NSW Department of Commerce

NSW Water Solutions

Nambucca Shire Council
Integrated Water Cycle Management Strategy
Draft Report

Date: May 2009

Draft Version 3b

Forward

The Nambucca Shire Integrated Water Cycle Management (IWCM) Strategy has been prepared by the NSW Department of Commerce using the IWCM guidelines developed by the NSW Department of Water and Energy. This study has demonstrated that an integrated planning and management of the urban water services delivers significant environmental, social and economic benefits compared to the traditional approach.

Commerce acknowledges the significant contribution made by Richard Spain of Nambucca Shire Council and Glenn George of NSW Department of Water and Energy.

Commerce also acknowledges the valuable contribution made by the Project Reference Group members.

The core Department of Commerce project team members involved in the preparation of this document were:

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Glossary

ABS	Australian Bureau of Statistics
ADWF	Average Dry Weather Flow
ASR	Aquifer Storage and Recovery
BAU	Business as Usual
Commerce	The NSW Department of Commerce
DECC	The NSW Department of Environment and Climate Change
DEUS	The former New South Wales Department of Energy Utilities and Sustainability
DSS	Decision Support System
DTM	Demand Tracking Model
DWE	The NSW Department of Water and Energy
EP	Equivalent Population
ET	Equivalent Tenements
GIS	Geographical Information System
HHS	Household Size
IDEA	Intermittently Decanted Extended Aeration
ILI	Infrastructure Leakage Index
IWCM	Integrated Water Cycle Management
LEP	Local Environmental Plan
LGA	Local Government Area
LWU	Local Water Utility
MLSS	Mixed Liquor Suspended Solids
MR1	Macksville Reservoir 1
NR1	Nambucca Reservoir 1
NRW	Non-Revenue Water
NSC	Nambucca Shire Council
NSW	New South Wales
NWSS	Nambucca Water Supply Scheme
OSS	On-site Systems
PDWF	Peak Dry Weather Flow
POEOA	Protection of Environmental Operations Act
PRG	Project Reference Group
PWWF	Peak Wet Weather Flow
RWT	Rainwater Tank
SBP	Strategic Business Plan
SMP	Stormwater Management Plan
SMR	South Macksville Reservoir
SPS	Sewer Pump Station
STP	Sewage Treatment Plant
TBL	Triple Bottom Line
TF	Trickling Filter
UFW	Unaccounted for Water
WMA 2000	Water Management Act 2000
WSUD	Water Sensitive Urban Design

Part A
Introduction

Part A provides an overview of the Integrated Water Cycle Management study process, the tasks that have been completed and the current status of the tasks ahead required to ensure that the future management of the urban water cycle is both sustainable in the long term and meets community expectations.

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1 Introduction

1.1 Overview

Water is a precious natural resource for the maintenance of ecosystems and human activities. NSW is now at the limits of its available water resources and there is clear evidence of the degradation of our rivers, groundwater, and estuaries. In response, new water legislation has been introduced in NSW to provide for the sustainable and integrated management of the water sources of the State for present and future generations.

Integrated water cycle management (IWCM) planning by local water utilities (LWU) is a way of managing the urban water cycle in which all parts of the water system are integrated so that water is used efficiently and optimally. This efficient and optimal use should result in minimal impact on the water resource and on other resources and users. For a LWU this means that the three main urban services – water supply, sewerage and stormwater – should be planned and managed in an integrated manner to ensure that the maximum value is obtained from the resource and that an appropriate return to the environment is maximised. Integration also means that local water management is integrated with other human waste management and recycling processes such as garbage removal, and various external elements. These elements can include global issues such as the greenhouse effect, natural processes within the catchment areas, Commonwealth and State policies, neighbouring LWU and the community.

1.2 The IWCM Planning Process

The IWCM planning process is based on three simple questions:

- **"What is the issue?"** relates to the impact of the environment (natural, built and operating) upon water service delivery and the impact of water service delivery upon the environment. To answer this question it is necessary to understanding the operating environment, relevant industry benchmarks, and business objectives of the LWU and the current performance of the water services.
- **"How do we fix the issue?"** looks at addressing water management problems and requires an understanding of State Government water reform policies. These policies describe key water management issues and the appropriate management responses to them. Since there is more than one management option to fix the problem, a balanced outcome planning process is used to select the best overall option.
- The last question **"How do we know the issue is fixed?"** is the process by which we confirm that all impacts are managed to the desired level and water use is optimised using social, economic and environmental objectives.

