5] See data provided in Appendix C

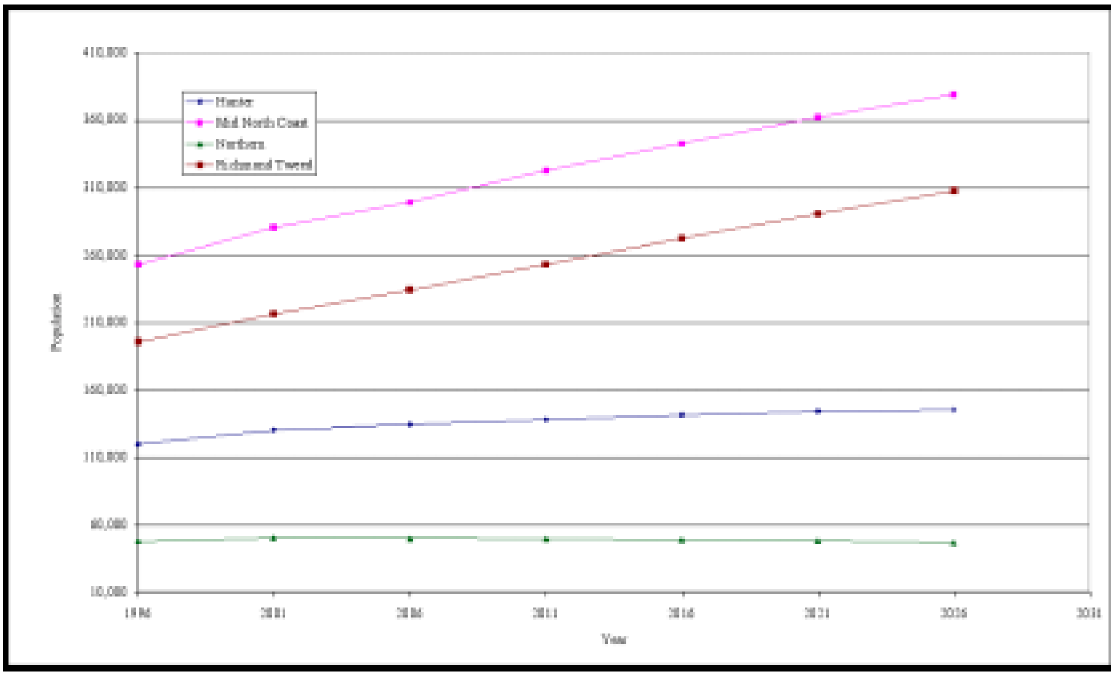

Figure 2-4: Regional Variation in Growth for the Study Area 1996–2026

Source: PlanningNSW(2002)

2.2.2 Water Demand Projections

Based on the population growth projections (as shown in Figure 2-3), the annual water demand projections for the study area to 2026 are shown in Figure 2-5. The calculation, which has been used to estimate the level of demand resulting from the population growth projected for the area, is an approximation giving an indication of the impact of growth on the region's limited water resources.

This projection is based on the following assumptions:

- In terms of water consumption for toilet flushing, there is a range of dual flush units with flush volumes from 11/6, though 9/4.5 to 6/3 litres. In this study, the weighted average demand for water for toilet flushing is estimated as 40 L/person/day (LCD) in 2002 given the current mix of single and various models of dual flush units. This is estimated to reduce to an average of 27 LCD by 2026, a difference of 13 LCD. The change occurs naturally over time as the only toilets now available for purchase are dual flush toilets[6].

- Therefore consumption per person decreases by 13 LCD between 2001 and 2026. This is based on the fact that consumption of water for toilet flushing purposes is decreasing due to the exchange from single flush toilets to dual flush toilets.

[6] The move to dual flush toilets occurred through a mechanism no longer available. Initially agreement was reached at a meeting of the Metropolitan Water Supply Authorities (a forum no longer in existence) to regulate the installation of dual flush toilets. Subsequently the requirement was incorporated into standards.

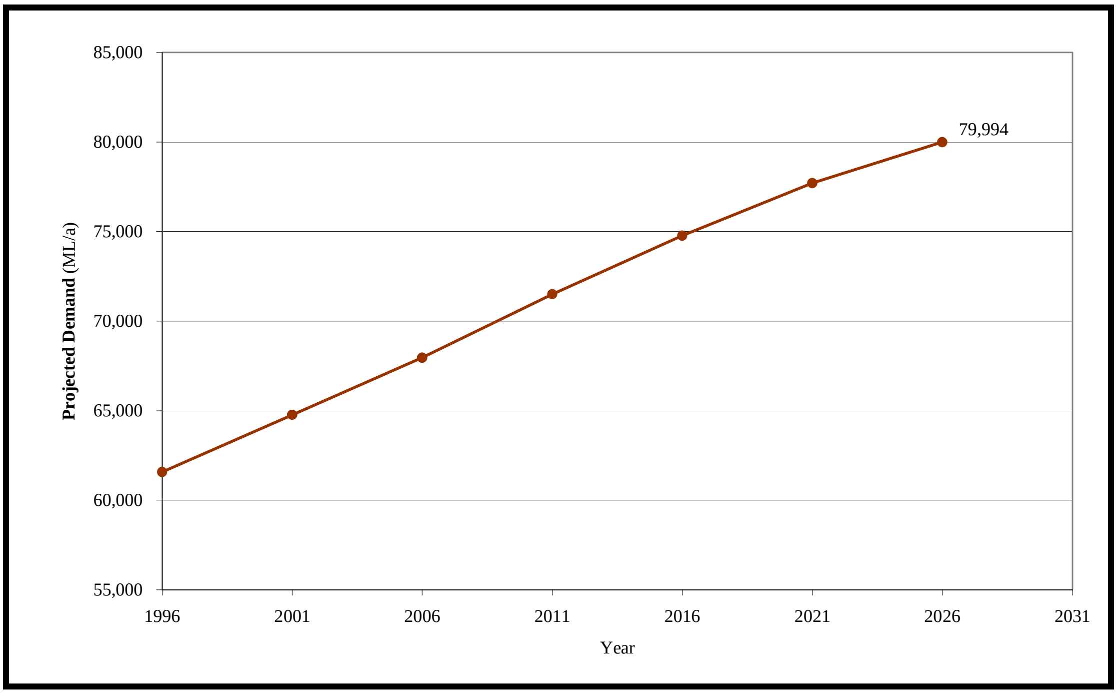

Figure 2-5: Total Regional Projected Annual Water Demand

Source: ISF modelling based on population growth (Planning NSW, 2002) and current water demand estimates (DLWC, 2002)

2.2.3 River Health and Environmental Implications

The likelihood of continuing growth in demand for water resources by the increasing population described in the previous section serves to illustrate one of the pressures on already stressed rivers. Continual extractions from rivers threaten riverine ecosystems and compromise the availability of water for licensed extractors further downstream. It is now generally recognised that some form of 'environmental flow' is required to maintain river health. Importantly, environmental flow requirements are not satisfied simply through water volumes, rather, natural flow patterns need to be mimicked. This requires the timing and quality of water provided for substitutional flows to be carefully managed.

Whilst substitutional environmental flows using highly treated effluent can serve to maintain connectivity along river paths, the pumping and treatment necessary have broader environmental consequences. Firstly, the energy consumption for water treatment contributes greenhouse gas emissions. Estimates based on the comparative statistics (DLWC 2002), indicate that the equivalent greenhouse gas emissions for treatment and pumping of water are 629kg of CO_2. The treatment and transport of sewage contributes on average an additional 484kg of CO_2 equivalent per ML treated in this study area.[7] This means that if annual water demand increases as projected by more than 14,000 ML, an additional 8,800 tonnes of CO_2 equivalent would be produced annually, comparable to the stationary energy emissions from more than 1,000 homes annually. Other resources lost during the continual processes of extraction of water from rivers, and return of treated effluent, are nutrients. In the right quantities nutrients are essential for healthy soils but they can also be damaging to rivers, for example resulting in toxic blue-green algal blooms.

Despite the fact that rivers might currently be used as a vehicle to transport water to areas where it is required further downstream, they also need to serve other key functions within the catchment ecosystem hence the costs to the community of continuing to extract water from

[7] The increased energy use to provide hot water is even higher, at approximately 25,000 kg per ML of hot water. There are also energy implications associated with sewage treatment. These are modelled as 484kg/ML pumped and treated.

rivers and return treated effluent means that this process is not in equilibrium. Nor is the process necessarily utilising natural resources to their maximum efficiency which would ultimately benefit the environment. A more integrated process, which reduces demand for water, reuses water where possible and captures water from a range of sources will result in greater resource efficiency and importantly will leave more water in rivers, thus being the preferred option.

2.3 Fragmented approaches

This study area has approximately 64 water extraction points for the purpose of town water supplies, which supplied an estimated total of approximately 60 GL of water to a population of 670,000 in 2000/2001. The sewage volume treated in the area is of the order of 50 GL per annum. The 29 LGAs are supplied with water by local councils, or in some areas by bulk water retailers, (including Rous Water, Hunter Water and North Coast Water), who sell water to councils. This results in more than 30 retailers to customers. There are 61 licensed sewage treatment plants (STPs) in the area operated by councils (NCC website, 2002).

The existing division of responsibility for water services is typified by:

- a regional bulk water supplier which is often a county council,
- local council responsibility for water supply distribution (infrastructure and service), sewage treatment and disposal and urban stormwater management,
- EPA responsibility for licensing STP discharges, and
- DLWC responsibility for licensing water extractions from rivers.

Table 2-6 provides a summary of the interactions between the array of stakeholders and some insight into the structure of their various responsibilities, the legislative and policy context and sources of funding.

Without a regional approach to water related services, fragmentation and variability of approaches is typical. It is common that councils supplied by the same regional bulk water supplier will manage their service provision differently. In some cases there has been collaboration, particularly with regard to restrictions possibly due to the high degree of visibility of this issue. Councils are also beginning to collaborate, for example in the preparation of Development Control Plans (DCPs).

This collaboration is driven in part by the pressures for councils to take on various responsibilities resulting from State Government mandates and the resulting need to rationalise their use of their limited internal resources. In response in some instances water service provision is beginning to be more integrated on the NSW north coast. However, in many instances the fragmented approach remains.

Table 2-6: Summary of Operations

	Responsibility	Major Legislation, licenses, policy etc.	Funding	Opportunities
Water Supply	Bulk water suppliers to councils. Councils retailing to customers.	NSW Water Conservation Strategy. Licenses from DLWC under the Water Management Act (2000). Local Government Act (1993)[8]. Approval by DLWC of water supply or treatment construction or extension works.	Developer contributions Water services annual levies. Water service metered charges CTWSSP.	Appliance and plumbing product efficiency standards Retrofitting to reduce demand for water supply by existing dwellings. Construction of new developments which are more water efficient and which take full advantage of alternative supplies.
Sewage Management	Local councils.	Licenses from EPA under POEO Act (1997). Local Government Act (1993)[9] approval by DLWC of works to discharge or treat sewage. Pollution Reduction Program. On-site guidelines according to AS/NZS 1546.	Sewage services levy. CTWSSP.	Consideration of the whole water cycle and management to maximise the reuse of the nutrients currently removed through a centralised system.
Stormwater	Local council through drainage of roads and ownership of infrastructure.	POEO Act. Directive to councils to prepare SMPs.	NHT. Stormwater trust grants. Revenue from general rates.	Capture and reuse of this supply source to prevent flooding, reduce pollution and provide alternate supply. WSUD principles in DCP/LEP.

One example of the fragmented internal organisational responsibility within councils is the management of stormwater. This responsibility is often delegated to the roads section of council. This reflects an approach to managing stormwater which is often limited to preventing flooding of properties and ensuring adequate drainage from road surfaces (See Box A). Whilst these are both important aspects of water management, this approach overlooks the potential for capturing a valuable resource. Apart from the first flush, stormwater is generally of a relatively high water quality, superior to sewage, and yet it is rarely managed as a resource to be captured.

If allowed to flow overland and collect nutrients and sediments the potential resource of stormwater can be detrimental to the environment, depending on the nutrients or pollutants it carries into watercourses. The run-off from roads in particular carries a whole range of pollutants. Other stormwater, including that which falls on roofs or paved areas, is much less polluted and therefore need not be treated in the same way. In many cases it is economical to capture rainwater near to the point where it falls, for example in raintanks. The tanks serve as an additional storage to prevent localised flooding as well as capturing water to provide an additional or alternative water source. This water is useful not only for water use outdoors (in

[8] Section 60, Council works for which the approval of the Minister for Land and Water Conservation is required.
[9] As above.

gardens), but also for the flushing of toilets and potentially, if treated to a sufficient level, for laundry purposes. It should be remembered that many rural communities that do not have access to mains water rely on this alternative source.

In the Rous County Council supply region, where Rous Water supplies bulk water and Councils manage stormwater the lack of integration is even more obvious. These organisational arrangements mean the link of utilising stormwater as an alternative source is not explored and the more traditional supply side approach is utilised. This yields large infrastructure based solutions, which do not explore demand side or alternative source concepts, despite these approaches providing a range of other possible solutions.

Box A: Internal organisational structure

Ballina Shire Council for example, is organised according to the different departments in the Council and includes a section for "Roads and Drainage". The organisation, management and even presentation on the website of stormwater as an aspect of roads and drainage does not serve to inform the public about the extent to which stormwater can be a resource. Rather, it is presented as a problem requiring removal and disposal.

A representative of one council, explained that stormwater is commonly managed by considering "how do we best deal with the problem of water on roads or flooding of properties". This simplification of the issue was repeated by a number of councils and described as a result of an absence of a "practical profile" for stormwater. In greater detail this related to funding as well as responsibility for the management of the resource.

The issue of raintanks was discussed with some council representatives. Issues raised included the role of a water supply authority in providing incentives for customers to reduce their water bills. Rous Water, for example is currently investigating the viability of raintanks as an integrated supply option, i.e. interconnected with headworks. It can be the case that a water supply authority may consider encouraging demand reduction to be contrary to their core business of selling water. Water retailing licences can be used to require water supply authorities to reduce demand, as is the case with Sydney Water Corporation. Councils may consider their organisations under-resourced in skills and knowledge to fulfill for this role.

The division of responsibilities between water, sewage and stormwater management within a specific council and often in broader geographic locations between several councils can cause other management difficulties. For example data collection and interpretation can be a very useful tool for managing all water services as one continuous cycle, thus allowing for a wider choice of options utilising stormwater or effluent as an alternative source of water or utilising demand management to reduce overall demand.

Fragmented management arrangements and variable data collection mean, however, that it is difficult to construct a reliable picture with this data, such as a water balance[10] if the data collected is not consistent across councils. A consistent or standardised means of measuring demand and supply is essential in order to highlight issues such as unaccounted for water, which can result in significant wastage if not identified. Furthermore customer feedback on their own consumption needs to be accurate in order for customers to relate their behaviour to their water related service bills.

[10] A water balance is an analytical process comparing the water volume metered as leaving the reservoir (production) with the volume of water metered to customers (consumption).

Box B: Divided responsibilities

Ballina Shire Council is a water retailer, selling water to customers within the Council area. The bulk water supplier is Rous Water, which operates two main water supply storages, Rocky Creek Dam and Emigrant Creek Dam, and some smaller bore sources. Rous Water also supplies water to the councils of Lismore, Byron Bay and Richmond River (excluding Casino township) as well as rural customers who obtain water direct from trunk mains.

Within the Rous Water supply area five different organizations meter the water use. Each council maintains meters in the supply area and Rous Water also supply some customers directly (rural connections). The reading of meters by councils alone varies significantly, both in terms of the frequency of readings and in terms of meter replacement programs. This leads to difficulties in the analysis of data to support planning.

Ballina Shire Council for example reads the water meters for most customers on a six-monthly basis (including all residential customers). High water users have their meters read on a monthly basis. The six monthly meter reading period provides less data to indicate seasonal trends compared with quarterly readings, which have, for example, been taken in Richmond River since 1994 and in Lismore since 1997.

Some progress is being made toward more regional approaches and toward councils working together, for example in the recent restrictions Councils in the Rous Water supply area recognised the need to provide a consistent message regarding water restrictions to what is an increasingly mobile community, living for example in one LGA and working in another. Other motives, particularly staff resources have seen councils work together, for example in the development of a common DCP for stormwater. Officers based at Maclean Shire Council are working with surrounding Councils to develop the template plan, which each council can then adopt.

Box C: Stormwater on the north coast

Joint Stormwater DCP, Stormwater Extension Officer Program (SEO) (north coast)

Funding for stormwater is repeatedly highlighted as an issue preventing the successful management of this valuable resource. The reliance on externally funded grants (NHT, DLWC or Stormwater Trust) means that stormwater competes with other issues for general revenue funding. In some rare cases environmental levies may be used for this purpose. One resource, which has apparently effectively been provided to support councils in their management of stormwater is the SEO program. The EPA is funding a program to help increase stormwater management capacity in local councils. There are nine Stormwater Extension Officers (SEO) across NSW, and the SEO serving sixteen (16) councils on the north coast is based at Maclean. The aim of the program is to help increase stormwater management capacity in local councils on the north coast. The major issue associated with this program is the short-term nature of the funding. Councils have utilised these resources in a number of positive ways, including for organising short courses and to prepare model DCPs. The funding for this program State-wide is expected to reduce from $20m in 2002-2003 to $1m in 2003-2004. The steps taken as part of this program illustrate what can be done with specifically allocated resources.

Councils have found that whilst grants may be used for the implementation of one stormwater treatment device, this same device can then become a drain on resources for maintenance. The example of a CDS unit was used to illustrate a device where installation costs were met through a grant but maintenance costs of $9000 per year were now presenting a major burden.

Urban stormwater is often considered to be a relatively small issue both in terms of the percentage of the catchment which is urban and also due to the small contribution of that run-off to overall nutrient loads. Maclean Shire Council's Urban Stormwater Management Plan for example states that only 0.54% of the whole shire area is zoned for urban development.

That small component contributes 0.08% of the total nitrogen and 0.2% of the total phosphorus in the Clarence river nutrient budget. In some cases it may be deceptive to compare load contributions across whole catchments as this may not represent the significance of local impacts.

Councils generally see stormwater management as prevention of localised flooding of properties and drainage from roads (*pers comm*. Phil Warner). This approach is driven by historic management practices, funding sources and pressures, community attitudes and perhaps a lack of data about the related impacts. The approach is representative of a missed opportunity. Water sensitive urban design is a possible strategy to counter this approach.

In addition to councils rationalising resources to work together across the water cycle, recent legislation has been put in place to move away from the traditional water service arrangements, which do not fully value water or the environment. Two of the key aspects of policy and legislation are the NSW Water Conservation Strategy and the Water Management Act 2000, described below and followed by consideration of the licensing aspect implemented to date. Whilst the changes indicate a commitment to increased integration, opportunity remains to capitalise on these opportunities through implementation on the ground.

2.3.1 NSW Water Conservation Strategy

The Department of Land and Water Conservation (DLWC) published the *NSW Water Conservation Strategy* in October 2000. The strategy established the following vision for the conservation of water in NSW:

> *"People in NSW working towards greater efficiency in the use of water in a manner that recognises its true value, is economically viable and environmentally sustainable", (DLWC, 2000)*

The strategy contained some 19 strategy steps and 55 actions and one of the primary principles was for Government (both State and Local) to offer leadership in water conservation through policy and by example. The support of the water conservation strategy by education programs is also highlighted. The strategy forms part of the NSW Water Reforms under the framework of the Council of Australian Governments (COAG) water reforms.

The strategy was prepared but was not connected directly to funding, which in part appears to have contributed to the limited progress that has been achieved to date with regard to its implementation. In general reforms have been centred in the Sydney basin and the metropolitan region including extensive work such as the Hawkesbury Nepean River Management Forum. Hence there remains significant opportunity to embrace this strategy and support its implementation on many levels.

2.3.2 Water Management Act 2000

The Water Management Act was passed in December 2000. The Act sets out the requirement to provide water for the environment as a priority and establishes the need for approvals for activities that impact upon water. Other aspects include:

- Water management and planning to balance the needs of the environment and water users;
- Establishment of transferable water entitlements (TWE);
- Private sector development and operation of water infrastructure;
- Regulation of water service providers to maintain safe and reliable water services and protect the interests of customer and the environment.

The new legislation requires preparation of Water Management Plans, which are to be developed by communities. These have begun to be prepared in the study area although they have mainly focussed on water sharing plans (or bulk access regimes) and in the view of stakeholders contacted during this study, do not currently fully consider the environmental management provisions of the Act.

Although some of the legislative framework needed to assist change is now in place, the provision of water services and those responsible for those services have been slow to respond. This is in part due to:

- **Current Management Structures** – The fragmented nature of the stakeholders involved, principles used to manage resources, management structures and responsibilities (described here in Section 2.3);
- **Financing -** The current financing arrangements to do not satisfactorily provide either sufficient funds for the appropriate management of the valuable resources nor provide sufficient incentives to developers or operators to move toward a more efficient, integrated service (see Section 2.4); and
- **Planning Processes -** The existing non-integrated planning processes and the fact that these do not include an effective mechanism to consider the whole lifecycle cost (see Section 2.4).

2.3.3 Licensing and Policy

DLWC licences extractions from rivers in NSW. Under the Water Management Act (2000), these licences will be reviewed. The Act provides for fifteen-year general licences and twenty-year licences for towns and major utilities. Licenses will be for all towns and these, along with licenses for major utilities, will be converted to volume-based licenses.

Also under the new Act, water licenses are to be linked to the ten-year Water Management Plans (established under the Act), which will specify how water is to be shared, particularly between users and the environment. Whilst the Water Management Plans seem to provide a useful process for having communities consider the allocation of resources, the limited scope of water sharing plans to date (i.e. to focus on “Bulk Access Regimes”) means that other important issues like water quality impacts or flows as a result of STP discharges were omitted.

The Minister for Land and Water Conservation will make the final plan in agreement with the Minister for Environment, and the plan will be reviewed in its fifth year to assess whether agreed objectives are being achieved. Audits are to be conducted by the Minister every five years after this to ensure recommendations are being properly implemented. It seems that this degree of transparency is a useful model to evaluate programs against objectives however many objectives are unlikely to be achievable by a bulk access regime alone.

In a sample Water Sharing Plan considered in this investigation (Upper Brunswick), the section on “Committee issues and recommendations for the upper Brunswick River water source” (Part A p26), has a strong encouragement of off stream sources for irrigation and a need identified to provide incentives for water efficiency within that sector. It is not clear from these planning processes how such steps would be implemented. Further, given that the objectives under the “Drafting instructions for a water sharing plan for the upper Brunswick River water source” (part B p3), contain no reference to reuse or recycling of water this plan mostly deals with limiting extraction. This is one example of the limited scope addressed by the plans.

2.4 Decision making and planning

The planning of water service provision must occur at the same time as land release planning in order to achieve significant innovative integration and this is generally recognised among the councils’ representatives. However, typically the issues of staff resources are highlighted as an issue preventing council from responding in a timely manner to capture the opportunity presented by new developments. Strategic planning for water services in some cases is the responsibility of the council's one Development Engineer. Council staff contacted during this study revealed that strategic planning is the first aspect to be compromised when deadlines and resources are tight. In addition, the legal requirement to process Development Applications within set timeframes puts pressures on councils in terms of assessing innovative approaches.

This somewhat inflexible nature of development planning is part of what prevents more innovative solutions to water resource management being implemented more frequently. There is a need to provide a more flexible process, which can accommodate new ways to service developments. This is essential given the pressures that exist currently to better provide for new developments and reduce their drain on resources.

Box D: Servicing and costing of infrastructure

During this investigation council representatives have indicated their understanding of the ideal situation in terms of planning for growth. One suggestion was council based, localised planning, including a 30 year Strategic Business Plan. A long-term understanding of the land releases proposed in the area would provide Servicing Plans which would describe the expected number of residents in each area and this could be related to the remaining capacity of infrastructure. Based on these Servicing Plans it is possible to make appropriate estimates of the costs of new development for the purpose of developer contributions plans to ensure these contributions adequately capture the costs of the new development. The key difference with existing developer contribution plans is that the Strategic Business Plan would provide a larger scale, longer term understanding.

In general the lack of resources for strategic planning was highlighted. Whilst the opportunity for alternative servicing of new developments is recognised in general, its broader application is prohibited by the consideration of water service provision coming far too late in the planning process. The lack of a requirement to demonstrate consideration of water services at the land release planning stage is one barrier, but is also an opportunity. If land rezoning proposals were required to demonstrate the consideration of water services (supply and sewage and stormwater management) prior to approval, this would necessitate their early consideration. Such considerations could be required under *PlanFIRST*.

Ballina Heights is one example of the potential for new development to be constructed in a way that reduces the impact of the development on water services. This project includes the construction of 750 Lots and some community facilities where dual reticulation will be used to deliver high quality treated effluent back to the properties for outdoor water use.

The Suffolk Park development has seen Byron Shire Council approve the construction of some ten residential properties with a neighbourhood sewage management system. The local water supply authority has been contracted to manage this aspect of the development despite them (Rous Water) not having any sewage management responsibility in this area, that is, an 'inset appointment'. This illustrates the use of centralised management for decentralised services. Subject to the successful operation of the system the intention here is to extend the development to an additional 30 properties.This localised management of sewage is a step toward increasing the integration of water services since it requires local consideration of the resources.

At this scale it is more feasible to foster alternative source substitution and to manage treated effluent without discharge to rivers. The main benefit realised in this project (missed in some other reuse schemes) is the significant advantage of reuse without pumping to and back from a centralised treatment plant. This avoids not only pumping costs but also the capital, operation and maintenance costs of large scale infrastructure over the extended distances.

The approaches used in both Suffolk Park (Eco-Lane) and in Ballina Heights have both allowed development to occur within an area where water services are operating at or near capacity. The developers and residents of those new developments will then pay the cost of the provision of water services. These approaches represent the opportunity presented by new development.

Recent research has led to a questioning of the traditional 'economy of scale' in providing centralised water and sewerage services, that is, questioning the assumption that the more connections to a system the lower the cost per connection. The work of the CSIRO Urban Water Program (Booker, 1999) illustrates the fact that distributed systems of greywater treatment or water storage have similar present value costs as conventional centralised systems for greenfield sites due to the reduced reticulation costs.

Similar results have been obtained from research by the Institute for Sustainable Futures and CSIRO for Sydney Water Corporation in relation to a proposed development in South-Western Sydney where similar capital costs have been estimated for servicing options ranging from conventional centralised to fully distributed, using localised sewage treatment, rainwater tanks and water efficient equipment. This work has shown that water demand in new properties can be reduced by as much as 70% compared to the average demand in existing properties and even 100% if more innovative solutions are used (See also Section 3.4). This large-scale reduction will only be achieved through a more flexible planning process. BASIX (currently under development by PlanningNSW) is a first step toward providing mechanisms to encourage more water efficient management and provision of water related services in new developments. This is achieved through the use of rainwater tanks and by the substitution of potable water for all appropriate end uses (outdoor and toilet flushing mainly). Whilst it will not always be appropriate to recommend or even encourage development of this type, these two projects provide insight into how development, which satisfies needs on a more localised scale, could operate.

The key to achieving this type of integrated management of water services is the consideration of water service provision in a timely manner for all planning of new land release areas. Early investigation would allow the broader scale application of an outcome based DCP for example, rather than the case-by-case determination of a series of piecemeal developments. The reason to consider a broader area is that the total impact caused by a series of individual developments can cause more drain on resources than may be perceived on an individual basis.

2.4.1 Environmental Impact Assessment

The environmental impact assessment (EIA) process can also hinder the ideal provision of water related services, particularly through a lack of transparency inherent in the existing process. One of the fundamental issues is that the proponent of a project commissions the studies (SEE, REF, EIS) aiming to determine the project's environmental impact. The client/consultant relationship threatens the integrity of the study, which is intended to ensure environmental protection. Often EIA fails to fully explore the 'do nothing' option or even to consider a full range of alternatives like demand management or their full lifecycle costs.

A further conflict of interest exists when the same organisation, for example a local council, carries the role of both proponent and determining authority. It seems difficult, if not impossible to guarantee the adequate consideration of all options by a determining authority when they, albeit another department, are the project proponents.

2.4.2 Augmentation Needs and Water Cycle Management

One of the key current processes for planning for augmentation is the DLWC proposed Integrated Water Cycle Management (IWCM). Full details of the IWCM program were not finalised at the time of writing. From the limited information available it appears that the program will indeed encourage a more integrated management of the water cycle. The program, as yet in its infancy (currently being piloted in 12 LGAs in NSW), appears to consist of two phases:

i. A context report; and

ii. A concept options report.

The first phase allows the council to better understand the current status of the catchment. This includes considering the current situation with regard to demand and supply as well as the plans for augmentation and the biological and hydraulic loading of the existing system. Until the guidelines are officially released it is difficult to identify the exact contents of this plan. Participants have indicated that there is opportunity to include more specific aims during the first stage and also to broadly identify the possible options for consideration.

The second stage of the process identifies a range of options. These are then investigated in an iterative process, at each stage being submitted to council for review and examination.

The success of this program is likely to hinge on a number of aspects including:

- The establishment of objectives or targets for the area. Pilot program participants identified opportunity for the aims established by the Catchment Management Boards to be included in this process. These were seen to combine appropriately with the concept study in order to allow for both aims and the current situation to be considered.

- The skills and resources within councils to prepare the plans. Pilot program participants noted that while the plans were being prepared by DLWC or other organisations, the ultimate intention is that after the piloting stage, councils would take on this responsibility. This investigation has highlighted an expectation both within councils and outside them, that council staff be multi-skilled. It is possible that a degree of expertise would need to be sought, both in the formulation of options and in the more complete exploration of externalities, to ensure that a multitude of factors are considered. The need to include externalities in costs wherever possible is a difficult process and may not be best completed by council staff, who have a range of responsibilities and limited resources. The need to engage specialists could result in an expensive process.

- The scope of options considered in preparing the second stage report. It is essential that both supply and demand side options be considered in the provision of water services. Whilst demand management is beginning to be applied more broadly, it is unclear whether this aspect would be clearly identified as an essential first step wherever economically viable.

- The implementation both of the options and the process itself, including the funding for implementation of both aspects. This process is likely to be lengthy and costly by nature of the degree of expertise warranted and indeed the consultative nature expected. The absence of a plan to fund the process and implementation of the options developed would seem to indicate a barrier to the success of this program.

In considering the management of a water resource, there has traditionally been a focus on supply. More innovative approaches however would move away from simply measuring demand (predict) and then building large enough storages and pipes to supply that demand (provide). This "predict and provide" approach is no longer appropriate given the pressures of growing population in the area (see Section 2.2.1) and the limited resources to be shared. Rather it is essential that the opportunities for demand management are highlighted and implemented wherever economically appropriate.

The research on the real costs of water service provision alternatives referred to earlier indicates that providing water and sewage management services on a localised scale is comparable in cost to providing the more traditional centralised service. Given that there are plans to invest at least $148m in water supply/treatment infrastructure and at least $177m in sewage management systems by 2008[11], augmentation investment needs to be carefully evaluated to ensure the best outcomes for the community.

Box E: Demand side approaches

Rous Water's total bulk production in 2000 was 12.8 GL (ISF, 2002). This served a combined customer base of approximately 75,000 people across the four council areas.

Evaluation work has been undertaken on various programs incorporating the range of options for demand management (see Appendix B). The results of some of these evaluation programs have been used in this report to describe the potential benefits of increasing the integration of water services. The foundation aspect of demand management is improving the water efficiency of significant water end-uses. This has been proven to deliver cost-effective savings in recent evaluations (Sarac et al, 2002). For some residential programs implemented in this region, savings of the order of 23–35 kL/hh/a were measured from an average household demand of 220–250 kL/hh/a. This value has been used to model anticipated savings achievable through indoor retrofits of showerheads, tap aerators and flush arrestors in single-flush toilets.

2.4.3 Financing Improved Water Service

Funding for the management of natural resources and the provision of services to the community needs to reflect the value of the resources and where possible include externalities. Another important principle of sustainability is the need to require users to pay for services and the impacts they have on the environment. These principles can be difficult to implement due to historical circumstances and existing institutional arrangements.

Under the current arrangements there is both a general lack of economic incentive to encourage more integrated water services and a lack of funds to support continued strategic planning and management. On the contrary, a large proportion of existing funding is grants based and there has to date been a lack of connectivity between grant application success and the contribution of projects to a longer term strategic improvement of the service provided.

Grants

The grant-based nature of funding has implications of being short term in nature, contrary to a long-term approach to sustainability. The stormwater trust grants, other grants provided under the Natural Heritage Trust (NHT) (See also Box C) and grants provided as part of the Country Towns Water Supply and Sewage Program could be used to require individual projects to contribute to regional or long-term goals. To date this has not been the case. Instead the funding is generally limited to infrastructure projects.

Despite the scope of the Country Towns Water Supply and Sewerage (CTWSS) program extending only to backlog work (that is augmentation required to meet existing population and quality requirements, as they existed in 1994) this remains a significant funding program for local councils. In 2000/2001 19 projects were reported for the whole State (NSW EPA, 2002). There is no public reporting of the allocation of these funds, despite their significance and the potential for reducing costs to the State through implementation of alternative strategies. CTWSSP is estimated to deliver approximately $50–60m annually to the State and on a pro-rata basis this could be as much as $24m[12] to the north coast region.

[11] HRC Survey, 21 responses from Councils.

[12] Assuming that the population of NSW outside the greater metropolitan region (and therefore under the area of CTWSSP) is approximately 1.67m people (PlanningNSW, 2002), then the study area's 675,000 people is 40% of the population of the CTWSSP program.

A major opportunity presented by this program is for it to require a least cost planning approach to the integrated provision of water services as an interim measure in encouraging more sustainable financing. Given that councils are required to apply for funding under this scheme and that applications are considered by DLWC before funds are awarded, this provides an appropriate opportunity to require aspects of alternative supply-side options to be considered.

The nature of using grants to fund augmentation and even operation of water services can lead to fractional solutions and piecemeal approaches. The CTWSSP grants are one aspect of funding which could be changed. By making grants success be subject to projects being rationalised under an integrated urban water service plan and the adoption of a least cost planning approach to water service provision[13] these more comprehensive approaches could be fostered.

There are indications that the DLWC IWCM process may eventually be a pre-requisite for funding under the CTWSSP. The appropriateness of that intention depends significantly upon the quality of the outcomes of the IWCM process.

Levies and Charges

Councils fund water services through a range of mechanisms. These include water and sewage service charges. These charges are not rate pegged and thereby provide a means for councils to generate increasing funds, some of which is diverted into council general funds through administration charges. Obvious by its absence is the continuous funding stream for managing stormwater. There is no provision for councils to levy separately for stormwater. There may be scope to establish transfer payments from road levies to fund stormwater management.

Environmental levies have also been introduced by some councils and these funds have been diverted to water services (eg. Coffs Harbour City Council). There is significant lack of clarity with regard to how the approval process is undertaken in order to determine which council may apply an environmental levy. Councils have expressed concern over the lack of transparency and consistency with regard to this process.

Developer Contributions

Under Section 64 of the Local Government Act 1993 (s64), councils have the right to charge developers a contribution towards the cost of both existing and planned water and sewage infrastructure. The power given to councils by s64 is explicitly linked to the right of Water Supply Authorities to levy developer charges under Section 25 of the Water Supply Authorities Act 1987.

Historically councils often required developers to pay only a small fraction of the costs of providing water and sewage infrastructure to their developments and thereby subsidised development in their jurisdiction. Over the last ten years, however, both State and Local Governments have increasingly recognised the importance of water supply authorities recovering a greater part of their infrastructure expenditure from those who benefit from its construction.

[13] See Howe and White (1998), White (1998)

Box F: Developer contributions plan, Lismore City Council

The Lismore City Council, Developer Contributions Plan for Water Supply was established in 1993 and last updated in 1996. The plan sets out the costs of water service provision in each reservoir zone. The costs are calculated based on both the cost of constructing the existing supply per equivalent tenement (ET) capacity and the estimated cost of supply augmentation (based on generic reinforced concrete reservoir costs and the supply and installation of trunk mains) required by the additional demand of this development (based on average demand expectations, i.e. per ET). Discrete cost components include:

- Reservoir component – the present value of the capital costs of the reservoirs per capacity ET
- Reticulation component – the net current cost of upgrading the system for this development per additional ET to be served
- Trunk mains component - the present value of the capital costs of the trunk mains per capacity ET
- Telemetry component – the present value of the capital costs of the telemetry system per ET served
- Financing component – cost of finance for estimated funds that need to be borrowed to construct the required infrastructure for the new development per additional ET

Whilst this plan does succeed in theory at least, in charging for the cost of augmentation of the system that would need to occur as a result of a new development, there is no mechanism to provide an incentive for anything less than average water use. A proposed development, which included water efficient fixtures, would be likely to use significantly less water per tenement than a standard development. This plan does not propose any incentive for the consideration of the implications of the development on water services at the design and development proposal stage.

Discussions with staff from bulk water supply authorities in the area indicate that developer contributions alone would not be a significant incentive (or disincentive) for developers to modify practices. On average developers in this region face contribute $2,870/ET for sewage services and $2,640/ET for water services, a total of $5,510/ET (DLWC, 2002).

Ballina Shire Council reports Development Applications with a total value of more than $63M for the financial year ending June 30, 2001. Based on the reported 230 applications that may be liable for the developer contributions (i.e. total not including "non-classified", "swimming pools" or "alterations and additions"), this means an average DA value is in excess of $230,000. Since developer contributions currently contribute only about 2.4% of this total cost it is unlikely that given their current value, these can be successful in encouraging water efficient development if operating as an incentive alone.

The structure of developer contributions, and the planning/approval process in general, favours a single developer liasing with council. Developments including an independent operator of water or sewage services on a more localised scale may be disadvantaged by the prescriptive approach found in most of the contributions plans examined. Opportunity generally exists for councils to update their plans as many councils contacted during the study recognised that their developer contributions plans were often out of date. The updates could include providing a useful and flexible approach, which is better able to cope with more complex arrangements, which are commonly required for innovative on-site treatment and reuse options.

Green Offsets

The approach for encouraging developers to contribute to "off-setting" the impact their developments have on the environment has been described in a recent concept paper[14]. This program allows a developer to contribute funds or "in kind" work to mitigate similar environmental impacts to those caused through their development. This offset is intended to

[14] EPA, available online at http://www.epa.nsw.gov.au/greenoffsets/index.htm

be at the same site or nearby. In principle green offsets are a useful tool, however, the maintenance of an "offset" for the life of the development needs to be ensured.

Developments, which impact on river health not only during construction but also during operation, have long-term effects. Developers are generally not well placed to manage an on-going responsibility in a particular location due to their focus on short-term projects. They may, however, be required to accept the costs of a long-term commitment. Issues to be resolved include who would administer the longer-term commitment and where the burden for compliance monitoring would lie. It seems inappropriate to add this responsibility to that of local government without providing resources for that responsibility. This could be achieved in part by green offsets including the costs for on-going maintenance and compliance monitoring, including administration of that service.

2.5 Centralised, linear approaches to water servicing

A key issue resulting in a lack of integration of water services is the balance between using water for the growing community and maintaining healthy rivers. This is determined by the way a catchment and the natural resources within it are managed. The traditional linear approach to water service provision involves abstraction; treatment to one high quality standard use; discharge to sewer for treatment; and discharge to river, together with collection and discharge of stormwater to rivers. This approach is now known to be detrimental to the environment and is also an inefficient use of natural resources.

Typically water service provision in the study area remains highly centralised despite the various changes to legislation. This means the majority of households in urban areas are connected to a centralised system of water supply consisting of major reservoirs and treatment plants, which are managed by county councils and supply smaller reservoirs, which are managed by local councils. The reticulation system is provided and maintained by councils. The end uses for water, like kitchen sinks, showers, gardens and toilet flushing are all provided with high quality water, usually satisfying drinking water guidelines. Of note is the fact that some of these end uses, particularly toilet flushing could be satisfied by lower quality water using the principles of water quality cascade (See Figure 3-4).

Sewage systems are also typically centralised for those who live in sewered areas. All water used indoors in homes is collected through a common reticulation system and piped to an STP. The water collected ranges in quality from that water coming from sinks and showers, through water used in kitchens, to sewage from toilets. This water varies significantly in quality. Depending on the soaps and detergents used, water coming from showers is generally of a relatively high quality. Sewage from toilets however is obviously of an entirely different quality.

By collecting this water of varying qualities and treating it centrally all water, regardless of influent quality, is treated in the same manner. Most of the treatment is governed by satisfying disposal requirements. These also vary. Where disposal to rivers is proposed, discharges guidelines include high quality parameters. Land disposal options however have different quality requirements, particularly if sub-surface irrigation is proposed. Most disposal in the study area is either to oceans, rivers or land. Reuse option are limited and are estimated to constitute less than 5% of all effluent disposal.

The linear approach to water services often involves different departmental responsibilities. For example, commonly a supply authority manages water storage and council manages reticulation and sewage treatment plants. This divided arrangement means the reduction of sewage volumes which results from demand management programs does not provide a significant incentive for the water supply authority. Similarly responsibility for sewage treatment without responsibility for supply can reduce incentives to encourage reuse. In fact the STP focus on waste disposal can result in land disposal options being implemented, rather than genuine demand substitution.

STPs mainly dispose of highly treated effluent to rivers or oceans with some instances of land disposal. Treatment prior to the disposal of effluent serves a number of purposes and one of the primary activities is to remove nutrients. These nutrients however are costly to produce for fertilisers. There remains opportunity to close nutrient cycles closer to the source in the short term through land disposal of treated effluent for the purpose of irrigation. In the longer term improved capturing of the nutrient resource may be more common through urine separation[15] and/or composting toilets for example, where the compost can return nutrients directly to the soil. This approach to managing nutrients is still some way from broad implementation and would require a substantial shift in community perception.

2.5.1 Infiltration and Inflow to Sewers

Infiltration and inflow to sewers is one of the commonly occurring problems resulting from centralised infrastructure choices. Conventional gravity sewer networks are almost universally subject to significant ingress of water from illegal connection of downpipes, breaks caused by ground movement, deterioration and tree roots as well as poor fitting inspection covers which are lower than the surrounding surface[16]. Infiltration can be from surface runoff (ie rainfall events) or groundwater (which can be fresh or saline). The level and rate of infiltration depends on the soil type and profile as well as the leakage pathway, and the behaviour of sewer networks during wet weather is therefore quite variable (See Box D for an example). In permeable soils in particular there is also significant exfiltration, meaning that sewage will reach watercourses or groundwater.

The infiltration/ exfiltration from sewers is significant for this study in several respects:

- It represents a threat to river health arising from the urban water sector;
- It represents the literal, and problematic ‘integration’ of the sewer and stormwater systems in circumstances where they should be kept separate, but where some integrated consideration of solutions is beneficial;
- The benefits that can be derived from reducing sewage discharge from connected properties is reduced by virtue of the fact that sewage treatment plants and transport infrastructure is often sized to accommodate some level of wet weather discharge, and dry weather infiltration from groundwater displaces reduced sewage volume[17].

Infiltration/inflow is reported to contribute 17% on average of the volume of sewerage collected by councils in the region[18]. While this data should be considered with caution in terms of the actual rate of infiltration and inflow, it does indicate that infiltration and inflow to sewers is an issue of concern to councils in the area. This is almost certainly increasing the costs of sewage management. On a directly proportional basis, this could be up $24m annually across the region, although the relationship between sewer flows and costs depends on system characteristics.