The balanced outcomes planning process aims to give equal weight to each of the three parts of the triple bottom line (environment, social and economic) when choosing new management options. The six steps of balanced outcome planning are:

1. Setting goals in each of the environmental, social and economic categories;
2. Identifying management opportunities to control the issues;
3. Coarse screening of management opportunities using constraints mapping, feasibility, etc. criteria;

4. Economic analysis and ranking of the short-listed management options based on economic criteria;

5. Bundling the management options into scenarios to achieve the goals; and

6. Examining trade-offs and revising goals as appropriate to meet community expectations.

1.3 Principles of IWCM

IWCM is based on the following set of guiding principles:

1. Consideration of all water sources (including effluent and stormwater) in water resource planning;

2. Consideration of all water users (including the environment);

3. Sustainable and equitable use of all water sources;

4. Integration of water uses and natural water processes; and

5. A whole of catchment integration of natural resource use and management.

1.4 Background to Nambucca Shire Council's IWCM Plan

Nambucca Shire's water supply, sewerage and stormwater infrastructure requires upgrading to meet population growth, legislative and best practice standards. Therefore to address the current and emerging issues within a catchment context, it was decided to holistically review and evaluate how the urban water cycle in Nambucca Shire could be improved. Thus this strategy would be used to demonstrate that improved management of the 'urban footprint' can help achieve NSC's strategic business objectives, State resource policy objectives and community expectations for natural resource management. Importantly, the IWCM Strategy is:

- Driven by the local community and has whole of government support;
- Holistic and comprehensive;
- Long term in its horizon, (30 years), but should be reviewed every 6 years;
- Flexible to accommodate future uncertainties;
- Economically, environmentally and socially responsible.

1.5 Nambucca Shire's Progress So Far

The IWCM planning process for Nambucca began in early 2006 with the first stage of the study (The Concept Study) being completed in September 2006. The Concept Study identified the IWCM issues and provided a list of management opportunities that may be used to control these issues in the second stage of the IWCM study process. The issues were ratified and prioritised by the PRG in a workshop session held prior to the finalisation of the Concept Study report.

Council, based on the recommendation of the Concept Study report, proceeded in mid 2007 to undertake the various tasks in the second stage of the IWCM process. Figure 1.1 shows these tasks and where this report, referred to as the IWCM Strategy, fits within the overall process.