[15] For a discussion of urine separation see Lundin (1999).
[16] See for example EPA (2001), Sanitary Sewer Overflows: What are they and how can we reduce them? EPA 832-K-96-001-Summer 1996, URL http://www.epa.gov/earth1r6/6en/w/sso/ssodesc.htm.
[17] There is some evidence of this arising from the Brunswick Heads Water Efficiency Program, where reports indicate that the reductions in sewage discharged from properties was not reflected in measurable reductions in inflow to the STP, presumably due to the poor integrity of the sewer network.
[18] 2000/2001 NSW Water Supply and Sewerage Performance Comparisons.

Box G: Infiltration and inflow

Ballina Shire Council staff described the issue of saline inflows to sewers as it affects the local area. The major points raised as key problems were:

- The problem mainly occurs in either reclaimed land near saltwater environments or on sandy soils where significant damage has been caused to sewer pipes.
- The infiltration rates are expected to be high (See Appendix B).
- The impacts are higher treatment costs due to poor influent quality and poor water quality for reuse. In Ballina this issue has been revealed in part through the issue of users being unable to use the treated effluent due to salinity killing turf.
- Councils cite a hasty process of getting infrastructure constructed without a thorough understanding of the maintenance issues or of the best long-term solution. In some cases the sewer networks have a peak wet weather flow of over 7 times average dry weather flow even shortly after construction.

3 A NEW APPROACH

As described in Section 2, the main opportunities existing for increasing the integration of water services on the NSW north coast depend on overcoming:

1. Escalating demands for water supply and sewage and stormwater management compounded by population growth;

2. Fragmented local approaches which do not contribute to regional goals;

3. Inconsistent decision-making and financing in water services planning which fails to consider broader regional costs to the community; and

4. Centralised and linear approaches to water servicing.

Opportunities to decrease the average demand for water, increase the volume of source substitution and service new developments innovatively can be realised through combinations of measures to overcome the four key barriers to integration summarised above. The measures available include intervention (eg retrofitting), regulatory measures (eg efficiency standards), economic incentives (eg rebates) and education and awareness raising strategies.

This report describes three levels of approach. These are hierarchically arranged, moving from maximising existing potential, through a range of interim steps to a preferred, most cost-effective approach. The varying levels of change strategy are described for each opportunity, for example ranging from retrofitting, through to appliance efficiency standards on a national scale, to achieve demand reduction.

The combinations of measures have varying levels of costs and benefits. The costs depend upon such factors as the ease of implementation, responsibility for leading or enforcing the change, scale of impacts, effectiveness, applicability and the time required before benefits can be received. The costs and benefits of these changes will be explored throughout Section 3 and summarised in Section 3.5.

Minimising total lifecycle cost to society is a key factor in comparing options for service provision. The lowest total cost can only be determined by considering the whole lifecycle of the option. This means taking into account maintenance obligations for example or the costs of obtaining the materials for infrastructure. Externalities must be considered in these lifecycle costs. Decisions need to be made, taking into account externalities and comparing all the change strategies in a balanced manner. Integrated resource planning provides a framework by which to compare the options and is described in Section 3.1.

Interdependencies exist within and between both opportunities and approaches. These have been noted where relevant and discussed separately in Section 3.6. Examples include appliance efficiency being required to make most source substitution viable and regulation requiring educational strategy support to secure political acceptability of regulatory change.

3.1 Integrated resource planning

This investigation focuses on the key question “how can we improve water use, through integration of water services, in the interests of river health?” The availability of technology for improving water efficiency, increasing source substitution through effluent or stormwater reuse is one aspect of this, but the more important issue is how these efficient technologies and water using practices can become more widely used. What combination of regulatory measures, educational programs and economic instruments will result in a greater adoption and use of water efficient technologies and practices and source substitution?

Integrated water resource planning (IWRP), often referred to as least cost planning, can provide a framework for determining the best options to satisfy water related needs (Beecher 1996, Howe and White 2000, White 1998). IWRP allows consideration and evaluation of all the potential options to meet water related services, including the development of new water supplies, effluent reuse and other source substitution options, and investment in water use efficiency. The water related services that customers need, (eg showering, irrigation, clothes washing) can be provided by increased supply (new dams, pipelines, groundwater sources, treatment plant capacity, sewage treatment plant capacity), by increasing the efficiency of use, or through effluent recycling and other source substitution. In practice a combination of approaches is likely.

The environmental costs, for example of energy use and material use (e.g. greenhouse gas emissions) are key considerations in determining the best means to service the community at the lowest cost to them and the environment. Significant research exists describing the best ways to value externalities (those costs of a product which are not usually included in the price). This is particularly important in order to "make sure that public funds [are] spent wisely, with benefits exceeding costs," (Braden, 1997).

There are several important aspects of integrated water resource planning that distinguish it from historical water supply planning. Firstly, it assumes that the community will be involved in the decision making process on water related services at an early stage through deliberative and representative processes, and that all options will be available for consideration, not just a choice of supply options and siting considerations (See also Section 3.6.4).

Secondly, it assumes that all the options that reduce demand on valuable scheme water supplies, (eg leakage reduction, retrofitting showerheads, rebates on efficient washing machines) will be compared on an equal footing with options that increase supply. It is also assumed that these comparisons will be carried out by considering the total costs and benefits to the water service provider, the customers and the general community, rather than from the perspective of the water service provider alone. This is referred to as the Total Resource Cost test, and its application ensures that the options invested in first are those with the lowest net unit cost to the community. In almost all cases where this methodology has been used, options involving an investment in water efficiency (also called demand-side or demand management options) have a lower unit cost than supply options and therefore, if implemented, reduce the total cost to the community of providing water and wastewater services. Life-cycle costs should be used, including long-term maintenance and operating costs, and environmental and social costs where appropriate.

Thirdly, following implementation of options, there should be appropriate cycles of monitoring, assessment and review, in order to determine whether to continue investment in options and how to improve them. This represents an important accountability measure.

This integrated approach to decision making requires a cohesive management structure and approach to all water services, including supply, effluent and stormwater.

Councils should also be assisted to fund and manage the whole of the urban water cycle rather than separate areas of water supply, sewerage and drainage in what are often separate departments. For example charges should be for '*water services*' rather than the existing service availability levies for water and for sewerage combined with consumption charges. This would work to counter the concept of stormwater having no specific funding. This could possibly be achieved by the use of NHT grants for stormwater as a transitional step to fund aspects of an integrated water service management plan. Linking grant funding to a more long-term and strategic process in the interim may achieve a change toward a more cohesive and integrated approach. In the long term, grant based funding would be avoided as councils establish funding streams which are more sustainable, that is where customers pay the real costs.

The outcome of councils managing water service in a more integrated manner would be a broader application of some of the benefits illustrated in this study. These could include effluent reuse schemes, which genuinely satisfy demand rather than merely serving as a land disposal process. The possible benefits of effluent reuse could be demand reductions or they may be substitute environmental flows, depending on the requirements of individual locations. It is anticipated that demand reduction options would always deliver greater benefits to the community in the longer term.

Further there are qualitative benefits associated with the use of cohesive structures for decision-making and communication processes within councils. These are difficult to quantify but are expected through a more streamlined approach to development approvals via the consideration of the water cycle as one process rather than a series of discrete end-uses.

With respect to water services it is essential that least cost planning is undertaken and this has not been the case to date. One example of the range of options for water supply has been illustrated to demonstrate the typical comparison, on a cost curve, of the various options (see Figure 3-1). This example is designed to show the relative difference in costs (benefits are not shown) of various supply options relative to demand management. In this example the rainwater tanks and dual reticulation are for one new development only. The demand management strategy involves all sectors being brought up to reasonable efficiency levels. These results are also shown in Table 3-1.

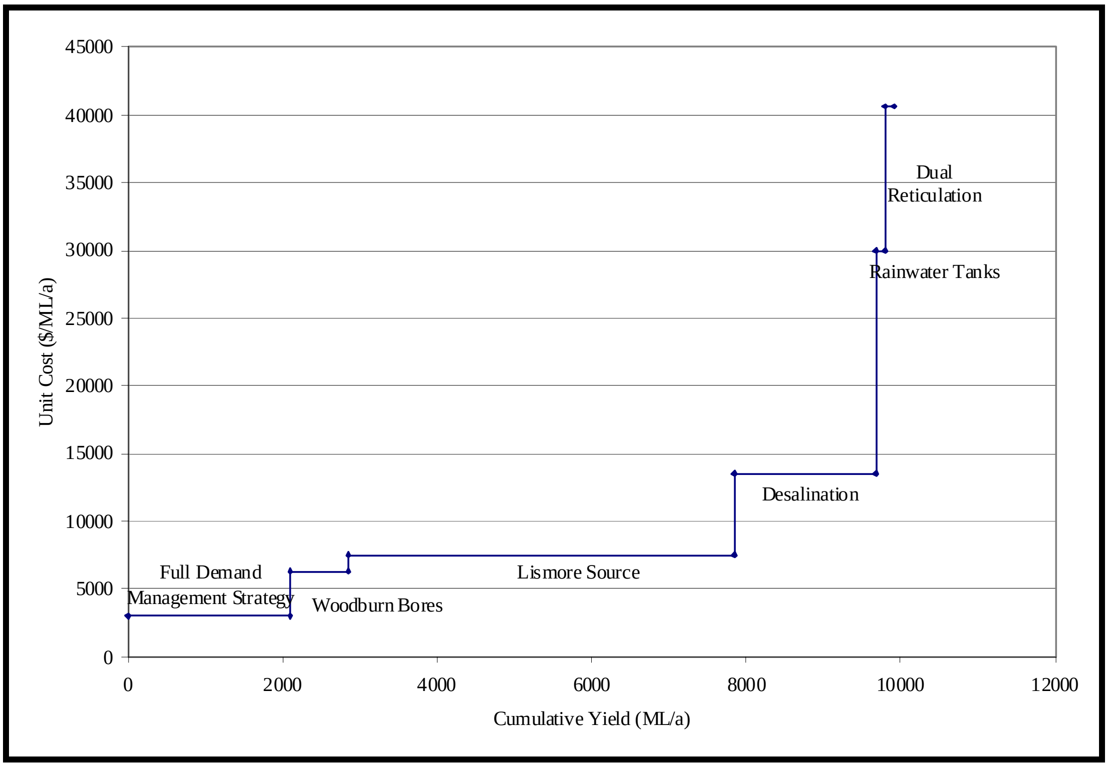

Figure 3-1: Typical Unit Costs of Water Supply Options – Illustrative example of a cost curve

Source: White, (April, 2002) Presentation to Rous Regional DM Committee

3.2 Reducing demand for water

Water demand reduction results in decreased extractions from rivers and reduced treatment costs, including energy usage for treatment and pumping. When indoor demand is reduced flows to sewers are also reduced and when hot water usage is reduced additional direct energy reductions result. The reduction in demand for water is also a fundamental step in integrating water services since a smaller demand can be satisfied in a range of innovative, integrated ways for example by source substitution using treated effluent or captured stormwater.

Reducing water demand is often the lowest cost means of providing ‘supply’ to a growing area and can be used to defer augmentation. Table 3-1 illustrates the approximate relative cost of water supply and demand side options for the region supplied by Rous Water on the north coast of NSW. In this case, the unit cost is a capacity cost, expressed as $/ML/a and represents the cost to supply a unit capacity of 1 ML/a reliably. The rainwater tank and dual reticulation options are sized to approximate the Ballina Heights proposed dual reticulation scheme.

Table 3-1: Comparison of options to supply capacity

Option	Capital cost ($m)	Operating cost ($m)	Yield (ML/a)	Unit cost ($/ML/a)
Full demand management strategy[19]	7	0.25	2,100	$3,000
Lismore source	25	0.9	4,000 to 6,000	$6,000 to $9,000
Woodburn bores	3.2	0.13	750	$6,300
Desalination	12.5	1	1,825	$13,500
Rainwater tanks	3	0.05	120	$30,000
Dual reticulation	3.75	0.09	120	$40,625

Source: S. White presentation to Rous Regional Demand Management Committee 18 June 2002

This same data is illustrated in Figure 3-1 and compares the unit capacity costs and (in this case) cumulative yield of various options for meeting water demand. The cumulative nature of the graph is used to illustrate that by choosing the option with the lowest cost first and then gradually adding more costly options, water demand can be met at the lowest cost to the community.

When compared to supply side options, if demand side options are found to be lower cost, then full demand management strategies should be embraced by water utilities. A comprehensive program would include leakage reduction, indoor retrofitting of AAA showerheads and flush arrestors, an incentive package for efficiency measures outdoor and water auditing of commercial premises. Prioritised implementation of strategies is usually achieved by first gaining an understanding of the approximate composition of demand.

Typically this process includes estimating the component of demand made up of leakage, non-residential uses, (agriculture, commercial and institutional buildings, industrial processes - some of which require high quality water and some which would be satisfied by much lower quality water), and residential uses (indoor end-uses and outdoor end-uses). Factors such as the relative efficiency of the existing water used will assist in devising a range of unique programs to reduce each aspect of demand in a cost-effective manner. These options would then be compared based on their unit cost (estimated cost per kL of water saving expected) and the most cost-effective programs would be implemented across a range of sectors and end-uses. Programs then need to be evaluated and refined where possible. For further details refer to Appendix B – Demand Management Programs.

There are two key aspects to reducing demand for water. Firstly the system itself can be most efficiently managed and operated to minimise losses and unnecessary demand (see section 3.2.1), and secondly water services provided to customers can be provided at varying levels of efficiency (described in section 3.2.2).

[19] See description in Appendix B.

3.2.1 Water service system efficiency

Improving the efficiency of the water service system is one way to reduce demand. Two of the major opportunities in this regard are reducing leakage and countering infiltration and inflow.

Leakage reduction programs

By preparing a water balance[20] it is possible to detect leakage, which can be a major drain on water service systems. Studies have revealed that leakage levels in NSW range from 7% to 35% of demand, (NSW Public Works in White, 1998, p61). Leakage is literally water for which the "utility has paid and which it cannot sell" (White, 1998) and it follows that minimising leakage will result in cost savings for utilities and ultimately for customers.

Leakage reduction programs, conducted intensively can result in significant savings but are only cost effective when towns face augmentation needs inside the five-year planning horizon (White, 1998). This is due to the lack of effectiveness resulting from a "rough" estimate of leakage and pilot programmes. For a genuine leakage reduction program waste metering would be required. Normal passive control of leakage however should be carried out, for example as faults are reported.

The sample strategy modelled for this report suggests that some 3GL/a of water demand could be reduced through a program costing of the order of $6m. This reflects the achievements of utilities like Rous Water and Sydney Water which both pursued leakage reduction programs.

Decreasing Infiltration, Inflow & Exfiltration

Infiltration, inflow and exfiltration have been described in Section 2.5.1 as one of the problems resulting from a traditional linear approach to water servicing. When stormwater flows into sewage pipes treatment volumes at sewage treatment plants are elevated due to coping with both sewage and some stormwater the additional demand.

Strategies for decreasing the level of infiltration/ exfiltration and inflow include the following:

- Smoke testing for illegal connections of downpipes to sewer.
- Sewer flow modelling and measurement, diagnosis and repair of leaking sewers.
- Improved compliance monitoring for the quality of work on sewer installations in new developments.
- Construction of pressurised or vacuum technology small bore reticulation sewer systems. These options can form part of alternative servicing possibilities for new developments, which can have other advantages in terms of improving the control over sewer flows allowing more efficient operation and downsizing of sewage treatment plants. There are then synergistic benefits with improving water efficiency and reducing base flows.

It is likely that the infiltration and inflow in the region is causing significant additional loads, approximated by 17% of flow volumes as reported in the comparative statistics (DLWC, 2002). If loads to sewage treatment plants could be reduced by 17% as part of servicing new developments differently, the impact of new development on existing systems would be

[20] Water balances are analytical processes comparing the water volume metered as leaving the reservoir with the volume of water metered to customers. The difference shown will indicate unaccounted for water (UFW) which includes slow running meters and system losses.

significantly reduced (see also Section 3.4). Gradually providing a more effective sewage treatment and stormwater management system will also reduce these loads.

3.2.2 Efficient provision of water services

Providing water services to customers is not the same as merely supplying water, or managing sewage and stormwater. Water customers need the service that water provides, for example clean clothes, personal hygiene, sanitation and aesthetically pleasing landscapes. These are all water related services and can be provided in many ways. A change in philosophy from commodity supply, to service provision is essential in order to provide the same high quality of service whilst reducing demand and satisfying the community's desire for least-cost river health protection by securing environmental flows.

Non-residential programs

Non-residential demand includes commercial, institutional and industrial (CII) uses. Typically, improvements in water efficiency of 20-30% are possible with a 2-5 year payback at current water and sewerage charges. CII customers are typically slow to implement even the most cost-effective measures due to a number of barriers, many of which are common to the residential sector:

- Water is typically a small input cost relative to wages, rent, energy, other input materials;
- There is often a split incentive between tenants and landlords or between different sections of the same company or between head office and branch office;
- Customers have often reached borrowing limits or are otherwise capital limited;
- Customers are not aware of the potential savings and benefits; and
- Customers have had some water efficiency work done, and believe that all opportunities have been taken up.

Overcoming these barriers requires a combination of information and advisory services (eg audits and 'water saving action plan' outlined in White 1998), management support and systems of loans or rebates[21] for implementing the savings opportunities. Programs targeting commercial and institutional premises typically form part of a comprehensive demand management program (See Appendix B). Commercial and institutional premises are particularly useful in providing working models of innovative technologies and exposing large numbers of people to new ways of providing water services.

The Charles Sturt University campus in Thurgoona, Albury and the Sydney Olympic Park, both place alternative methods for sewage management (like composting toilets and greywater for toilet flushing respectively) within the public domain. Such public venues are particularly useful for increasing the familiarity and exposure of the community to alternative methods of water and waste management. The success of the approach of piloting or constructing display projects depends highly upon the degree of transparency about the alternative technology or systems in place. It is particularly important that a positive experience of an alternate system is equally well connected to the approach as a less positive experience. This can be facilitated through signage and through the involvement of the users in the system's design and implementation to the degree that they are familiar with the system and understand the significance of that novel approach.

[21] Rous Water has adopted a policy of support for a rebate for customers installing reuse systems, which will provide (for example) $6,000 or more per ML/a of reuse capacity installed that reduces potable supply.

The north coast region is certainly at a stage where more education and communication about the possibilities for alternate servicing could be well received. This is due in part to the high degree of exposure water restrictions are currently receiving in the area. The added pressure of growth is certainly evident in areas like Byron Bay where growth has effectively been almost prohibited by the unavailability of extra sewage management capacity,

Communication and education strategies, including the institutional application of innovative efficient technologies are essential to:

- Reinforce regulatory and incentive based strategies to improve the efficiency of water use; and

- Provide a foundation program for increasing awareness of the importance of efficient water use, and measures that can easily be adopted by water users to reduce water use.

The integrated provision of water services and the more holistic management of the water cycle both tend to imply a need for greater effluent reuse. This option is not without barriers in the study area. The perception of effluent reuse remains somewhat negative, particularly when options for greater indoor reuse were discussed with stakeholders during the research process. Even the more broadly accepted option of land disposal of treated effluent still needs to be explored in greater detail and at a more practical level with the community in order to facilitate its broader introduction in private residences.

The opportunity within institutional premises to install water efficient appliances and plumbing products serves to provide a foundation required prior to the introduction of legislative change by building a basis of support for the devices and reducing the resistance to change. Furthermore the barrier of intervening in private premises is not an issue in institutional buildings where large scale retrofitting can be easily carried out without permission or timing delays. SWC has recently undertaken to unite with the Department of Housing to carry out water efficiency retrofits in premises owned by the department due in part to this particular aspect of ease.

Whilst it is important to utilise the advantage of ease of implementation of water efficiency measures in institutional buildings and important to involve the commercial sector, it is also essential to capitalise on water efficiency in private homes since residential demand typically comprises more than half of water demand and contributes major flow volumes to sewers.

Residential Efficiency

Significant water demand reductions are achievable through increasing the efficiency of water use without compromising the level of service received by the customer. Table 3-2 shows the major end-uses for water used in homes and compares their average water use. It is useful to note that less efficient, single-flush toilets are already being replaced with dual flush toilets and that most dishwashing machines are relatively efficient.

Table 3-2: Water use comparison

Appliance	Typical consumption (kL/hh/a)		Savings Potential	Notes
	Current average	Efficient		
Toilet	40	12	29	Dual flush toilets (6/3 litre) are the only type being produced in Australia. This results in a gradual change over of the toilet stock available
Shower	51	33	19	
Dishwasher	4	4	0	Dishwashers do not vary significantly in efficiency
Washing Machine	43	28	15	
Taps and other indoor	33	19	13	Includes leaks, baths and sinks
Indoor Sub-total	171	96	75	
Outdoor[22]	80	64	16	Discretionary demand, 15% savings potential assumed
Total	251	160	91	

Sources and assumptions: 2.7 people per household, BASIX preliminary work on what is currently in use as well as ISF recent research, efficiency options from a range of literature.

In the first instance, achieving appliance efficiency usually depends upon measures such as retrofits and rebates on the purchase of more efficient appliances and products, however efficiency standards are a more comprehensive approach.

Indoor retrofits are often offered by water suppliers and are mainly undertaken on a voluntary basis whereby households request a retrofit be carried out. Householders may be required to pay a fee to contribute to the cost of the equipment that is installed. Retrofits typically include a AAA rated showerhead, tap aerators and flush arrestors in single flush toilets. In addition leaks are often checked. The cost of completing a retrofit in a household has been modelled as $120/hh.

The water demand savings from programs such as this have been evaluated, and based on the evaluation of the Rous House Tune-Up Program[23], which has been operated by Rous Water, the savings are estimated to be 35 kL/hh/a (ISF 2000).

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[22] Outdoor water use warrants special note, as it is discretionary by nature, meaning that the customer has direct control over the water use. Typically this behaviour associated water demand provides significant scope for decreasing water use. Outdoor foundation and assessment programs can take a number of forms and usually involve incentives (vouchers or give-aways) as well as educational material to encourage more efficient use of water outdoors. The program cost has been modelled as $80/hh and has been assumed to deliver savings of 15 kL/hh/a, or just over 6%. This saving, achieved in 60% of houses in the region would deliver an additional 2GL/a at a cost of around $11M. In practice, such programs would be targeted in high avoided cost areas.