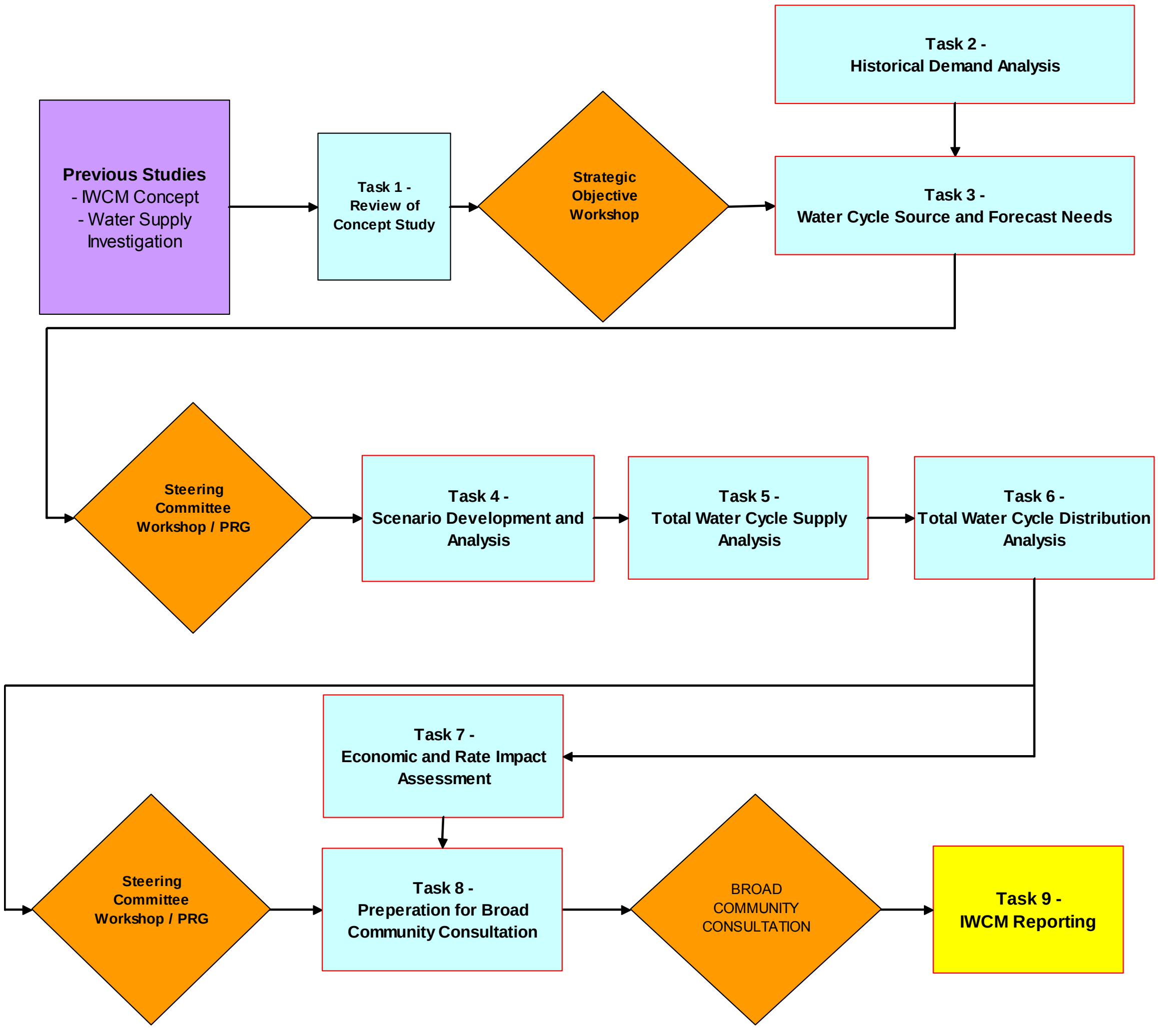

Figure 1.1 Nambucca IWCM Strategy Study Process

As shown in Figure 1.1, all the tasks except for 'Broader Community Consultation' and the Final IWCM Strategy report have been completed. This Draft IWCM Strategy report has been put together to facilitate the broader community consultation process. Thus this draft report contains a summary of all outcomes from previous tasks and an assessment and ranking of the IWCM Scenarios using the TBL criteria developed by the PRG. The final IWCM Strategy report will incorporate the feedback received from the community and stakeholders.

1.6 Where To From Here?

As indicated earlier the Draft IWCM Strategy will be finalised based on the feedback received during the broader consultation. Parts D and E of this report provide a summary plan as to how Nambucca's IWCM Strategy will be delivered in the future along with a time frame for the various delivery stages.

Part B
What is Nambucca's Profile?

Part B provides an outline of Nambucca LGA, the study area, and a description of the existing water supply, sewerage and urban stormwater services within the study area.

2 Description of Nambucca Shire

2.1 Overview

Nambucca Shire is located on the Mid North Coast of NSW approximately 530 km north of Sydney and about 150 km south of Coffs Harbour. The urban centres within Nambucca Shire are Nambucca Heads, Valla Beach, Hyland Park, Macksville, Scotts Head and Bowraville.

2.2 Water Catchments

The majority of the Nambucca Shire's urban areas are located within the Nambucca River Coastal sub-catchment, with the exception of Valla Beach, which lies within the Lower Deep Creek sub-catchment.

The Nambucca River extends from its headwaters in the north west of the Shire through to its confluence with the Pacific Ocean, some 100 km downstream, adjacent to Nambucca Heads. Two main tributaries of the Nambucca River are Warrell Creek, which drains the south-eastern section of the Shire, and Taylors Arm, which drains the south western section. The intermittently closed and opening lagoons (ICOL) of Deep Creek and Oyster Creek drain relatively small catchments in the north east of the LGA. A map showing the study area, the LGA and the catchment is presented in Figure 2.1.

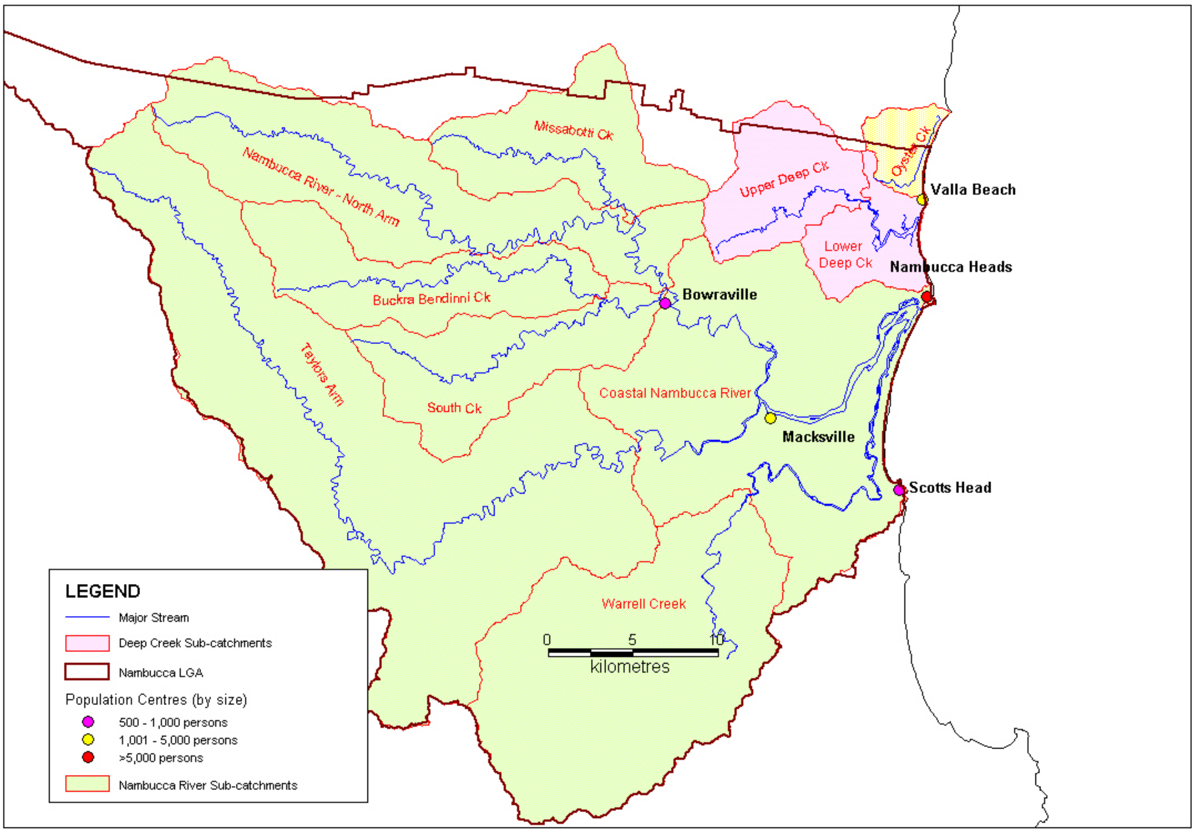

Figure 2.1 The Water Sub-Catchments of Nambucca LGA

The Bowraville Borefield, which supplies the majority of the LGA with potable water, is located within the North Arm Nambucca River sub-catchment. Nambucca Heads is situated on the northern side of the Nambucca River, close to where the Nambucca River empties into the Pacific Ocean. Macksville, which is the other main centre of the LGA, is located on the Nambucca River, some 12.6 km upstream of Nambucca Heads. Macksville is the administrative centre of Nambucca LGA, containing the Nambucca Shire Council (NSC) Chambers. The village of Bowraville is located near the confluence of South Creek and Nambucca River. The coastal village of Valla Beach is located to the north of Nambucca Heads, at the mouth of Deep Creek. Valla Beach is located in the Lower Deep Creek sub-catchment. Finally, the coastal village of Scotts Head is located near the southern border of the Nambucca LGA with Kempsey LGA. Scotts Head is located in the Coastal Nambucca sub-catchment, nestled between the Pacific Ocean and Warrell Creek.

2.3 Historical Nambucca River Flows

Figure 2.2 shows the flow duration curve for Nambucca River at Bowraville Stream Gauge 205006, located 1 km downstream of the extraction point for the district water supply scheme. Figure 2.2 shows the seasonal nature of Nambucca River flows best indicated between the 80th percentile flows of September (15.8 ML/d) and March (75.8 ML/d), while the 80th percentile flow for the entire record is 34.3 ML/d.