[23] See description in Appendix B.

In addition to saving water, such programs deliver the following benefits:

- Reduction in discharge to sewer by the same amount as the total savings since this is all indoor water use; and

- A reduction in energy consumption as a result of reduced hot water usage and reduced treatment and pumping, and associated reduction in greenhouse gas emissions. This is a significant saving, given that showers are the major indoor end-use consuming hot water.

It is reasonable to assume that a retrofit would achieve an average saving of 35 kL/hh/a[24] across 70% of houses in the region (allowing for some to already be efficient). If 70% of connected properties on the NSW North Coast were retrofitted (158,000 houses), at a cost of $120/hh (approx. $19M over ten years) annual regional demand could be reduced by more than 5.5 GL. That is a reduction of almost 8% and $2.2m per annum of benefits due to avoided costs. This demand reduction would offset the growth expected in the region over the next five to eight years and reduce greenhouse gas emissions by approximately 95,628 tonnes[25]. Additional benefits accruing as a result of indoor retrofits are the reduction in volume of flows to sewers, in this case some 15 ML/d, equivalent to the additional sewage discharge anticipated from population growth over the next 25 years. In practice, such retrofitting may be implemented in areas where the avoided cost of water supply or sewage treatment is high due to augmentation requirements.

This example of a retrofit does not include removing single flush toilets and installing dual flush units because these ‘toilet retrofits’ are not commonly carried out in Australia. A gradual change over of this stock is already occurring as a result of dual flush toilets (currently 6/3 litre) being the only type of toilet available on the market. The change over is likely to occur without intervention, although over a longer time scale. If savings are required sooner, or the avoided cost is high enough to warrant such an intervention, then toilet-retrofitting programs provide reliable and large savings[26].

The best way to cost-effectively complete the retrofit of toilets is as part of a larger retrofit program. This is mainly due to the overheads costs of organising the visit by a plumber. The cost of retrofitting toilets has been modelled as $200/hh and around 30% of households are estimated to still have single-flush units. Retrofitting those 67,000 houses would cost a total of $14M over ten years and deliver water demand savings of the order of 2 GL/a and reduce flows to sewers by 5.4 ML/d.

Whilst retrofitting is often used to increase the efficiency of lower cost appliances and plumbing products, other measures are required to address efficiency in larger appliances. Washing machine rebates are an example of an economic incentive approach. These are described in Appendix B as part of the Rous Regional Demand Management Strategy and involve a rebate at point of sale on the purchase of a front-loading machine. The program cost has been modelled as $150/hh and based on replacing 70% of the machines in the region in the next ten years (since some will already be front loading and others will not be replaced in this time). The 158,000 rebates would have a present value cost of $17M and deliver demand savings of more than 2.4 GL/a, and reduction in flows to sewers of 6.5 ML/d.

Retrofitting options have unit costs in the range 30-80c/kL, in other words it costs approximately $0.30 to $0.80 to save 1 kL. This is equivalent to a unit capacity cost of $3-8m/GL/a saving, in other words it costs around $3m-$8m to ‘buy’ savings of 1 GL/a. These

[24] This is based on the evaluation of the Rous House Tune-Up Program, which has been operated by Rous Water (ISF 2000).
[25] Total residential emissions in the region are approximately 2 million tonnes per annum.
[26] In Kalgoorlie-Boulder, nearly 4,000 dual flush toilets were retrofitted in 1995 at a cost of more than $1m, as part of the Kalgoorlie-Boulder Water Efficiency Program. The savings from this component of the program were between 25 and 50 kL/hh/a (ISF 2002).

costs are less than most augmentation and supply options for water supply, and therefore retrofitting and rebate options implemented in areas where augmentation is proposed is likely to yield economic benefits for the community. However, in areas with lower avoided cost, this may not be the case. The use of regulatory options to improve the efficiency of appliances has benefits, both as a means of protecting investment in retrofitting and rebate programs, and also as a low cost means of increasing efficiency of appliances over time. In summary, where pressures exist to augment supply, retrofits can deliver savings in a timely manner and defer augmentation, however this investment is not secure whilst inefficient appliances continue to be available. Where there is less haste required, the gradual change over of products and appliances as a result of regulation will result in secure, long-term demand reduction.

Regulation opportunities exist on a number of scales and most of these options are not limited to the North Coast in terms of their application. The range includes:

- **State Environmental Planning Policy (SEPP)** – A means for assessing the water efficiency of a new development is currently being prepared by the Sustainability Unit of PlanningNSW. The proposal is an index, which establishes the demand reduction gained by using a water efficient appliance relative to the average water demand of that end use. It is intended that developments would be required to achieve a minimum number of points on that index in order to be processed as a development application. Floor-space ratios area an example of incentives, which may accompany the index to encourage the securing of additional points. The eventual mechanism used to implement this index (currently referred to as BASIX) is as yet uncertain. It is possible that a SEPP would be prepared giving the index immediate validity across all new developments in the State and this could occur as early as 2003. At this stage the index is likely to address the following indoor water uses: toilets, showers, taps, washing machines and dishwashers. If a SEPP were introduced the cost would be minimal and would include the preparation by PlanningNSW (say $100,000) and training for council officers who would include water efficiency measures in construction compliance checks ($40,000 for 4 training courses in the State).

- **Development Control Plans (DCP)** – DCPs provide a more flexible means for Councils to require water efficiency on a local scale. This has already been successfully applied in some locations (including Leichhardt for solar hot water heaters). It would be a more costly exercise for all councils on the north coast to independently prepare appliance efficiency DCPs relative to the cost of a SEPP. The Department of Local Government (or a Regional Organisation of Councils (ROC)) might be in a position to commission the preparation of a model DCP, which could then be modified at council level for implementation. This scale of approach could be particularly useful for outdoor water use. While this may be captured in part by the current PlanningNSW work in the longer term, it is likely that in the interim and due to climatic variation, a more localised approach could be used. This type of DCP would include a list of approved species for use in gardens and incentives for mechanisms to capture stormwater or increase infiltration rates in urban areas. Development Control Plans are the most flexible instrument at a localised scale for implementing water efficiency. In the interim, existing DCPs should be reviewed and should require new developments to incorporate best practice water efficiency and reuse particularly with regard to outdoor water use. As the BASIX method for measuring water efficiency in new developments is implemented this would be used to replace interim DCPs and ultimately would guide planning under PlanFIRST.

- **Certification at time of sale** is another option, which is yet to be fully explored as it applies to appliance efficiency. Already operating in part in Canberra for energy efficiency, the basic idea is that properties would need to be “efficiency certified” prior to sale. This strategy works to capture all properties rather than only those new developments. Estimates for Sydney indicate that the housing stock changes hands once every seven years. In rural areas this is likely to be a longer time period. This strategy is worthy of further investigation, particularly with regard to the legality of such a requirement under the existing legislative framework.

- **Appliance efficiency standards** are by far the most comprehensive means of securing appliance efficiency although they can have significant lead times. This strategy involves minimum efficiency standards being established for appliances and plumbing products. Whilst it is possible to regulate the installation of efficient appliances by registered plumbers for example, homeowners install many plumbing products in particular themselves, rather than requiring a plumber. In order to ensure that these fittings are also efficient, it is necessary to regulate the sale rather than the installation of appliances and plumbing products.

  Forums have already occurred where this process has been considered although it is yet to be advanced on a national scale. Due to the issues of appliances or plumbing products being able to be purchased in one State for installation in another, it is necessary that these standards be implemented on a national scale. The nature of the issue crossing State borders has resulted in little progress being made to date. There is a need for State Governments to take a lead role in progressing this issue. Minimum performance standards are supported by the QLD EPA, (2001, p10), and the Melbourne Water Strategy Committee has also recommended appliance efficiency regulation[27].

  In order to secure national regulation significant consultation and planning is required. This could cost as little as $250,000 if sufficient lead times are given to manufacturers as this lead time has been shown to be a crucial factor in comparable programs (Wilkenfeld 1993). As illustrated in Figure 3-3, this approach could result in savings of 11 GL/a in 2026 or a 14% reduction in household demand, given that most appliances have a life of about ten years. This has been assumed to include showers, washing machines and tap flow regulators.

Figure 3-2 illustrates the increasing relative effectiveness of mechanisms to increase water efficiency. Whilst a retrofit will deliver savings in the short to medium term that investment is not protected. The reason is that without regulation of plumbing products, lower efficiency products will remain available for purchase and may be swapped by users. The DCP or SEPP mechanisms are useful however their scope is limited to new developments. National regulations control the availability of the end-use devices and are the most comprehensive approach available.

Whilst the regulatory approach described is the most comprehensive, it also has a longer lead-time to achieving savings. This is illustrated in Figure 3-3, which shows that the benefits resulting from a DCP (modelled here without point of sale certification) are limited by the low number of new properties expected each year and by the minimal savings expected through current models of DCPs for water efficiency (eg BASIX). The most obvious difference shown in the graph is the early benefits delivered by retrofits. It is important to note that without regulation of appliance and plumbing product efficiencies these savings are likely to decay. The most significant impact shown on the graph is the step beyond appliance efficiency involving source substitution. In this option 80% of demand is satisfied by alternative sources. These options are described in Section 3.3.

[27] The committee has selected a scenario including regulation of AAAA washing machines (Water Resource Strategy Committee for the Melbourne Area, 2002, p85).

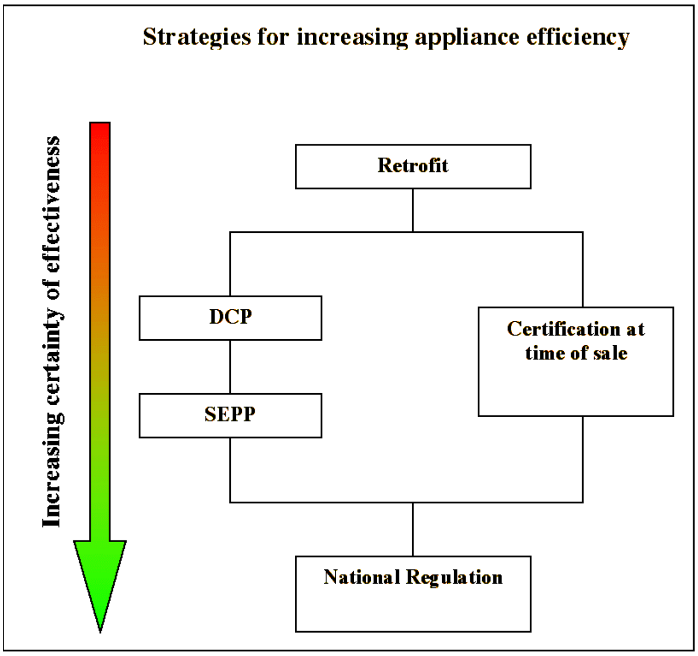

Figure 3-2: Increasing Certainty of Strategy Effectiveness

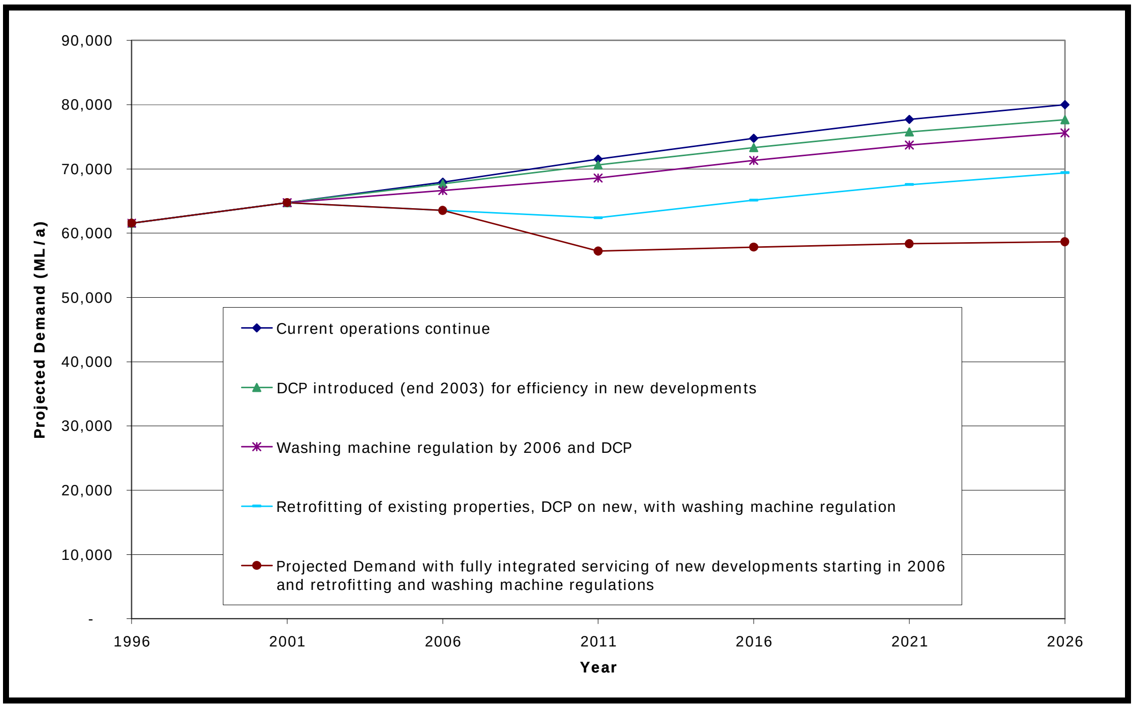

Figure 3-3: Comparison of benefits received

3.3 Encouraging source substitution

Figure 3-3 shows that source substitution in new developments can have major impacts in offsetting demand increases due to growing population, however there is no reason for source substitution options to be limited to new developments. The principle that needs to be applied is that the best use for alternative sources such as treated effluent or stormwater is to substitute demand from scheme supplies. This is particularly relevant in the case of utilising treated effluent as this has been managed via land disposal in some cases and this is not the same as source substitution.

Treated effluent, along with rainwater and stormwater can be used to satisfy the demand for water. By applying the principle of the water quality cascade (see Figure 3-4) the lowest quality of water fit for purpose would be used and water would be treated to the level of quality for which it is required. The most cost effective way to reuse water is at or near to the source, as this reduces the cost of transporting effluent to the treatment location, thus effluent reuse within houses and businesses is favourable. It also allows a reduction in the cost of sewerage service provision, since there is a reduction in the volume of effluent discharged to sewer and requiring treatment at sewage treatment plants. Since various end-uses also have varying influent quality requirements, water can be recycled through more than one use prior to being discharged from the home for treatment. It would be possible for example to reuse water from showers for the flushing of toilets. This reuse avoids the treatment of water to a quality which is above that required in the individual end use, thus reducing operating and capital costs as well as energy and other resource inputs.

This section describes the following alternative supply sources: rainwater, effluent and stormwater.

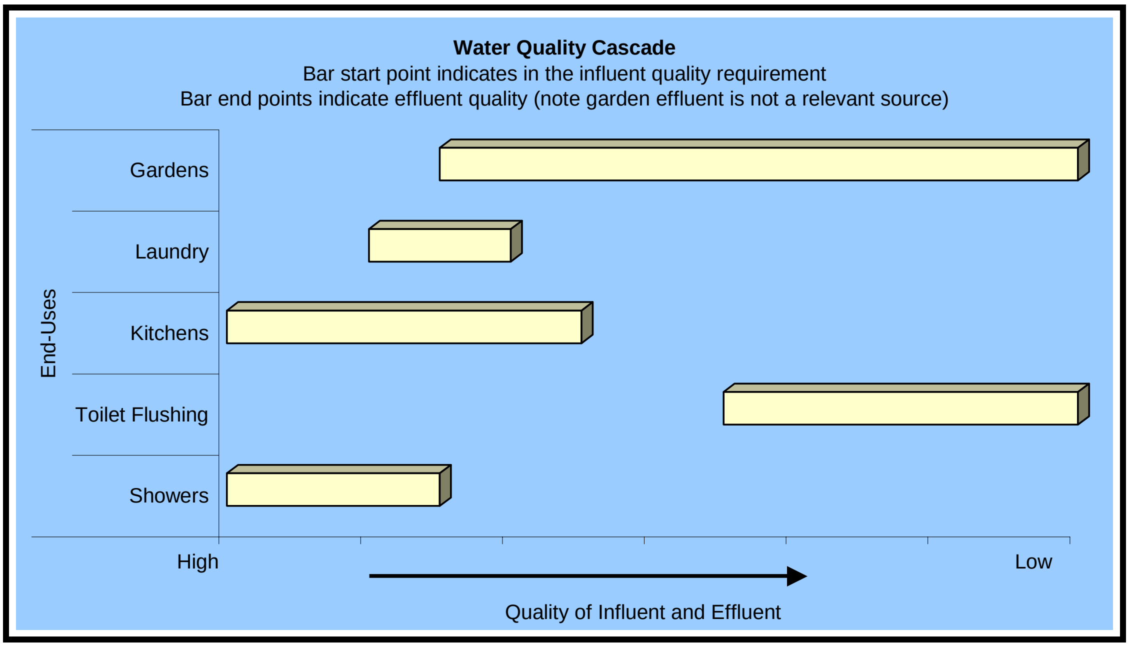

Figure 3-4: Water Quality Cascade

Source: ISF Representation (2002), indication of qualities only

3.3.1 Rainwater

The three major opportunities for using rainwater tanks are:

- To provide a supplementary water supply to existing customers (thus reducing demand on the centralised system and deferring augmentation needs);
- To provide the sole supply for a dwelling or building, which would otherwise need to be connected to the centralised system (thus reducing costs by avoiding reticulation needs and reducing demand); and
- To capture stormwater and prevent erosion and pollution.

In one example set in the study area (Alstonville), ISF staff modelled a 1,000 gallon tank (4,500 litres) costing approximately $1800 with installation and equipment. This scenario was found to satisfy the average household demand for toilet flushing using a single flush toilet (55kL/a) with 95% reliability even during a drought period in the area (White 1997).

A comparison of costs and benefits needs to be undertaken in specific locations to determine the optimum size of tank to be installed. Since rainwater tanks can satisfy more than one objective, it is justifiable to combine the benefits to help offset the costs. Some councils in Sydney for example, have onsite detention requirements for new developments. This has not generally been the case in the study area, however that is not to say that benefits would not be received. Augmentation of the drainage system is required in Byron Bay due to the system's inability to cope with a 1 in 5 year rain event. Savings have been estimated (Wymer, 1997) and used in this study (See Box H – Byron Shire Council, Onsite Detention).

3.3.2 Effluent Reuse

The reuse of effluent is an important strategy, combining both water supply provision and the management of sewage and/or stormwater. In principle, the demand should be met using options that have the lowest total cost to the community. Capturing the synergies that exist between these three aspects of water services is particularly valuable. Figure 3-5 illustrates that effluent reuse can reduce both water demand and sewage. It is important that further research work is undertaken to better understand the effect of reducing water use on sewage treatment costs.

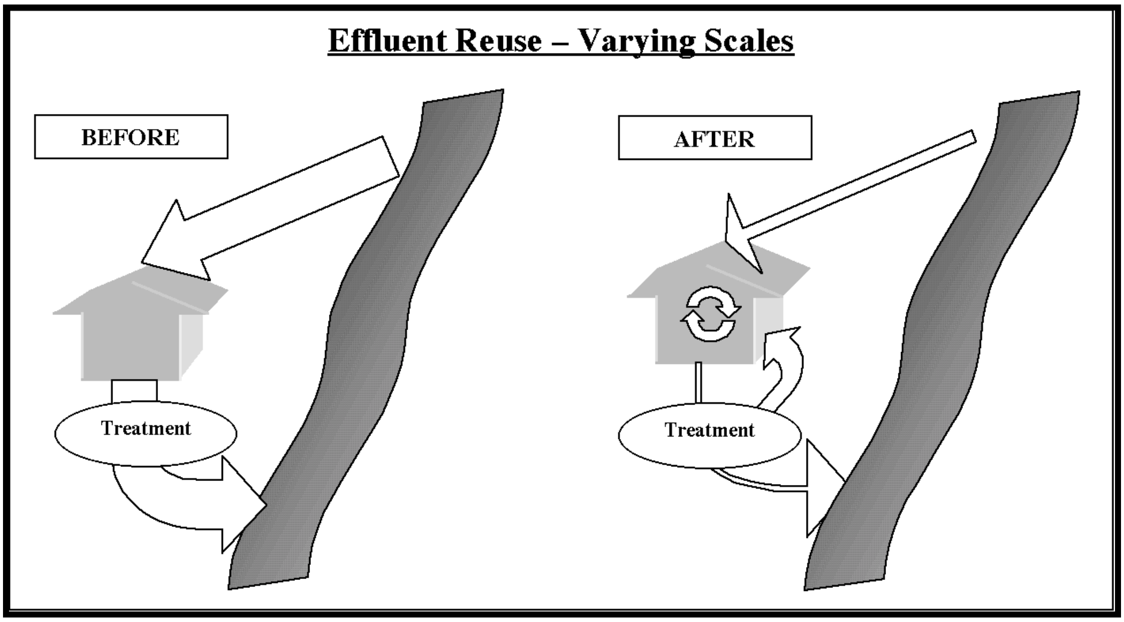

Figure 3-5: Varying Scales of Effluent Reuse – Typical now (Linear), Possible (Cyclic)

Source: ISF representation (2002), indication only

The most common means of effluent reuse is to substitute treated effluent in order to reduce the demand for water for irrigation purposes (e.g. gardens and lawns). Importantly, strategies need to be used which encourage substitution of genuine demand rather than land disposal. One of the common problems associated with this type of reuse is that times of high sewage (and therefore treated effluent) volumes are also times of rainfall the times when irrigation is least required.