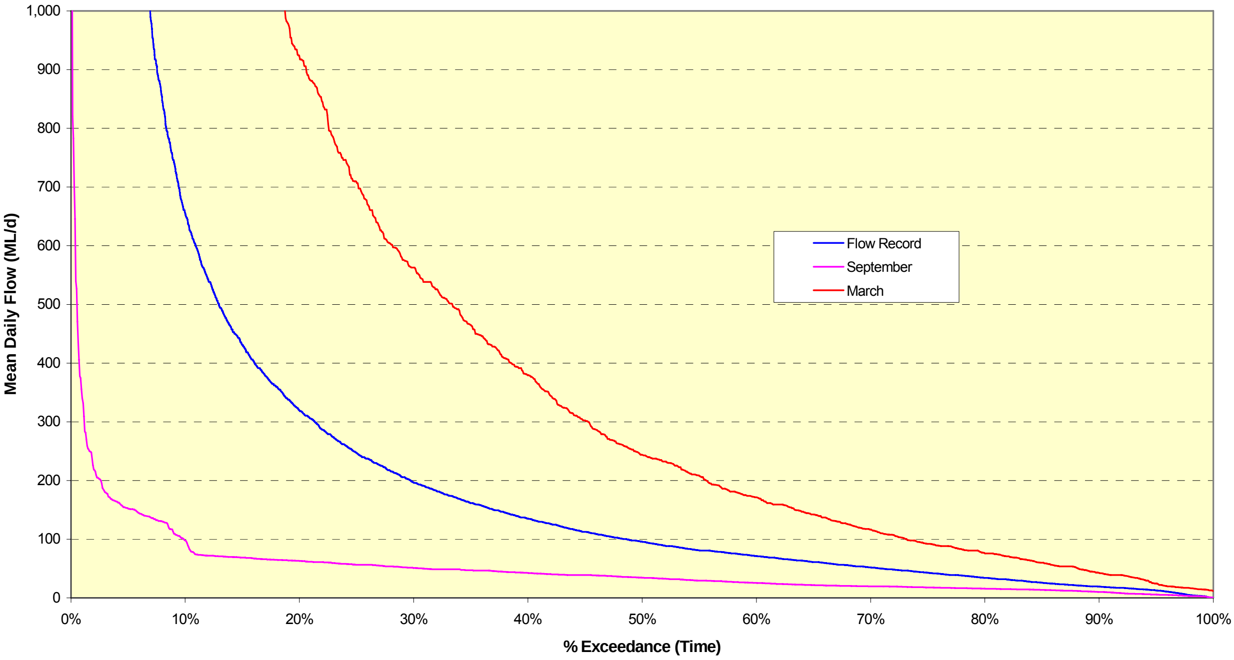

Figure 2.2 Flow Duration Curve for Nambucca River @ Bowraville 205006

2.4 Population Growth Overtime

ABS census records show that the Nambucca LGA has been experiencing a steady population growth and that the population has tripled since the 1960's. Typical to most coastal centres in NSW, the 1980's exhibited strong growth peaking at about 4.8% per annum in 1986 mainly due to migration of retirees into the shire. The last decade was characterised by slow but positive growth of about 0.1% per annum (ABS 2002) between 1996 and 2001. However the development boom that commenced in late 2001 saw a significant increase in annual growth resulting in a 2006 census population of about 18,219. NSC has estimated the ultimate population to be about 49,500 based on the occupation of vacant land and future urban expansion (SOE 2005).

Nambucca Heads is the largest population centre of the Shire with a population more than twice that of the next largest town (Macksville). Nambucca Heads' population shrunk slightly in the period 1996 – 2006, but previous to this the town had experienced strong population growth. Much of the growth within the Shire is occurring in the coastal areas of Nambucca Heads, Valla Beach and Scotts Head, however Macksville has also been targeted for future urban growth with a Development Control Plan (DCP) finalised in 2005 in order to manage urban residential development.

Nambucca Shire has experienced moderate growth in rural residential lots and dwellings, with 128 rural residential dwellings approved in the period 1998-2003 (SOE 2004). A large proportion of this growth has occurred within the Kingsworth area to the south of Nambucca Heads.

In common with the rest of the state, Nambucca Shire's dwelling growth rate has exceeded that of population. The high proportion of unoccupied dwellings in some urban centres is significant (e.g. 32% in Scotts Head), which reflects the high proportion of holiday homes in the coastal settlements.

Year 2007 populations were established for water supply, wastewater and stormwater by matching customer billing database assessments and connections on a spatial basis with 2006 Census household sizes (HHS). Table 2.1 shows the 2007 connected population for urban water services while Table 2.2 shows the same information for equivalent tenements. The Task 3 Paper (Ref. 4) contains more detailed analysis with population and tenements distributed into reservoir zones (water supply), sewer pump station catchments (wastewater) and stormwater sub-catchments.