3.3.3 Stormwater and Run-off

The benefits of managing stormwater and urban run-off as a source of water extend beyond the demand management aspect, that is the reduction in demand. The costs of stormwater pipelines and other drainage system components, to cope with additional run-off from increased impervious surfaces in new developments, can be reduced through increased use of on-site detention. In other words, if rainwater tanks are used as a combined (hybrid) storage for supplying water, as well as a system for storing roofwater runoff from storm events, then the benefits associated with these two functions can help to offset the capital cost of the tanks and associated equipment. The potential for a reduction in the cost of providing drainage infrastructure needs to be considered in order to select the option with the lowest total cost to the community. Modelling of the benefits of using combined (hybrid) rainwater tanks and on-site detention has been carried out for a case study in the Byron Shire Council area (Byron township). There are also examples of where large scale on-site detention basins are used to provide water for irrigation. In Lismore, the playing fields at the campus of Southern Cross University are irrigated using a pump drawing from the stormwater detention basin.

Box H: Benefits of Onsite Detention, Byron Shire Council

The council faces a situation where an inadequate drainage system requires a significant upgrade. Modelling undertaken for this case study suggests that improved on-site detention will significantly reduce the capital cost of the drainage upgrade. This on-site detention capacity could be provided by hybrid rainwater tanks/ on-site detention ie sharing the cost between the two functions.

This case study relied upon examining a typical lot, for which 34% of the area was roof area (impervious surface) connected to the stormwater system. Based on the requirements of the drainage system to cope with a 1 in 5 year storm event and the expected flow volumes that result a range of savings comparisons were prepared.

One conclusion with regard to savings was that the average cost of augmentation of drainage systems was $3,090/lot. Council estimates indicated that 11.25m^3 of onsite storage could reduce the cost of drainage upgrades to $1,037, a saving of $2,053. By spending $1,441 on a tank, the required volume of storage can be provided.

Since water services need to be managed in an integrated manner, the supply possibilities were also considered. Taking into account the benefits in the drainage system, at a net cost of only $737 the tank size could be doubled and a first flush diverter and pumping system provided (White 1997).

The quality of stormwater is another aspect that needs to be considered in its management. Given that stormwater is produced as run-off from a variety of sources the contaminants vary significantly. For example, run-off from roads, which is collected in stormwater drainage, is often contaminated by lead, however this is mainly an issue in urban contexts. In rural areas eutrophication resulting from nitrogen and phosphorous accumulation is a more common problem. Road surface run-off also contributes to the nutrient load in stormwater and can transport large volumes of litter to rivers.

Infiltration and inflow from stormwater to sewage systems in storm events contributes to the overflowing of these systems at those times. The additional capacity and infrastructure costs, which would be necessary to prevent or reduce the severity and occurrence of these events, can be avoided through better management of stormwater.

Butler and Parkinson (1997, p59) summarise the issues arising from stormwater as the following:

- Requirement for large and expensive sewerage systems;
- Transient flows disrupting treatment processes; and
- Discharges from overflows cause environmental damage.

A range of strategies can be used to counter these impacts including:

- **Utilising overland drainage patterns to reduce the speed of stormwater flows.** Since piped drainage increases the speed of flows the peak events are much larger and extend the capacity required;
- **Storing and reusing stormwater as a resource.** As described, this strategy utilises the synergies that exist between capturing relatively high quality stormwater to avoid unnecessary treatment and substituting centralised supply options;
- **Providing infiltration ponds, percolation basins and permeable pavements.** These strategies are useful to reduce the volume of stormwater that needs to be

managed centrally. These attempt to maintain a more natural permeability in an area despite urban settlements.

- **Promoting ecologically sensitive engineering, e.g. constructed wetlands.** These approaches provide alternative means for managing urban stormwater, which do not rely on centralised treatment systems. The scale of these approaches will determine their relative cost, including the amount of land required to satisfy the volume of stormwater expected.

Box I: Relative Nutrient Benefits of Passive Stormwater Management Options, Great Lakes Shire Council

The following table has been adapted from the draft *Wallis Lake Stormwater Source Control Study 1999*, prepared by Jelliffe Environmental Pty Ltd. It outlines selected stormwater management options, and indicates their effectiveness in removing pollutants, maintenance requirements, relative costs, and applications in stormwater quality control.

Stormwater Management options (adapted from Wallis Lake Stormwater Source Control Study Draft)

Management option	**Effectiveness**				**Maintenance**	***Cost***	***Application***
	Phosphorus	**Nitrogen**	**Pathogens**	**Suspended Sediments**			
Using Overland Drainage patterns to reduce the speed of stormwater flows							
Filter Strips	Moderate	Moderate	High	High	Low	Low	Drain edges, lower edges of lots, parks
Reduced impervious area for new development	Variable depending on reduction; may be significant				Low; usually mowing or vegetation maintenance	Low – Mod	Low use parking areas, paths, low use roads
Storing and reusing stormwater as a resource							
First Flush diversion, collection and treatment for specific industries (eg service stations, dairies)	May be moderate to high depending on the type of pollution, flush diverted and treatment system type				Moderate – high; Regular cleaning	Mod	Industrial sites, service stations, workshops, wrecking yards, dairy wastes
Rainwater tanks	Moderate	Moderate	High	High	Moderate	Mod – High	Small to medium sized buildings
Providing infiltration ponds, percolation basins and permeable pavements							
Infiltration basins	Moderate	Moderate	High	High	Moderate Cleaning costs	Mod – High	New sites or retrofit were there is sufficient space
Porous pavements	Moderate	Low	High	High	Low; occasional cleaning	Mod	Low use roadways, parking areas, paths
Promoting ecologically sensitive engineering eg constructed wetlands							
Off stream constructed wetlands	Moderate	Low	High	High	Mod. to high; some weeding required	Mod – High	New urban areas and existing areas with available land. Retro-fit in confined areas
Litter racks / booms	Negligible	Negligible	Negligible	Low	Mod. to high cost; very effective for litter removal	Low – Mod	Suitable for new development and some existing drains and creeks

3.4 *Innovative water servicing*

The additional infrastructure requirements for dual reticulation are significant in terms of retrofitting, as are the costs of greywater reuse and rainwater capture and reuse. The most recent research and costing prepared (as yet unpublished) however tends to indicate that to install a combination of clustered treatment and reuse systems, rainwater capture and reduced size (diameter and scale) reticulation systems, at the time of construction, does not cost more than the real lifecycle cost of a conventional centralised system. This has significant implications for the potential for reduced impact in new developments and is the application of the principles of integrated water cycle development.

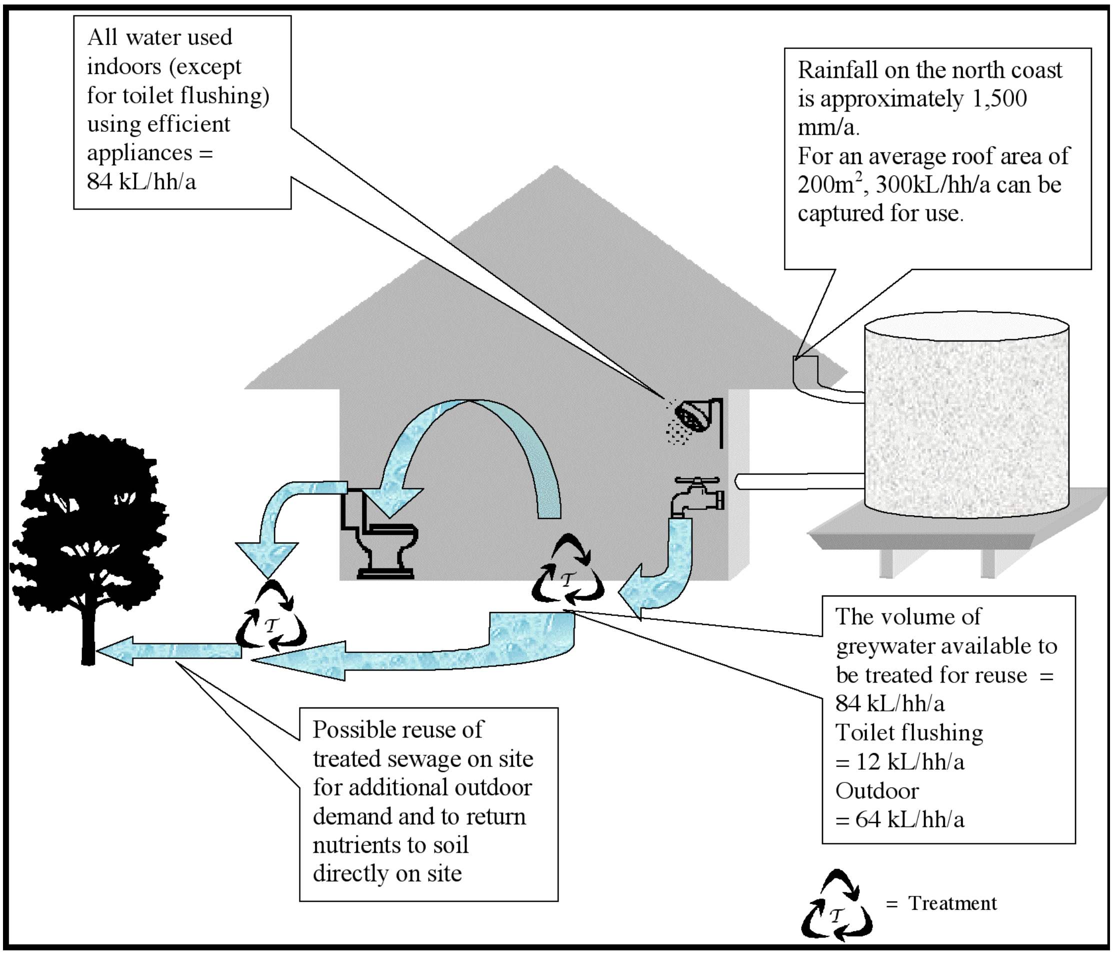

Figure 3-6: One example of a configuration for water reuse within the home

The possibilities for integrated servicing of new developments are varied and can present significant savings. For example, the demand for water from centralised sources could be reduced by 80%. If that reduction were to be achieved in 90% of all houses built in the region between now and 2026, savings would reach 8.5GL/a demand reduction by that date. Over the next 25 years the reduced water demand could save the region a total of $44million.

3.4.1 Unsewered Areas

Septic Safe programs have been part of a successful program to improve the effectiveness of septics as a means of handling sewage on-site. In many areas, particularly rural villages, the high cost of providing gravity sewers and a sewage treatment plant means that these areas will rely on on-site system for some time to come. In some instances the cost of providing the centralised system exceeds $30,000 per lot.

The performance of these systems is particularly poor in areas where reticulated water is supplied, due to the combination of higher supply pressure, unlimited supplies and density of development. In these areas, improvement of water efficiency through intensive investment in household water efficiency (at a cost per household of less than $300), as well as greywater reuse will significantly improve the performance of septic tanks (increased settling efficiency) and absorption trenches (Carew et al 2000). This will reduce costs to the householder significantly, reduce runoff from surcharging trenches with associated reductions in health and environmental risk.

3.5 Costs and Benefits Summary

These measures have varying levels of costs and benefits. The costs depend upon factors such as the ease of implementation and the responsibility for leading or enforcing the change. Scale is also important. Some measures are local scale measures, which would need to be repeatedly applied in order to facilitate regional change (eg development controls), whilst others have broader scale impacts (eg regulatory standards), often leading to economies of scale. The scale of applicability of a measure also impacts on the benefits delivered, for example some measures only affect new developments while others can apply to all properties. Measures also vary in their effectiveness, for example some measures can determine the products available on the market while others simply encourage the purchase of more efficient products. The impact of a measure also varies, for example affecting outdoor water use only, or affecting hot water use indoors and resulting in direct reductions in energy use and reduced flows to sewers. The time required before impacts of the change are felt also varies, ranging from a retrofit, which has instant impacts through to gradual change over of products when they are replaced.

A more integrated management of the whole water cycle would result in a number of economic, environmental and organisational benefits for service providers and for the community. These include:

- Operating cost reduction through reduced energy for pumping and treatment;
- Reduced greenhouse gas emissions through reduced energy for pumping and treatment and reduced hot water use;
- Deferral of capital works for water supply and sewage transport and treatment as a result of reduced demand;
- More secure environmental flows through reduced extractions as a result of reduced demand;
- Better nutrient management through capture and reuse of treated effluent and water sensitive urban design; and
- More cohesive and transparent decision-making by managing the water cycle as one system.

This study has quantified some of the typical costs of strategies to deliver these benefits. The values of typical water savings and costs, reductions in sewage discharge and greenhouse gas emission reductions have been obtained from work already completed in this area and in other areas, for example the typical cost of implementing demand management is based on the Rous Regional Demand Management Program. These costs have been extrapolated, mainly on a per connection basis, to indicate the possible cost of such a strategy if it were to be applied on a regional basis. Local estimates of cost savings within the study area, for example the estimated augmentation costs for the water supply system to Ballina and surrounds, have been used and extrapolated to indicate the regional benefits anticipated.

Table 3-3 summarises range of benefits, which can be delivered to the region as steps are undertaken to move toward genuinely integrated water service provision. As discussed, without efficient usage and management of water, a fully integrated supply and treatment system is unlikely to succeed.

The columns in Table 3-3 describe:

- Water demand reduced, which results in reduced extractions from surface and groundwater sources, often from rivers (or additional supply capacity).

- The sewage discharge reduction based on all indoor demand reductions resulting in reduced flows from houses to sewers.

- Based on the average energy consumption for treatment and supply, the reduction in water demand and sewage flows have been converted to energy savings and then to a reduction in greenhouse gas emissions. The average energy use for sewage transport and treatment is around 500 kWh/ML (median value from regional statistics, See Appendix C), and for water transport and treatment, 634 kWh/ML (ibid). The reduction in water demand can be assumed to deliver direct reductions in treatment energy costs of water and reductions in greenhouse gas emissions, for example greenhouse gas reductions of 629kg CO_2 equiv/ML of water pumped and treated, can be anticipated. Hot water energy consumption is much higher and has been evaluated in retrofitting programs (Ellis 1999) to be as high as 575kg CO_2 equiv for a showerhead retrofit for example. The sewage treatment implications are not as obvious and further research is required. This has been modelled as 484kg CO_2 equiv /ML of sewage pumped and treated

- The typical annual avoided costs shown are for water supply only, based on typical operating costs for water supply, plus the augmentation cost where supply is constrained, assuming that 20% of the study area's demand requires augmentation and that the remainder of those savings can be satisfied by demand management approaches.

- The regional present value costs are the estimated cost of implementing the strategy across the region.

Benefits of deferring or downsizing sewage treatment plant augmentation have not been included in the table as they are specific to each sewage treatment plant. Typical augmentation costs range from $1m to $2m per ML/d, therefore the cost savings could be of the order of $7m to $40m for the region if these programs were targeted in high cost areas. This benefit is dependent upon the sewage discharge reductions being realised as actual reductions in inflows to sewage treatment plants i.e. steps need to be taken to ensure that the sewer network is improved to minimise inflow and infiltration.

With regard to the cost comparison for water supply augmentation, for example, in Ballina it has been shown that augmentation would cost of the order of $7,000/ML/a (that is, the present value cost of supplying 1 ML/a reliably is approximately $7,000), based on the next likely source of water supply (pumping from the Wilson River at Lismore). If demand can instead be reduced (for example the 35 kL/hh/a reduction achieved through retrofitting programs - see Appendix B Rous Demand Management Strategies), then the unit cost of the program to achieve this level of savings is equivalent to $3,000/ML/a. Since the water reduction is achieved indoors, the 35 kL/hh/a reduction in demand is also a reduced volume to be carried by the sewage system. Reducing the load on sewage systems has not yet been thoroughly investigated in terms of the treatment cost at STPs, which would vary from location to location, however it is clear that infrastructure sizing could be reducing in new areas where it could be demonstrated that the hydraulic load on sewers would be substantially reduced compared with the average.

Example Strategy	Specific Assumptions	Units	Water demand reduction (GL/a)	Sewerage Discharge Reduction (ML/d)	GHG Reduction (Tonnes/a)	Typical Present Value Implementation Costs - Regional ($m)	Estimated Typical Annual Avoided Costs - Regional, 2026 (Water Supply Only) ($m/a)	Saving Compared with Predicted 2026 Demand (%)
Indoor Retrofit	70%	of connected properties	5.5	15.2	95,628	19	2.2	7%
	158,000	hh						
	35	kL/hh saved						
	585	kWh/hh saved due to hot water (ISF, 2000)						
Toilet Retrofit	30%	of connected properties	2.0	5.4	1,236	14	0.8	2%
	67,714	hh						
	29	kL/hh saved						
Washing Machine Rebate	70%	of connected properties	2.4	6.5	18,049	17	0.9	3%
	158,000	hh over ten years						
	15	kL/hh saved						
	118	kWh/hh saved due to hot water (estimate)						
Outdoor Foundation and Assessment	60%	of connected properties	2.0	0.0	1,278	11	0.8	3%
	15	kL/hh saved						
Leakage Reduction	3.75%	overall demand reduction	3.0	0.0	1,888	6	1.2	4%
Non-residential	3.75%	overall demand reduction	3.0	0.0	1,888	12	1.2	4%
Effluent Reuse	27.5%	overall demand reduction	22.0	0 to 30*	13,842	34	8.8	28%
Integrated Servicing of New Developments	80%	demand reduction (relative to an efficient home)	8.5	23.2		Potentially cost neutral	3.4	11%
	90%	of new homes						
	66,060	hh						
	128	kL/hh saved						

Table 3-3: Costs and benefits

**This range indicates the possibility of using rain tanks for source substitution. Where they are used, the benefits in terms of flows to sewers are low, however stormwater is reduced by the same amount. Alternatively, reuse within the home reduces flows to sewers, but does not necessarily reduce stormwater.*

The reduction in energy costs is one of the benefits that have cost implications. Considering only the changes proposed to increase water efficiency and to serve new developments in an integrated manner[28], GHG emissions reductions of approximately 120,000 tonnes per year of CO_2 equivalent could be achieved (See Table 3-3). For comparison purposes, at a rate of 7.7 tonnes per household[29], the residential sector in the north coast region produces 1,746,000 tonnes CO_2 equivalent annually due to stationary energy consumption.

Estimates are still being developed regarding the economic cost of GHG emissions. If the value of carbon dioxide emissions for the purpose of trading were A$25 per tonne[30] and the GHG emissions reductions described in Table 3-3 were fully realised across the region, the economic value would be $2.9 million per year[31].

It is clear that by supplying less water treatment costs other than energy could also be reduced and that deferring augmentation and reducing hydraulic loads have infrastructure provision related economic benefits.

3.6 Interdependencies

3.6.1 Education

The use of education, communication and advisory strategies is an essential part of an overall strategy of improving the sustainability of water use and is an important support for regulatory options and economic instruments. Either of these three types of measures will not succeed by itself, and a balance between them is needed. Historically, education measures, often without appropriate evaluation, have been relied upon to meet objectives in terms of, for example, reducing water demand or reducing stormwater pollutant loads. Within this context these educational measures may have appeared less than successful. However, as part of a larger strategy, education measures play a significant role in helping to meet several goals that are important in the context of the current investigation.

For example, appliance efficiency standards are more likely to be accepted because of awareness increases once some of the efficient products are already in homes, for example by virtue of a retrofit program.

3.6.2 Retrofitting and regulation

Retrofitting is a strategy which secures savings in the short term, often before it would be possible to effect legislative change. Furthermore, because of the intervention of the program, the savings are in essence guaranteed in the short term (subject to the correct installation of devices which only replace inefficient devices). Therefore, retrofitting is particularly effective in delivering short-term savings.

In the longer term however, homeowners can reverse the changes typically made in a retrofit, for example by replacing the new water efficient showerhead with a less efficient device. This type of reversal of efficiency and loss of savings means that other strategies should

[28] Source substitution options have not been considered due to issues of double counting.

[29] The stationary energy component of residential energy consumption in Australia contributes 58 million tonnes of CO_2 equivalent annually (pers comm. Riedy, C, doctoral student, ISF, work in progress, 25.09.02). 7.5 million households in Australia (ABS, Australian Demographic Data).

[30] Hamilton, C. and Turton, H. 1999, *Business tax and the environment: emissions trading as a tax reform option*, Discussion Paper no. 22, The Australia Institute, August, pp. 36-38. Hamilton and Turton review Australian and overseas market prices and modelling estimates. They conclude that A$20 is quite reasonable, although $15 is possible, at the then prevailing exchange rate of A$1 = US$0.67. At the exchange rate as at 25 September 2002 of US$0.54, A$20 (then) is equivalent to A$25 (now).

[31] 116,190 Tonnes (includes efficiency and integrated servicing of new developments from Table 3-3) at $25/Tonne = $2,904,750

accompany retrofits in order to secure savings. Having installed products, those savings are best secured through standards so that a homeowner who wishes to replace a device can purchase only equally efficient appliances or plumbing products.

3.6.3 Local and regional approaches

Actions are required on a number of levels and essentially at both the local and regional level. In pursuing integrated water services on the NSW north coast, there needs to be concerted local efforts at points of greatest need and broader pursuit of regional goals overall.

Agenda21 is the foundation for the principle of 'Think Global, Act Local". This principle is essential in ensuring the flexibility and autonomy required for successful implementation of a range of strategies because it establishes ownership of the strategies at the level at which the effort is required. The regional goals however are also crucial. These serve to ensure that fragmented approaches do not diverge and counter the benefits of each other. Rather the establishment of regional goals directs all players toward a common direction and ensures that cumulative local impacts are well managed. This is also a principle of PlanFirst.

3.6.4 Community engagement

The community must be involved in decision making about how the water services are provided and about how the impacts of the service provision are minimised.

The NSW Government's five key outcomes for the process of *PlanFirst* will be achieved by:

"collaboration; maximising the combined efforts of a range of Government departments, agencies, industry groups, community organisations and individuals" ,

(Carson and Gelber, 2001, p5).

This can only be achieved by meaningful consultation (consultation which has an "impact on decision making" (ibid)) and effective consultation (consultation which has an "impact on service delivery"(ibid)). By using consultation to generate a sense of ownership by the community of decisions, which affect them, there is a mandate for change. This helps to secure both action by the responsible party and answerability to the community.

Given that managing water services in an integrated manner will require the negotiation of access to valuable resources, it is essential that an understanding the community's priorities and willingness to pay form the foundation for decision making. Carson and Gelber (2001) cite a range of procedures for meaningful and effective community consultation and engagement. One recent application of one of these tools is the use of a citizen's jury regarding water quality improvements in the Bremer River in South East Queensland (Robinson, 2002)

4 IMPLEMENTATION

This section provides background information and support for a series of conclusions that form advice to the Healthy Rivers Commission. Integrating the provision of water services in the region would have major benefits in terms of river health in the longer term. The strategies described in Section 3 represent the means by which this integration could be achieved in practice. This section aims to locate these strategies within an overall framework, and to draw conclusions about what changes would be needed to existing regulations, practices and policies.

Many of the strategies that have been identified in Section 3 would provide benefits to a range of stakeholders, notably water service providers and the communities they serve. The reasons why these strategies have not been widely adopted is due to a number of major constraints and barriers. These can be summarised as a lack of:

- Appropriate regulatory framework and economic instruments to support strategies that will enhance integrated provision of water services;

- Appropriate institutional support for water service providers, councils, developers, customers and other stakeholders to assist in implementing these strategies, especially in the regional areas; and

- Appropriate indicators of performance, which can assist in determining what strategies are worth pursuing, how they are working, and where adjustments need to be made.

Integrated resource planning can provide a framework for greater integration of water services and has the potential to address each of the barriers identified above.

As described in Section 3.1, integrated water resource planning, in summary, provides a framework in which:

- The community is engaged through representative and deliberative processes in deciding on strategies for implementation;

- All options are considered in determining how to meet an increase in demand for water related services. This includes for example, all available water resources including stormwater and reclaimed effluent as well as traditional surface and groundwater sources, and including demand management options such as leakage reduction, improved efficiency of water use and improved system configurations;

- The least cost options are implemented first, and the relative cost of options are considered on the basis of whole-of-society costs, rather than from a single perspective (e.g. the water service provider, or a developer) and from a life-cycle perspective, eg the long term operating and maintenance costs of options are considered; and

- There is a process of monitoring, evaluation and redesign of strategies that ensures that these strategies are meeting the objectives, and that future strategies are redesigned and where necessary better targeted to meet these objectives.

Some of the barriers are described below along with appropriate responses. These responses are grouped as either: regulatory or economic; institutional support; or performance monitoring.

4.1 Regulatory responses to reduce demand

The best example of appliance efficiency in reducing demand is dual-flush toilets, which were regulated in many cities and States in the 1980's. Standards for appliance efficiency present the greatest opportunity for the successful implementation of a baseline for water efficiency in homes. This is due to the discretionary nature of compliance by homeowners in circumstances where there is a DCP for water efficiency. Unless significant bonds and compliance inspections are incorporated, it is likely that a DCP for water efficient appliances may have limited success. The point of sale regulatory approach however can limit the products available to consumers, as is the case in the United States with the Federal Energy Act (1992), which mandates the performance of showerheads, toilets and taps. This approach prevents the replacement of a water efficient showerhead with a non-efficient fitting for example and thus would be a far more successful approach to increasing appliance efficiency. These measures are the lowest cost means of improving water efficiency and help to protect the large investment water service providers make in retrofitting programs and rebates (ISF 2000).

A reduction in the demand for water needs to be achieved in order to counter the impact of increasing population. The NSW Government could assist in meeting this objective by taking leadership at a national level, through appropriate Commonwealth–State fora, in regulating the efficiency of water using appliances and equipment at point of sale, including showerheads, taps, urinals and washing machines. This would fulfil key components of the NSW Water Conservation Strategy, as well as commitments made by the ALP prior to the 1995 election. There is support within other States (Queensland, Victoria and Western Australia particularly) for this initiative.

Performance standards of this kind are less appropriate for other aspects of demand, such as outdoor water use. These water uses are better suited to a more localised, outcomes oriented approach such as the use of a points system for rating the efficiency of landscapes and irrigation systems. This approach allows householders to develop lawns and gardens in an efficient manner whilst providing flexibility and can also stimulate innovation. Planning controls, which establish targets for efficiency in new developments are consistent with the undertaking of the Government outlined in the NSW Water Conservation Strategy (point 11). The development of such an index system to assist councils (eg. the BASIX system being developed by PlanningNSW) helps to initiate the process of assessing a development for water efficiency prior to providing planning approval. This tool should be implemented by Government and then further developed to assist councils to extend the reach of the mechanism to additional water use categories, including the commercial and industrial sector, outdoor water use, cooling towers and to require dual reticulation in buildings, effluent reuse, separate metering of all units and roofwater capture.

New developments have been highlighted as a major opportunity for a more integrated provision of water services. This requires community engagement in decision-making about land use and its impact on water resources. The proposed mechanisms of PlanFIRST for regional planning could be an ideal means to facilitate this planning in a timely manner on a regional basis. Importantly the requirement for "consideration" has not proved to be successful in requiring natural resources to be considered at the planning stage. A requirement should be made for "demonstration" of the basis of decisions. These decisions should be made to ensure the least cost to the community.

Strategic planning has been highlighted as one area where water resources have been considered a "given", rather than as a constraint. PlanFIRST regional plans need to consider land use and resource needs simultaneously and in an integrated manner.

The expected outcome of this type of planning would be new developments that are more water efficient. There is also likely to be a reduction in stormwater pollution, especially sediment, since more stormwater is likely to be captured for reuse.

By using planning controls it is possible to require consideration of integrating water services at the development planning stage, thus presenting opportunities for innovative options to be developed. The mechanism of PlanFIRST, aims to provide a consultative process for establishing regional goals. As this process is further finalised by PlanningNSW, the Government's undertaking to integrate over-arching water conservation principles into policy and legislation (NSW Water Conservation Strategy, point 7) should be acted upon. In this way PlanFIRST should require the consideration of water services on a regional basis and at the land release planning stage. This requirement will also need to be mirrored in the local planning processes, including in the approvals process for construction of water and sewage infrastructure, where historically there has been limited consideration of alternative strategies that may reduce the capital and operating costs or avoid the infrastructure item entirely.

The rezoning process also needs to require demonstration of these considerations using an integrated water resource planning framework. The regulation of appliances and plumbing products combined with appropriate planning controls can significantly reduce demand for water services, including the discharge of sewage. The use of greater levels of source substitution, and new ways of providing water services in greenfield and infill developments also addresses the fourth barrier of linear, centralised infrastructure provision.

Licensing of water extraction by water service providers, approvals for new capital works, and discharge licences for sewerage service providers currently provide only limited incentives to reduce demand for water use, to maximise substitution and to integrate water service provision through different means of servicing new developments. Establishing licence conditions that ensure that water service providers have encouragement to identify opportunities for investing in options that use less water and increase source substitution would provide a driver for sustainable water use and integration that is currently lacking. Similarly, although IPART does not currently have regulatory oversight of pricing for country town water suppliers, there is an opportunity for IPART to provide strong guidelines and support for these water service providers to utilise an IWRP framework as a means of reducing the cost of service delivery. This would provide strong signals regarding the need for these water service providers to undertake appropriate investigation of, and investment in, water efficiency and source substitution.

Augmentation proposal approval should be made subject to proponents demonstrating that the alternative means of reducing demand (through demand side options) has been fully considered and where cost effective, implemented to its fullest potential prior to the approval of augmentation. The determining authority would require this demonstration to their satisfaction prior to approving upgrades or construction.

The second and third barriers to be overcome are the fragmentation of responsibility and this commonly relates to the existing programs, decision-making, planning and financing arrangements. Overall the systems needs to provide a direct and clear connection between all aspects of water service provision and financial arrangements need to require customers to pay the real costs of the services they receive.

4.2 Establishing sustainable funding and economic incentives

The existing funding arrangement for stormwater services is an example of a funding model which does not lead to appropriate outcomes. The grant driven nature of funding results in short term programs and establishes a dependency between councils and agencies for funds. There is a clear need for a more strategic approach, and this could be achieved by a collaborative process between all the stakeholders, including the grant providers, to determine a means of using the funding as a transition to more sustainable, locally generated funds through appropriate stormwater pricing, which provides incentives for options which ensure greater integration of services. IPART could be requested to provide advice and assistance for developing options, which would include establishing the real cost of stormwater management and ensuring this is reflected in user charges.

One existing mechanism, which is not currently utilised fully in this regard, is Developer Contributions. Developer contribution plans typically are prepared separately for each aspect of sewage and water supply without any reference to stormwater. The plans are usually designed around the assumption that the traditional centralised water supply and gravity sewer system will be installed. These characteristics mean that innovative servicing options, with lower impacts on the system are not encouraged, as there is no effective way of providing economic incentives through the fixed contributions. An IPART revision to the guidelines for Developer Contributions in regional areas could include an explicit objective of encouraging integrated water service provision and establish the process for a more flexible approach which seeks to recover the real cost of individual developments.

One other major injection of funding for water service provision into the region is the Country Town Water Supply and Sewerage Program (CTWSSP). As addressed by the HRC in their inquiry into the Clarence and reflected in the NSW Government Statement of Joint Intent, this program is restricted to infrastructure based responses and the criteria need to be revised to provide funding for water efficiency and other non-structural solutions to water service provision. In addition, this program like grant based funding in general, needs to work strategically to establish sustainable operations, rather than establishing dependency relationships. The transition phase between individual project funding and fully sustainable funding of water service needs by councils is that grant based funding would be subject to the demonstration of options being the most preferred option under an IWRP framework. This comprehensive comparison of options is likely to contribute to a move away from centralised infrastructure responses and toward more innovative servicing due to the lower lifecycle costs as well as the use of demand side options. This approach recognises that backlog sewerage programs (the focus of CTWSSP) represent an opportunity comparable to new developments in terms of avoiding or deferring augmentation needs through demand reductions and different servicing options.

4.3 Supporting Change

The need to support councils to implement changes such as those described above is recognised, including by the HRC in their directive strategies relating to environmental management by councils in the Statement of Joint Intent for the Hawkesbury Nepean River System. Furthermore, the NSW Government has undertaken to ensure that water conservation is supported throughout the whole community in the NSW Water Conservation Strategy (point 14). Institutional support must take the form of information and advice to councils (as described above from IPART relating to pricing) and should be provided by the DLWC to assist councils in their Integrated Water Cycle Plan to ensure that all options are considered and compared in an appropriate manner. The DLWC process for Integrated Water Cycle Management appears to be a positive step toward community engagement in decision-making about water services. It is important that if this is the process of choice established by DLWC, that it dovetail with other processes. There are also fundamental principles that must be embedded within the process. These include:

- A service based approach to managing water;
- Choosing the option with the lowest lifecycle cost to society; and
- Ensuring community engagement in decision-making.

The additional support of appropriately skilled personnel located in local areas is evidenced by some of the outcomes of the Stormwater Extension Officer (SEO) Program. This approach, with longer-term commitments to funding, including jointly by councils, can ensure that responsibilities are better managed. Water Conservation Officers are required broadly across the region and their responsibilities must extend to technical input into analysing demand and the co-ordination of options addressing demand-side approaches, (See Appendix E for a sample position description). This approach has been successful in California, where such personnel form a backbone of institutional support for utilities in designing and implementing major water conservation programs under the Best Management Practice requirement of the Memorandum of Understanding between utilities, regulators and community organizations represented on the California Urban Water Conservation Council.

The positions should be funded in part by the local or regional organisations with some transitional funding being provided by DLWC. This funding should be a redirection of CTWSSP funds, given that supporting implementation needs to be given priority at a similar level to infrastructure. This approach draws on the existing framework for Road Safety Officers funded jointly by the RTA and councils, and heritage officers funded by PlanningNSW and councils, as well as the example of California. The key responsibilities of the new appointees would be to implement the NSW Water Conservation Strategy at a local level by facilitating the integration of water services. Whilst there is a major educational role within and outside the organisations in which the WCOs would work, technical skills are essential. The first two tasks to be undertaken by all WCOs would be to:

1. **Prepare a water balance for the area –** this process reconciles the water being released from storages with that being metered for sale to customers. This data is fundamental in managing water resources and will highlight issues of un-metered consumption, leakage and slow running meters; and

2. **Review the Developer Contributions Plans for water and sewage –** this is a large an on-going task and would specifically require liaison with the strategic planning sections of council in order to ensure that costs for servicing are captured if these charges.

This implementation step supports most of the key strategies arising out of the Water Conservation Strategy, particularly *Government Leading by Example* (No. 8), *Pricing and Valuing Water* (No. 5), and *Integrating Water Conservation Principles into Policy and Legislation* (No. 7)

This initiative must be evaluated (at least every 3 years), as it is implemented and the north coast region would serve as a useful pilot area. The program is estimated to deliver savings of at least a 5% reduction in water demand and the benefits of such savings over the region are likely to exceed the estimated costs, particularly if activities are targeted in higher cost areas or areas facing augmentation[32].

Individuals cannot support the changes required alone. Information was sought during the course of this research with a number of agencies. This process served to illustrate the disparate nature of many of the agencies with responsibilities for water services. The DLWC regional offices combine with the metropolitan office to provide advice, licensing and funding for water services. Concerns were expressed both from within the department itself and from organisations required to liaise with DLWC about the possibility of receiving mixed information for example, receiving advice from a regional office, and later having that advice overturned by a metropolitan office.

Councils themselves face similar issues of miscommunication within their own internal structures. The historic division of sewage services from water supply services has possibly contributed to the separation of the operation of these two heavily interdependent services. This is in general avoided altogether in smaller councils where one person may carry responsibility for both aspects and even some of the larger councils are moving away from this fragmented approach and more toward the "Water Services" approach.

One strategy to facilitate the more integrated consideration of a range of options for water servicing is a management structure reflective of the interaction of all aspects of water services in one cycle. In smaller councils this occurs partly because of the limited number of employees and resulting dual responsibilities borne, and in others, for example Ballina, a Manager for Water Services has recently been appointed. In some larger councils there is a need to more specifically restructure. Coffs Harbour City Council has recognised this opportunity and recently embarked on the process.

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[32] For comparison, the Country Town Water Supply and Sewerage Program allocates approximately $50-60m per year to capital works subsidy.

Box J: Organisational Restructuring for Integration Purposes - Coffs Harbour City Council

In order to better address communication needs for the purposes of integration, Coffs Harbour City Council is changing their internal structure. The long-standing arrangement of departments within the Council has been a division of responsibility according to the water service provided, that is water supply or sewage management. The Water Supply Department and the Sewerage Services Department will merge to form a new department.

The result will be one Water Services Department with an Operational and a Strategic section. The division of responsibility under the new arrangement is likely to increase the integration of water services since issues will be dealt with having regard for both the water supply and for sewage management implications.

The change of responsibilities for officers within the new departments is part of what will aid in integration. Instead of responsibility ending when water arrives at a house or alternately which starts with the sewage leaving a property, officers will be required to manage the water cycle. Naturally expertise in supply or sewage management will be maintained within each side of the new arrangement.

The changes came about because of the recognition that there had been duplication of efforts at times when communication links had not proved reliable. The changes also mean there will be a greater focus on the strategic provision of water services. The need to consider this essential service in a timely manner when planning for growth has been a driver for the proposed changes.

4.4 Performance monitoring and indicators

Performance monitoring and indicators are essential both for the design and implementation of strategies for integrated water services, and also for the evaluation of programs and assessing progress relative to targets. For example, this investigation and previous studies confirmed that the most basic data in relation to the demand for water and discharge of sewage, is not accurate or widely available. This limits the ability of water service providers to undertake a simple water balance. The lack of reliable data on infiltration and inflow to sewers has implications for the design and operation of sewage treatment plants that can run to millions of dollars. Water service providers would benefit from allocating sufficient resources to the collection of data and the maintenance of monitoring systems for bulk and customer metered demand, sewage flows and costs. Evaluating any water efficiency and source substitution program is also important to ensure that program design is improved and that the best options are being implemented.

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APPENDIX A - BALLINA

Ballina Shire Council is referred to throughout this report. A detailed investigation of all aspects of water service provision in this Council area was carried out and this section summarises the findings of those investigations. The Ballina case study in particular serves to illustrate:

1. Opportunities to implement new ways of supplying water services in new land releases which will be required on the north coast to cope with the growing population.

2. Effluent credit schemes, which use highly treated effluent to supplement environmental flows.

The Ballina case study also highlights a range of issues and barriers common throughout the region including:

- Lack of opportunity or organisational support for treating stormwater as a resource, rather than a nuisance;

- The benefits and difficulties of adopting a regional approach to demand management and drought response; and

- Infiltration and inflow to sewers is a significant issue.

A.1 Context

Located on the far north coast of NSW and currently home to approximately 40,000 people, Ballina Shire Council is a rural-coastal locality with a temperate to sub-tropical climate. It covers an area of 487 square kilometres (Ballina Shire Council website, 2002) and relies heavily upon agricultural industries like sugar cane.

The LGA has had an average population growth rate of 1.6% per annum between 1996 and 2000 (ABS, 2001 and ABS, 2002) with a higher growth rate of 3% between 1991 and 1996. The Council's population projections are shown in Table A-1. These projections have been determined by Council to require a release of some 600 dwellings per year (Ballina Shire Council, 2002a, p6.).

Table A-1: Ballina Shire Council Actual Population and Population Projections

Year	Population Projection	Source
1996	34,702	ABS Data
1999	36,656	ABS Data
2000	37,074	ABS Data
2000	39,300	Ballina Urban Land Release Strategy, 2000
2010	57,500	Ballina Urban Land Release Strategy, 2000
2033	90,700	Ballina Urban Land Release Strategy, 2000

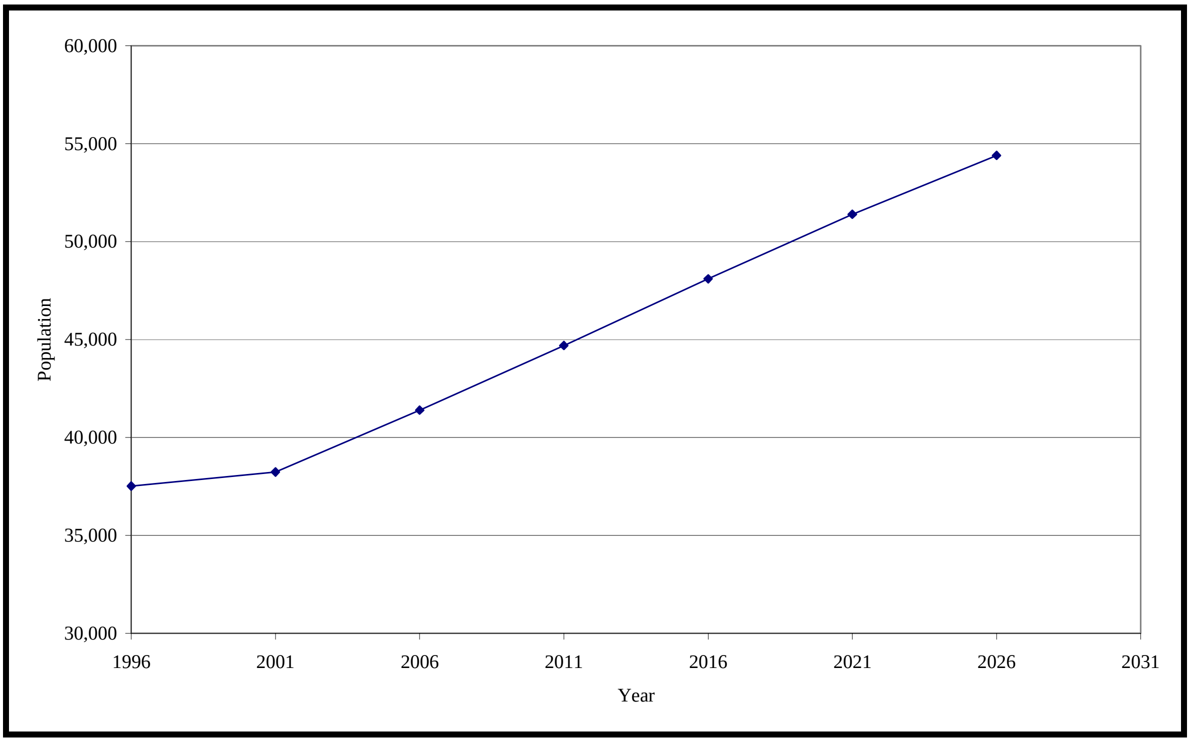

Figure A-1: Population Projections, Ballina 2001-2026

Source: ISF interpretation of PlanningNSW regional growth rate projections and ABS Statistics for the LGA.

Figure A-1 shows an alternate scenario for population growth resulting from the application of PlanningNSW regional growth rates to current population. The differences between the two projections illustrates the uncertainty regarding the absolute population growth. However, as illustrated in both these projections of population, there are significant issues that will be faced in Ballina in the near future with regard to the provision of water services to a growing population. Further evidence of this growth and growing needs are illustrated in Figure A-4.

One particular indication of the pressures on the area is shown by the population projection for Cumbalum. In 2000 the area is shown to have no residents and this is projected to increase to a population of 14,000 by 2033. When this is considered in conjunction with the sewage treatment capacities (Table A-2) and the increasing water demand projected (Figure A-3), it is clear that in the longer term there will be a need for change. This could include either a significant investment in sewage transport and treatment infrastructure, or realisation of the opportunity to service new sub-divisions in ways that reduce water demand, maximise reuse and rainfall capture and reduce infiltration and inflow to sewers.

Table A-2: Ballina Sewage Treatment Capacity

STP	Volume of Effluent Discharged from STP: actual volumes (ML per year - average)	Volume of Effluent Discharged from STP: EPA Licence volumes (ML per year)
Ballina	1460	1000 – 5,000
Lennox Head	1460	1000 – 5,000
Wardell	65.7	219 – 1,000
Alstonville	620.5	219 – 1,000
Total	3,606	2,438 – 12,000

Source: NCC, Website

The current sewage treatment capacity in Ballina is estimated to be 18,000 EP at Lennox Head with planned upgrades to 28,000 EP in 2003 (DPWS, 2002).

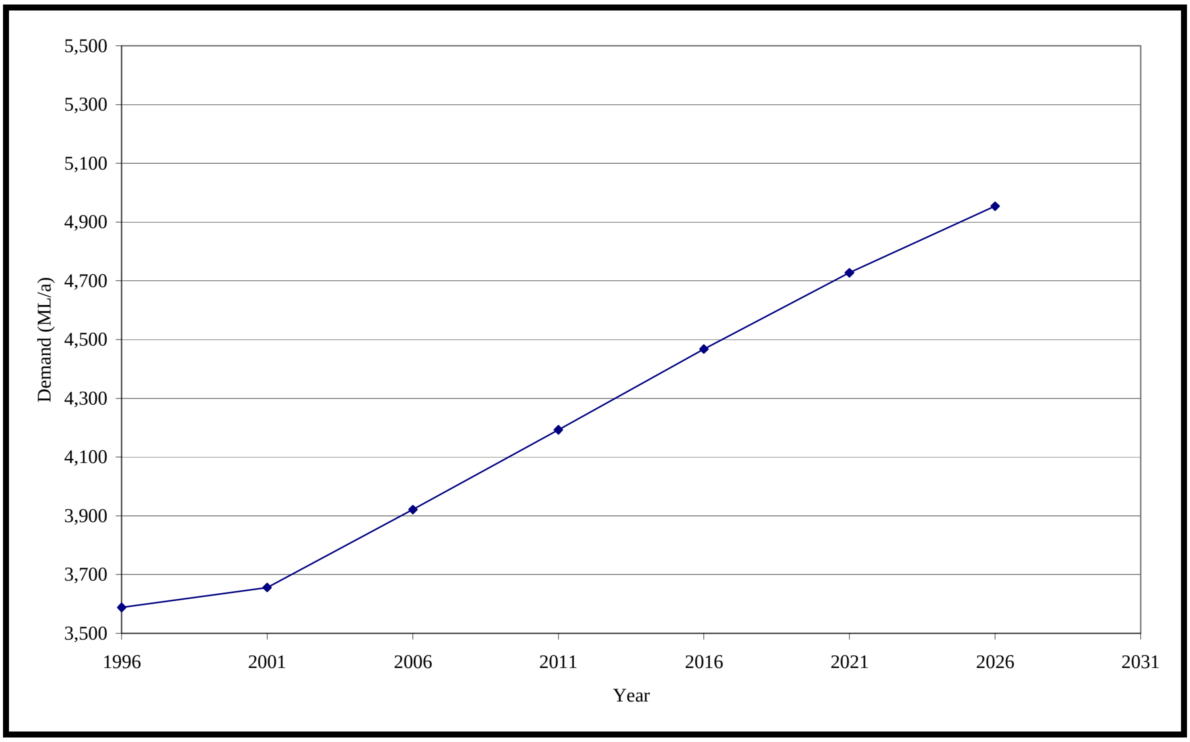

Figure A-3: Projected Annual Water Demand for Ballina (2001 – 2026)

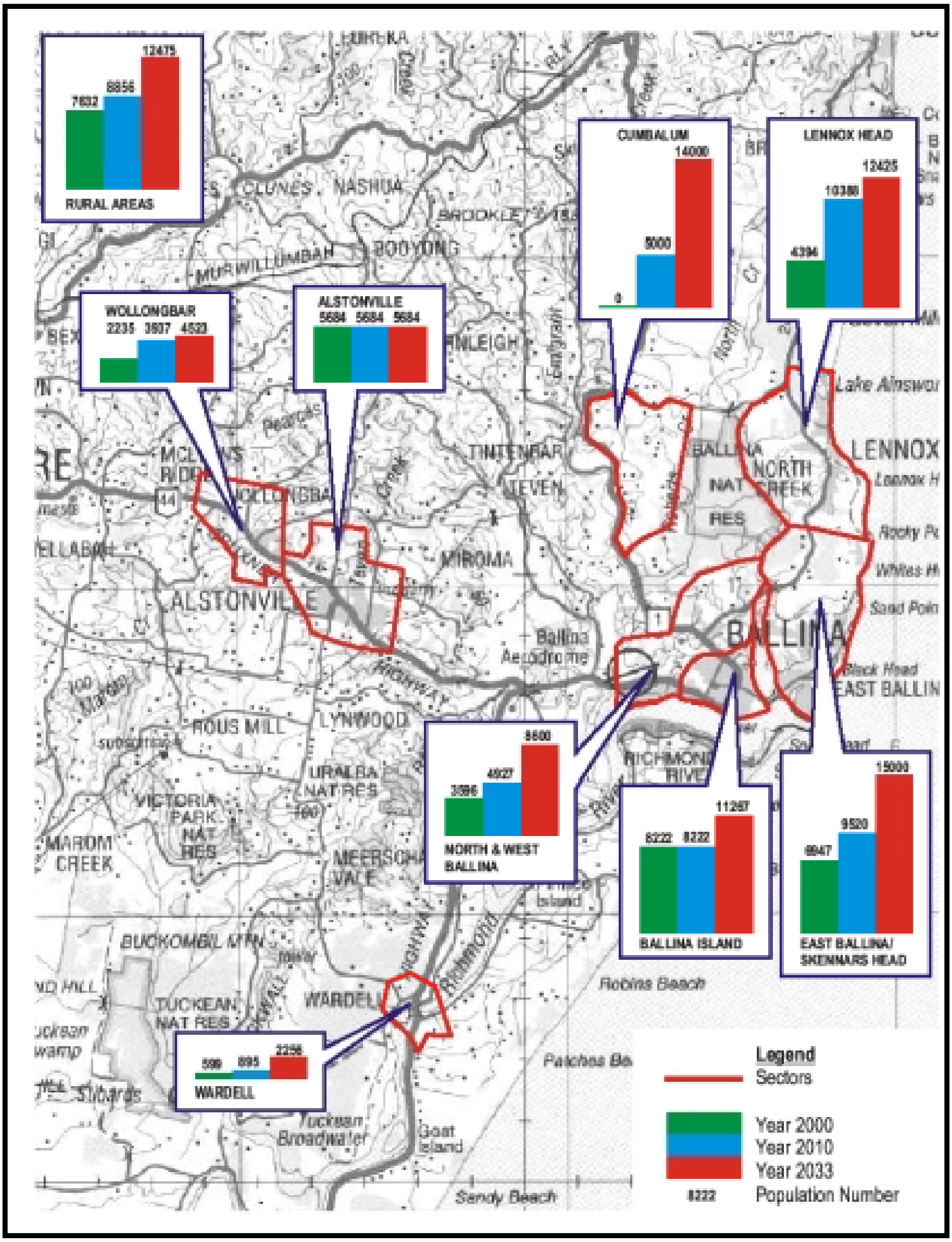

Figure A-4: Ballina Shire Council - Geographic Growth Planning

Source: Ballina Shire Council, Road Contribution Plan, May 2002, Illustration 2.1

A.2 Provision of Water Services

A.2.1 Responsibility, Objectives and Scale of Service Provision

The provision of water services to residents of Ballina Shire Council is the responsibility of a number of organizations.

Primarily the Council is responsible for the delivery of retail water supply to customers and the reticulation, treatment and reuse or disposal of sewage. Ballina Shire Council has the following objectives for its Water and Sewerage Section:

- *"Manage the successful completion for adoption of the Urban Water Strategy to improve the quality and manage the quantity of water reaching the marine environment within the Shire;*
- *Ensure proper implementation of Council's Trade Waste Policy;*
- *Further develop, formalise and implement maintenance programs;*
- *Commence project management for augmentation of sewerage infrastructure; and*
- *Establish Sewerage Reticulation model."*

These objectives sit within the Council's whole mission, which is:

"To enhance community lifestyle and environment through effective leadership, community involvement and commitment to service." (Ballina Shire Council, 2002b)

Recently Council has appointed a Water Services Manager, which is an important step in recognising the importance of water services. Prior to this appointment, water services were managed within the Civil Services section of council. The Group Manager of Regulatory Services has responsibility for stormwater. However that role is not undertaken from a planning perspective and does not consider stormwater quality or quantity in detail. The role instead considers mainly the responsibility of individuals to ensure that stormwater does not concentrate and flow onto adjacent properties.

Ballina Shire Council provides stormwater infrastructure within its Roads and Drainage department. The organisation, partial management and even presentation on the website of stormwater as an aspect of roads and drainage does not serve to inform the public about the resource which stormwater can provide. Rather it is presented as an issue to be taken away and disposed of.

Rous Water (formerly Rous County Council) manages the bulk supply reservoirs in the area and sells the water to the local councils. The main supply reservoir is Rocky Creek Dam with an annual yield of 12,460 ML/a in 2001 (ISF, 2002). Other contributing supplies in 2001 contributed less than 0.5% of the annual production.

Representatives described how a regional water authority could play a stronger role in increasing integration in the area as the current array of council retailers continues to present administrative challenges. Data issues are one challenge where it is difficult to understand the demand and supply in the region because of the variety of meter reading processes in operation with each council retailer responsible for their own system. One other example of data issues highlighted was the experience in summer 2001/2002 where a major peak in sewage loads was experienced at STPs. It was however not able to be tied to patterns of consumption due to the lack of available data.

The EPA licenses the 4 Sewage Treatment Plants operated by Council. The combined licensed volume discharge annually is shown above. The DLWC provides licenses for extractions and council representatives have described difficulties in liasing with the various offices of the DLWC given that there are split responsibilities between regional and metropolitan offices.

A.3 The Present

A.3.1 Planning

Ballina Council is currently preparing an Integrated Urban Water Management Strategy. They expect to spend between $24 and $40m in preparing and implementing aspects of the 30-year water management plan for Council. The plan is described by Council representatives as a basis for change and is intended to consider aspects of supply, stormwater and sewage management. The Council is currently in the process of engaging the community through public exhibition. They have found the process to be a useful one, particularly with Rous Water being able to look at the supply side issues on a more regional level. It is a particularly important and commendable step for a council to undertake this type of planning, especially given that the strategy is intended to span the whole water cycle in terms of water supply and sewage and stormwater management.

Ultimately the planned upgrades in the Draft Strategy (DPWS, 2002) include a capacity of 58,000 EP at Lennox Head and closure of the Ballina Sewage Treatment Works. The options in the strategy have costs ranging from $24m to $40m. These augmentation plans are based on population projections by Council, which are far higher than those resulting from the application of regional growth rates to the LGA population. The growth is possible, given the variation in growth rates within regions, however major infrastructure of this type is only economically viable when used at or near capacity. Variations in population projections make infrastructure planning particularly difficult. Demand side options on the other hand are viable options at many different scales. These have been referenced in the strategy however the implementation issues have not been considered in detail and instead responsibility has been left to the Water Supply Authority.

As a relatively small council it was suggested that Council, may not be the most efficient level at which responsibility for strategic planning could rest. In fact the structures were described as “limiting” in their current form. A regional approach was recognised as presenting a possibly advantageous alternative.

Developer Contributions Plans were highlighted as an example of how strategic planning is not working effectively. The ideal approach, as described in an interview, would include considering a Land Release Strategy and for each 2A zoned residential area, define the existing services and the anticipated demand. This produces servicing plans, which describe the additional service needs. Based on these plans it is possible to appropriately attribute costs via Developer Contributions Plans. The absence of servicing plans (common among councils) is part of the reason that Developer Contributions do not adequately reflect the servicing implications of new developments.

Restrictions are currently in place in Ballina and importantly a regional approach has been used to implement these restrictions. This is a good example of the gradually increasing integrated approach. It is also an indication of the real challenge in this area, which is projecting a major change in population growth rate (illustrated in Figure A-1).

The Council, has recognised this need in part as demonstrated, for example, by the proposed Ballina Heights development. Ballina Heights is one example of the potential for new development to be constructed in a way that reduces the impact on water services. This project includes the release of 750 residential lots and surrounding land for community uses (total 1000 ET) where dual reticulation will be used to deliver high quality treated greywater back to the properties for toilet flushing and outdoor water use. In this system sewage flows first to a centralised treatment location and treated effluent is later returned via a third pipe. This model increases effluent reuse, decreases nutrient discharge and reduces water demand. However it is at the high end of unit costs for alternative servicing options, as it does not allow any reduction in reticulation costs because it relies on centralised treatment.

Growth impacts in general are not well considered in the planning of water services according to the Council. Regional planning does not currently cohesively address that level of detail.

Rous Water prepares plans on a regional basis by consulting with individual councils regarding their plans pertaining to growth and land releases. Since there are two Councillors from each constituent Council on the board of Rous Water it is possible to have some flow of information and consideration of constraints at the land release planning stage. However the absence of a strategic, bulk water supply steering committee means there is a lack of transfer of information about growth and water service capacities between constituent councils.

This leads to what councils describe as a major issue of timing. Often the consideration of water servicing comes too late in the planning process, preventing substantial change in the way water services are considered for new developments. The example provided was the responsibility placed on one Development Engineer for considering all development in the whole Council. The need to act in a timely manner about innovative approaches is well recognised by council, however they admit to having difficulty in being actively involved in planning processes.

A.3.2 Augmentation

In Ballina it has been shown that augmentation of bulk water supply would alone cost in the order of $7,000/ML/a (that is, the present value cost of supplying 1 ML/a reliably is approximately $7,000), based on the next likely source of water supply (pumping from the Wilson River at Lismore). Desalination, which has a unit capacity cost greater than $10,000/ML/a has also been raised as an option. For comparison, the unit cost of demand management programs to achieve this level of saving is approximately $3000/ML/a, and while they have been pursued in this region to a limited extent, the scope for further investment is clearly demonstrated in Section 3.

Significant sewage system augmentation is also proposed in the Ballina area. Whilst historically Ballina has successfully matched service capacity to land releases for roads, water and sewerage, the pressures of growth are beginning to be evident. Indeed the issue was described as being at "crisis point" in terms of the central area of Ballina, which is out of capacity. In addition the existing effluent management practices were not in line with community preferences and direct discharge was becoming less well accepted within the community.

The council feels that regulatory authorities discourage initiatives causing more difficult regulation by Government departments, due to complex regulatory pathways. A need appears to exist to provide more flexible approaches which can better respond to innovative solutions. Agency support as well as standard assessment and prevention roles can actively facilitate change.

Another seemingly innovative approach in the area is the proposal to return highly treated effluent to the base of Emigrant Creek Dam. A volume of approximately 6 ML/d would be provided as substitute environmental flows. This proposal was nominated as the preferred option by council and is yet to be presented to Councillors. It is not clear how the evaluation of this option was carried out and there may be cost and operational advantages associated with reducing extractions in preference to treating and returning effluent.

The council described rainwater collection via tanks as a useful but difficult step in integration. The council staff described the array of responsibilities including: the Department of Health, which is yet to respond consistently on the issue; the Department of Local Government, which is not well resourced to advance this supply option; and water suppliers, who perceive no advantage to establishing such supplies as these are not seen as their business. Rainwater collection and use is an issue requiring an integrated solution and council see a need for models or case studies suggesting how to fund their implementation on a broader scale. Rous Water has recently commissioned ISF to undertake a study of the potential for charging for integrating raintank supplies with existing storages.

A.3.3 Infiltration

In this coastal area the inflow of saltwater to sewers has caused particular problems. Representatives of Ballina Shire Council described the issue of saline inflows to sewers as it affects the local area. The major points raised were:

- The problem mainly occurs in either reclaimed land near saltwater environments or on sandy soils where significant damage has been caused to sewer pipes.
- The infiltration rates are expected to be high with average dry weather flows recorded as 300 L/person/day compared to the nominal NSW design allowance of 240 L/person/day (DPWS, 2002).
- The impacts are higher treatment costs due to poor influent quality and poor water for reuse. In Ballina this issue has been revealed in part through the issue of turf farms being unable to use the treated effluent. The effluent has been disposed of at the farms and the saline qualities have meant the turf has not survived.
- Councils cite a hasty process of getting infrastructure constructed without a thorough understanding of the maintenance issues or of the best long-term solution.

Despite attempts being made to introduce reuse of treated effluent, the unsatisfactory outcome from the use of treated effluent on Ballina Turf Club, where salt content killed the turf, represents an approach of sewage disposal rather than replacement of genuine demand.

A.4 What are the implications for the region based on this case study?

Ballina is an example of the typical issues related to the management of water related services on the north coast. A representative of a Council contacted explained that stormwater is commonly managed by considering "how do we best deal with the problem of water on roads or flooding of properties". This simplification of the issue was repeated by a number of councils and described as a result of an absence of a "practical profile" for stormwater. In greater detail this related to funding as well as answerability for the management of the resource. Funding through the CTWSSP provides for major backlog issues and provision of services rather than maintenance. Council representatives recognised that sufficient funds should be collected through rates to maintain services once in place, rather than undercharging or cross-subsidising.

The management of supply and demand in Ballina is considered to be an example of exceeding the standard practice in terms of integration. Some of the work occurring in Ballina has been used to develop a scenario for quantifying the benefits that a more integrated approach to water management could deliver on a regional scale, particularly demand management programs.

Contact with representatives of Ballina Shire Council highlighted the need for a consistent approach to water management across councils due to the high mobility of people in the area. It is important that people living within one Council area and travelling to work in a neighbouring area hear a consistent message about water resources and their scarcity. The regional introduction of restrictions is one example of how this has worked well. Restrictions are a highly visible aspect of water management and impact on residents directly. Other less obvious aspects are not necessarily managed in a uniform manner.

Appendix B – Demand Management Strategy Example

Rous Regional Demand Management Strategy

Commencing with an extensive period of consultation, this regional approach to demand management was embarked upon in 1996. Rous Water has championed the program and has recently appointed a Demand Management Co-ordinator to ensure the smooth implementation of a range of strategies. This range of mechanisms is integral to the success of demand management programs generally and Rous has pursued strategies encompassing the following aspects (*examples in italics*):

Pricing and billing;

The introduction of a two-part tariff by water retailers consistent with COAG principles of water reform.

Refinement of customer water bill to ensure clarity and ease of understanding by customers, particularly relating to ways by which to reduce costs – implemented by some of the Council retailers (eg Lismore) in the Rous region.

Infrastructure leakage and investigation of unaccounted for water;

Rous Water has undertaken analysis of the water balance for the region. This work compares the water released from bulk supplies with that metered at customer premises, thereby highlighting leakage or slow running meters. The introduction of telemetry and mag flow metering on the bulk supply points has significantly improved the data available for analysis of this type and its accuracy.

Regulations and policy;

Regulations and policies applied to new premises protect investment made by organisations like Rous Water who had invested more than $100,000 in water efficiency in existing buildings by 1996. Some of these types of mechanism are outside the responsibility of water supply authorities but can easily be applied through Development Control Plans (DCPs) by local councils. For example, in Ballina, a regulation was introduced in 1992 requiring all new houses to have showerheads with a flow rate of 12 litres per minute or less. This regulation has not been evaluated. Costs for changes to regulation are low involving only a proposal to Council. Compliance monitoring and training were not carried out.

Incentives for appliance efficiency;

Since regulations and policies only affect new developments it is useful and has proved effective to use economic incentives to increase the sales of water (and energy) efficient appliances. In the Rous Water supply area a successful program incorporated funding by water and energy retailers. A rebate on the purchase price of a new front-loading washing machine was delivered to customers via their accounts with these retailers. The program evaluation indicated that 77% of people were influenced by the rebate in their decision about which type of machine to buy and 11% of participants were replacing existing front- loading machines (ISF, project report – unpublished).

Non-residential water efficiency;

Commencing in 1996 a non-residential program was implemented in the area. The development of water saving action plans assisted businesses to reduce their water use. Average savings were of the order of 25% of water use prior to the program (ISF, unpublished data). Although this is a small sample, non-residential water efficiency programs operating on a broader scale, for example through Sydney Water Corporation have also delivered significant savings. It is appropriate to consider that on average commercial water use can be reduced by 10% through a simple audit and implementation of recommendations.

Programs to educate regarding outdoor water efficiency; and

Rous Water found that outdoor water use, despite being lower than almost any other part of Australia, was the single largest end-use of water among their residential customers. This highly variable water use has a behavioural aspect not common among water end uses generally. Since it is discretionary, outdoor water use can be targeted and is likely to deliver particularly significant reductions in demand. Surveys for Rous Water have indicated that customers often watering too frequently but may not be delivering the right amount of water. Significant analysis remains to be done internationally to evaluate the savings from education of this kind. It is not unreasonable to assume that water use could be reduced by 5 to 10% on average.

Alternative supply.

Alternative supply options are usually the most costly in terms of deferring or reducing the need for augmentations to bulk supply options. In the Rous Water supply area investigations and surveys indicated that people in general are not aware of the possibilities of this alternative. Rain tanks are permitted in all of the four local councils in this supply area. Byron Shire Council has investigated the significant benefits of on-site detention that are connected to providing rain tanks (described in Box D).

Demand management is one of the most appropriate responses for organisations aiming to deliver integrated water services. Managing demand in essence means delivering the same service at the least cost to the community. In terms of considering water services as an uninterrupted cycle, demand management focuses on all the costs of providing a service and chooses the least cost means of providing that service. Costs in this sense extend from the supply reservoir right through to (in some cases) the avoided costs of managing run-off. This approach, 'integrated water resource planning' or 'least cost planning', is now well documented (eg. White, 1998) in terms of the means to integrate that approach into decision making frameworks in organisations.

Evaluation work has been undertaken on various programs incorporating the range of options for demand management. The results of some of these evaluation programs have been used in this report to describe the potential benefits of increasing the integration of water services. The foundation aspect of demand management is water efficiency of significant end-uses. This has been proven to deliver cost-effective savings in recent evaluations (Sarac et al, 2002). Savings of the order of 23 - 35 kL/hh/a on average were received in the programs evaluated. This value has been used to model anticipated savings achievable through indoor retrofits of showerheads, tap aerators and flush arrestors in single-flush toilets, as was carried out in the Rous House Tune-Up Program.

APPENDIX C – MODELLING COSTS AND BENEFITS

The first table in this appendix shows the modelling results used to indicate the potential savings from the implementation of options for integrated water services across the whole north coast region.

This appendix also includes the summaries prepared from the DLWC *2000/01 NSW Water Supply and Sewerage Performance Comparisons* (Tables C-2, C-3 and C-4) That publication is based on reports provided by DLWC and reviewed by councils. The results included in the following tables rely on that publication and have not been independently verified.

Omissions do exist in the data set published and these have been estimated where possible by extrapolating averages from reported information across the total regional number of connected properties.

Some key points to note from this data are:

- There is a high variability of data between the councils reported average annual household consumption data;
- There is significant variation between the degree of urbanisation within councils; and
- The populations provided are for LGAs, not water supply areas.

Table C-1: Demographics

Year	Population	Occupancy Assumed	Estimated Total No. Households
2001	677,286	2.74	247,185
2026	878,400	2.74	320,584
New Houses	201,114	2.74	73,399

Average demand
Although the comparative statistics indicate (DLWC 2002) that current average demand is 251kL/hh/a, for the purposes of modelling a higher average has been assumed due to analysis of actual demand in the study area (ISF 2002).

Table C-2: Minimum Appliance Efficiency Standards

End use	kL/hh/a Saving expected (standard to efficient)	Saving anticipated in x% properties	Weighted Average Saving	
Showers	19	80%	15.2	kL/hh/a
Washing machines	15	90%	13.5	kL/hh/a
Tap flow regulators	8	80%	6.4	kL/hh/a
			35.1	kL/hh/a

Since these appliances have lifetimes of around 10 to 15 years, it has been assumed that most appliances would be replaced by 2026 if the regulation came in in 2005.

That is all houses in 2026,	320,584	hhs reducing demand by	35.1	kL/hh/a on average
		a total of	11,252	ML/a
			11.25	GL/a

Table C-3: Retrofitting

Estimations by extrapolation of comparative statistics, indicate there are 225,700 connected properties in the North Coast region in 2002. Since retrofitting is usually an investment by a water supply authority these savings have been calculated based on connected property estimates.

If 70% of all these connected properties were retrofitted, i.e.158,000 houses the following savings could be anticipated:

Assume	158,000	houses are retrofitted, saving	35	kL/hh/a	5,530	ML/a
					5.5	GL/a

35 kL/hh/a = 14% of current average demand (DLWC 2002), 251 kL/hh/a

Table C-4: DCP on new houses

A DCP which regulates efficient showerheads and tap aerators could be expected to deliver savings of 21.6 kL/hh/a, by saving 15.2kL/hh/a through showers and 6.4kL/hh/a in taps (See Table 2.)

DCP on new houses	73,399	saves	21.6	kL/hh/a	1.59	GL/a

Table C-5: Savings Comparison

General Assumptions:

Demand			
Outdoor	25%		
Toilet Flushing	55	LCD	
Regional Demand (by 2026, only reduction due to exchange of toilets)	80	GL/a	
Energy & GHG			
Energy consumption for water treatment and pumping	650	kWh/ML	
	629	kg CO_2/ML	DLWC (2002) and ISF Appendix C
Energy consumption for sewage treatment and pumping	500	kWh/ML	
	484	kg CO_2/ML	DLWC (2002) and ISF Appendix C
CO_2 Equivalent Produced /kWh	0.968	kg	Australian Greenhous Office, 2001, *Greenhouse Challenge - Factors and Methods Workbook* ,
Cost of 1 kWh	$ 0.11	/kWh	Published Tarrifs, Energy Australia
Cost of 1 Tonne CO_2 Equivalent	$ 10.00		
Costs			
Augmentation (Range)	$ 0.20	/kL	Assumption of 20c/kL, p15. (ISF for DLWC)
	$ 1.20	/kL	Rous Augmentation Plans
Weighted Value	$ 0.40	/kl	

Example Strategy	Specific Assumptions	Units	Water demand reduction (GL/a)	Sewerage Discharge Reduction (ML/d)	GHG Reduction (Tonnes/a)	Typical Present Value Implementation Costs - Regional ($m)	Estimated Typical Annual Avoided Costs - Regional, 2026 (Water Supply Only) ($m/a)	Saving Compared with Predicted 2026 Demand (%)
Indoor Retrofit	70%	of connected properties	5.5	15.2	95,628	19	2.2	7%
	158,000	hh						
	35	kL/hh saved						
	585	kWh/hh saved due to hot water (ISF, 2000)						
Toilet Retrofit	30%	of connected properties	2.0	5.4	1,236	14	0.8	2%
	67,714	hh						
	29	kL/hh saved						
Washing Machine Rebate	70%	of connected properties	2.4	6.5	18,049	17	0.9	3%
	158,000	hh over ten years						
	15	kL/hh saved						
	118	kWh/hh saved due to hot water (estimate)						
Outdoor Foundation and Assessment	60%	of connected properties	2.0	0.0	1,278	11	0.8	3%
	15	kL/hh saved						
Leakage Reduction	3.75%	overall demand reduction	3.0	0.0	1,888	6	1.2	4%
Non-residential	3.75%	overall demand reduction	3.0	0.0	1,888	12	1.2	4%
Effluent Reuse	27.5%	overall demand reduction	22.0	0 to 30*	13,842	34	8.8	28%
Integrated Servicing of New Developments	80%	demand reduction (relative to an efficient home)	8.5	23.2		Potentially cost neutral	3.4	11%
	90%	of new homes						
	66,060	hh						
	128	kL/hh saved						

Table C-6: Modelled extrapolations of local savings to regional levels

Council Name	Coast	Population	Land Area (km^2)	Population Density ($pers./km^2$)	2000/01 Water Usage (ML/a)	2000/01 Water Usage (ML/a/ person)	2000/01 Average Annual Residential Usage (kL/ connected property /a)	No. Connected Properties (00/01)	People per connection	2000 /01 Energy Used (kWh/ property)	2000 /01 Energy Used (kWh /ML)	2000/01 Treatment Capacity (ML/a) - assumes 260 working days	2000/01 Treatment Capacity (ML/d)	2000/01 Treatment Volume (ML) (annual)
Armidale-Dumaresq*	N	24,875	4,235	5.9	3,390	0.14	286	7,600	3.48			10,920	42	
Ballina	Y	38,236	484	79.0	4,210	0.11	252	12,100	3.10	1	4	780	3	160
Bellingen*	Y	12,742	1,602	8.0	1,480	0.12	260	3,700	3.53			3,900	15	1,480
Byron	Y	29,576	567	52.2	3,070	0.10	198	9,600	3.42	1	1	1,040	4	478
Coffs Harbour*	Y	61,770	961	64.3	5,730	0.09	190	20,500	3.17			15,860	61	5690
Copmanhurst*	N	4,596	3,166	1.5	35	0.01	161	150	35.08					35
Dungog	N	8,364	2,251	3.7	770	0.09	203	1,900	4.20					
Glenn Innes	N	6,016	67	89.8	760	0.13	195	2,600	2.18	200	700	3,120	12	760
Gloucester	N	4,877	2,952	1.7	750	0.15	314	1,600	3.66	330	700	1,300	5	822
Grafton*	Y	17,395	83	209.6	2,360	0.14	185	7,200	2.61			18,200	70	7440
Great Lakes	Y	32,598	3,376	9.7				12,400	1.82					
Great Taree	Y	44,849	3,730	12.0				*16,495*	2.72					
Guyra*	N	4,446	4,408	1.0	320	0.07	270	1,100	3.79			780	3	260
Hastings	Y	65,481	3,687	17.8	6,600	0.10	204	24,200	2.78	210	750	34,320	132	6570
Kempsey	Y	27,512	3,380	8.1	5,490	0.20	395	10,300	2.80	200	700	8,632	33.2	5480
Kyogle*	N	9,766	3,589	2.7	650	0.07	243	1,600	5.75			780	3	622
Lismore	N	43,231	1,290	33.5	4,110	0.10	209	13,200	3.60	1				133
Maclean*	Y	17,062	1,049	16.3		-		*7,161*	2.38					
Muswellbrook	N	15,291	3,406	4.5	2,330	0.15	337	4,800	3.12	310	600	5,200	20	2210
Nambucca	Y	18,213	1,491	12.2	1,800	0.10	250	5,700	3.39	100	400	5,980	23	1800
Nundle	N	1,337	1,601	0.8	130	0.10	450	230	7.04			260	1	0.3
Port Stephens	Y	59,210	858	69.0				22,921	2.58					
Pristine Waters	N	10,987	6,800	1.6	600	0.05	233	*1,900*	5.78					601
Richmond Valley	Y	21,050	2,609	8.1	3,220	0.15	312	6,400	9.11			5,980	23	2570
Scone	N	9,918	4,041	2.5	1,490	0.15	244	2,700	3.76			3,120	12	1490
Severn*	N	2,908	5,575	0.5	30	0.01	119	180	18.29	90	500	520	2	30
Tenterfield*	N	6,816	7,177	0.9	570	0.08	233	1,700	3.49			2,080	8	524
Tweed	Y	74,858	1,309	57.2	9,680	0.13	240	25,000	3.15	400	1150	15,860	61	9870
Walcha	N	3,306	6,267	0.5	260	0.08	198	830	4.12	500	1650	1,300	5	261
TOTALS		**677,286**	**82,011**		**59,835**			**225,767**				**139,932**	**538**	**49,286**
Average		23,355	2,828	27	2,393	0.101	247	7,785	5.31	195	650	6,663	26	2,143
Median		17,062	2,952	8	1,490	0.100	240	5,700	3.48	200	700	3,120	12	760
Total (extrapolated/connection)					55,819		251							

Table C-7: Water Supply Information, North Coast Rivers Region

Council Name	Coast	Population	Land Area (km^2)	Population Density (pers./km^2)	Total Volume Treated Annually (ML)	Capacity (EP)	% Population able to be served	2000/01 Energy Consumption (kWh/ML)	2000/01 Energy Consumption (kWh/prop)	% Infiltration/Inflow Reported
Armidale-Dumaresq*	N	24,875	4,235	5.9	1,590					
Ballina	Y	38,236	484	79.0	3,720	39,750	0.96	500	150	
Bellingen*	Y	12,742	1,602	8.0	682	10,550	1.21			16
Byron	Y	29,576	567	52.2	2,910	29,900	0.99			
Coffs Harbour*	Y	61,770	961	64.3	6,360	70,000	0.88			19
Copmanhurst*	N	4,596	3,166	1.5	96	1,550	2.97			
Dungog	N	8,364	2,251	3.7	1,100	2,000	4.18			
Glenn Innes	N	6,016	67	89.8	718	6,000	1.00			
Gloucester	N	4,877	2,952	1.7	331			500	100	5
Grafton*	Y	17,395	83	209.6	2,130	26,100	0.67			11
Great Lakes	Y	32,598	3,376	9.7	3,900	48,362		800		17
Great Taree	Y	44,849	3,730	12.0		66,538				
Guyra*	N	4,446	4,408	1.0	350	2,200	2.02	6980		
Hastings	Y	65,481	3,687	17.8	6,940	75,000	0.87	750	225	
Kempsey	Y	27,512	3,380	8.1	2,600	17,600	1.56	300	120	
Kyogle*	N	9,766	3,589	2.7	252	4,100	2.38	300	60	17
Lismore	N	43,231	1,290	33.5	2,960	53,600	0.81	150	40	
Maclean*	Y	17,062	1,049	16.3	902	11,160	1.53			
Muswellbrook	N	15,291	3,406	4.5	1,450	23,000	0.66	800	290	3
Nambucca	Y	18,213	1,491	12.2	100	17,700	1.03	600	140	
Nundle	N	1,337	1,601	0.8		No STP				
Port Stephens	Y	59,210	858	69.0						
Pristine Waters	N	10,987	6,800	1.6	43					
Richmond Valley	Y	21,050	2,609	8.1	2,050	17,000	1.24			4
Scone	N	9,918	4,041	2.5	206	10,000	0.99			39
Severn*	N	2,908	5,575	0.5	13	500	5.82	50	20	36
Tenterfield*	N	6,816	7,177	0.9	287	2,750	2.48			
Tweed	Y	74,858	1,309	57.2	7,800	95,200	0.79	1150	382	10
Walcha	N	3,306	6,267	0.5	218	2,200	1.50	150	50	25
TOTALS		**677,286**	**82,011**		**49,708**	**632,760**				
Average		23,355	2,828	27	1,912	26,365	1.66	1,002	143	17
Median		17,062	2,952	8	1,001	17,300	1.12	500	120	17

Table C-8: Sewage Management Information, North Coast Rivers Region

Council Name	Coast	Population	Land Area (km^2)	Population Density ($pers./km^2$)	2001/02 Typical developer charges	2000/01 Average Customer Account / property	2001/02 Minimum Access Charge	2001/02 Usage Charge (>200kL or >Allowance) (c/kL)	2001/02 Access Amount (minmimum)	2001/02 Developer Charges (Typical/ET)	2000/01 Op, Main, Admin Cost / Connected Prop	2000/01 Management Cost / Connected Prop
Armidale-Dumar	N	24,875	4,235	5.9	$ 3,620	$ 409	$ 153	65	$ 235	$ 1,240	$ 555	$ 280
Ballina	Y	38,236	484	79.0	$ 1,350	$ 238	$ 91	70	$ 330	$ 4,200	$ 511	$ 151
Bellingen*	Y	12,742	1,602	8.0	$ 5,500	$ 279	$ 194	57	$ 410	$ 6,990	$ 420	$ 118
Byron	Y	29,576	567	52.2	$ 4,900	$ 318	$ 93	87	$ 429	$ 5,230	$ 657	$ 228
Coffs Harbour*	Y	61,770	961	64.3	$ 2,890	$ 311	$ 168	114	$ 486	$ 2,400	$ 470	$ 173
Copmanhurst*	N	4,596	3,166	1.5	$ 690	$ 358	$ 250	90	$ 600	$ 3,850	$ 943	$ 348
Dungog	N	8,364	2,251	3.7	$ 2,650	$ 359	$ 264	115	$ 310	$ 2,870	$ 354	$ 140
Glenn Innes	N	6,016	67	89.8		$ 370	$ 269	117	$ 250		$ 326	$ 137
Gloucester	N	4,877	2,952	1.7	$ 1,140	$ 340	$ 350	100	$ 346	$ 1,660	$ 462	$ 118
Grafton*	Y	17,395	83	209.6		$ 206	$ 134	50	$ 380		$ 516	$ 165
Great Lakes	Y	32,598	3,376	9.7	$ 3,500	$ 389	$ 190	59	$ 450	$ 3,800		
Great Taree	Y	44,849	3,730	12.0								
Guyra*	N	4,446	4,408	1.0	$ 555	$ 337	$ 214	73	$ 470		$ 424	$ 161
Hastings	Y	65,481	3,687	17.8	$ 3,200	$ 400	$ 175	77	$ 462	$ 2,800	$ 393	$ 128
Kempsey	Y	27,512	3,380	8.1	$ 3,500	$ 376	$ 400	66	$ 445	$ 3,120	$ 468	$ 151
Kyogle*	N	9,766	3,589	2.7	$ 1,000	$ 311	$ 242	63	$ 242	$ 1,000	$ 463	$ 196
Lismore	N	43,231	1,290	33.5	$ 3,100	$ 254	$ 84	85	$ 317	$ 4,120	$ 427	$ 77
Maclean*	Y	17,062	1,049	16.3					$ 416	$ 3,180		
Muswellbrook	N	15,291	3,406	4.5	$ 2,370	$ 285	$ 95	60	$ 298	$ 4,290	$ 609	$ 114
Nambucca	Y	18,213	1,491	12.2	$ 3,110	$ 221	$ 145	65	$ 394	$ 1,830	$ 373	$ 145
Nundle	N	1,337	1,601	0.8		$ 410	$ 470	156			$ 396	$ 34
Port Stephens	Y	59,210	858	69.0								
Pristine Waters	N	10,987	6,800	1.6	$ 2,520	$ 408	$ 180	50	$ 650	$ 1,700	$ 233	$ 55
Richmond Valley	Y	21,050	2,609	8.1	$ 2,130	$ 208	$ 116	40	$ 385	$ 4,400	$ 526	$ 220
Scone	N	9,918	4,041	2.5	$ 2,560	$ 351	$ 186	80	$ 290	$ 2,080	$ 500	$ 181
Severn*	N	2,908	5,575	0.5		$ 250	$ 211	45	$ 475		$ 206	$ 69
Tenterfield*	N	6,816	7,177	0.9	$ 1,500	$ 395	$ 243	64	$ 279	$ 1,500	$ 592	$ 211
Tweed	Y	74,858	1,309	57.2	$ 3,840	$ 236	$ 220	73	$ 405	$ 3,220	$ 406	$ 154
Walcha	N	3,306	6,267	0.5		$ 450	$ 295	80	$ 250		$ 545	$ 122
TOTALS		**677,286**	**82,011**									
Average		23,355	2,828	27	$ 2,649	$ 326	$ 209	77	$ 385	$ 3,118	$ 471	$ 155
Median		17,062	2,952	8	$ 2,650	$ 339	$ 192	72	$ 390	$ 3,120	$ 463	$ 151
Weighted Average					$3,175					$3,278	$619	

Table C-9: Costs of Water Services

APPENDIX D – LOCAL GOVERNMENT AREAS

1. Armidale-Dumaresq*
2. Ballina
3. Bellingen*
4. Byron
5. Coffs Harbour*
6. Copmanhurst*
7. Dungog
8. Glenn Innes
9. Gloucester
10. Grafton*
11. Great Lakes
12. Great Taree
13. Guyra*
14. Hastings
15. Kempsey
16. Kyogle*
17. Lismore
18. Maclean*
19. Muswellbrook
20. Nambucca
21. Nundle
22. Port Stephens
23. Pristine Waters
24. Richmond Valley
25. Scone
26. Severn*
27. Tamworth
28. Tenterfield*
29. Tweed
30. Walcha

* indicates councils covered in the HRC Clarence River System Inquiry

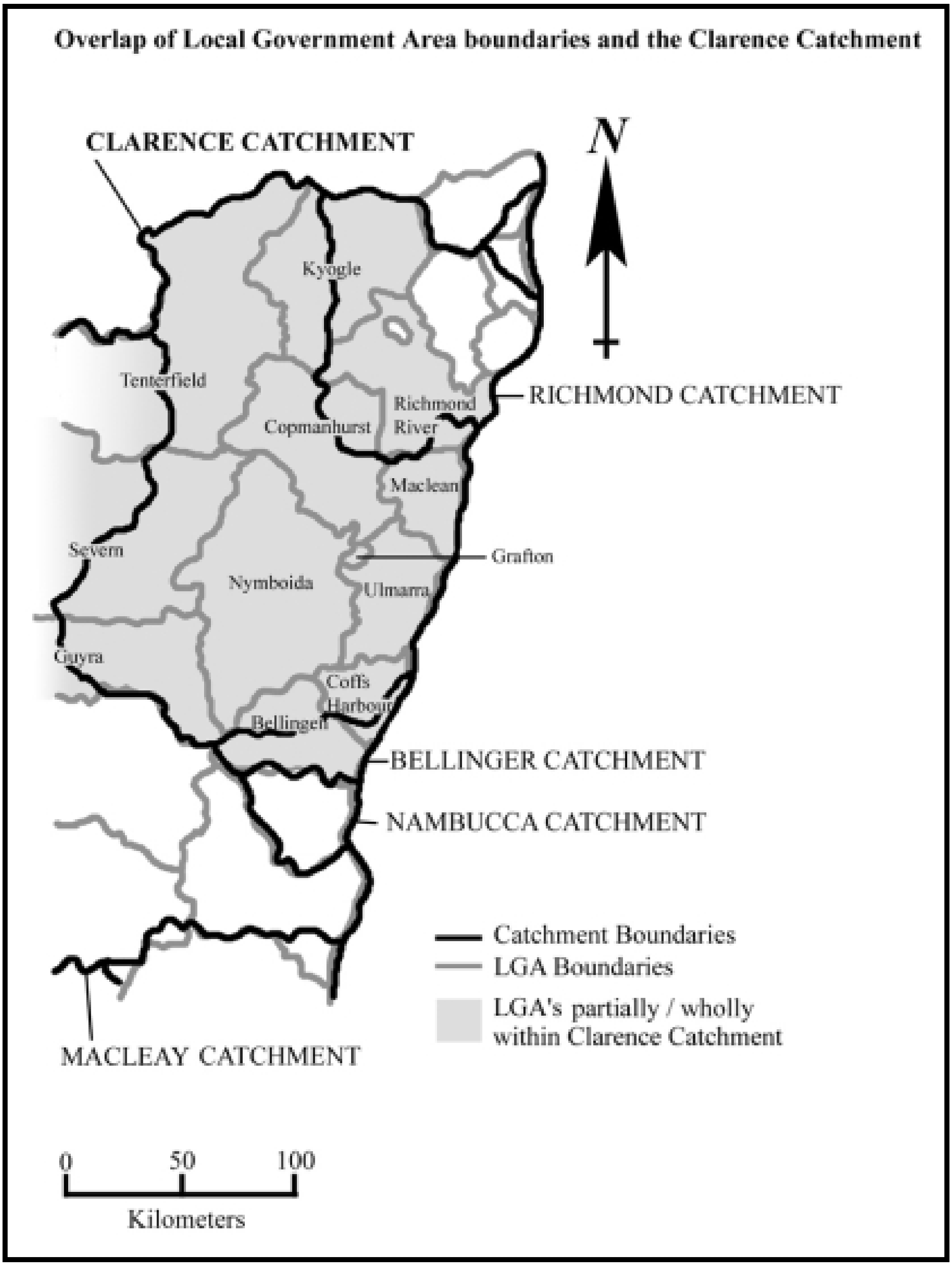

Figure D-1: Extract from Map of Study Area – Clarence Catchments & LGA Overlaps