Table 2.1 2007 Permanent Population Served by Urban Water Services

Location	Permanent Residential Population Served			
	Water Supply	Reticulated Sewerage	On-Site Systems	Stormwater[1]
Bowraville	992	992	0	992
Macksville	2,705	2,580	187[3]	2,705
Nambucca Heads	5,984	5,876	108[3]	5,984
Valla Beach[2]	1,486	1,481	5[3]	1,486
Scotts Head	804	804	0	804
Rural	1,069	0	1,069[3] 5,179[4]	257[5]
Total	13,040	11,733	6,548	12,228

1. Stormwater populations were established using sub-catchments defined in the Nambucca Heads Stormwater Management Plan plus some additional catchments for Nambucca and Kingsworth
2. Includes Hyland Park
3. Connected to water supply
4. Not connected to water supply
5. Kingsworth only
6. Numbers in **Error! Reference source not found.** have been corrected (1.8%) for traditional undercounting of Census data (Ref. 3)

Table 2.2 2007 Permanent Equivalent Tenements Served by Urban Water Services

Location	Permanent Residential Tenements Served			
	Water Supply	Reticulated Sewerage	On-Site Systems	Stormwater[1, 6]
Bowraville	349	362	0	407
Macksville	996	990	61[3]	1,138
Nambucca Heads	2,302	2,469	34[3]	3,169
Valla Beach[2]	557	611	2[3]	673
Scotts Head	340	335	0	534
Rural	335	0	335[3] 2,703[4]	124[5]
Total	4,879	4,767	3,135	6,045

1. Stormwater populations were established using sub-catchments defined in the Nambucca Heads Stormwater Management Plan plus some additional catchments for Nambucca, Macksville, Valla Beach and Kingsworth
2. Includes Hyland Park
3. Connected to water supply
4. Not connected to water supply
5. Kingsworth only
6. Residential stormwater ET have been set to total dwellings as reported for 2006 Census

2.5 Climate

Nambucca LGA is generally considered to be semi-tropical with summer dominant rainfall. The average daily maximum temperature is around 23.2^{o}C, while the daily minimum temperature is around 14^{o}C. Long-term average annual rainfall over the estuary area is between 1,300 mm and 1,400 mm. Annual rainfall typically ranges from 1,300 mm to 1,600 mm in the northern and eastern section of the high ridge country and between 1,200 mm and 1,600 mm to the south and west along Taylor's Arm. Annual pan evaporation is estimated to range from 1,650 mm at Bowraville to 1,200 mm in the upper Nambucca catchments.

2.6 Soil and Geology

The main geological feature of the Nambucca study area is the Nambucca block, which consists of slate, phyllite, schistose sandstone, schistose conglomerate and basic volcanics. Other features include alluvial, paludal and estuarine deposits. Much of the urban and agricultural development of the shire is undertaken on the Nambucca River floodplain. Approximately 76 km^2 (5.1% of the LGA) of the floodplain is underlain by potential acid sulphate soils (PASS).

2.7 Land Use and Economic Activity

Much of the original vegetation of the Nambucca catchments has been cleared (approximately 15% of the study area). Rainforest areas were logged by the timber industry in the 1830s and later cleared for cropping and cattle grazing. Much of the original riparian vegetation of the areas has also been removed for grazing and the installation of flood mitigation works, or impacted by logging. This not withstanding, approximately 39% of the study area is covered by either National Parks or State Forest (NPWS GIS dataset).

Nambucca Shire Land Use Data:

Primary Land Use:	State Forest (355 km^2)
Major Agriculture Types:	Banana Growing Grazing Macadamia Nut
Annual value of Agriculture:	$18.8 million
Major Industries:	Extractive Industry, Tourism, Forestry
National Parks & State Forests:	NP 17% of Study Area (238 km^2) SF 22% of Study Area (313 km^2)
Urban Development:	9.5 km^2
Catchment Planning:	Mid North Coast Catchment Integrated Catchment Management Plan (2002)

The shire includes over 100 ha of freshwater wetlands and over 1,850 ha of estuarine wetlands. Large areas near the coast are SEPP No. 14 Coastal Wetlands, especially where Nambucca River and Deep Creek empty into the Pacific Ocean.

Agriculture is one of the major land uses in the shire with 23% of the Nambucca LGA dedicated (NSC SoE, 2004) to this pursuit. Major agricultural activities include banana growing, the macadamia industry and intensive animal production. Other industries that provide local employment include forestry, aquaculture (oyster farming in the Nambucca estuary), meat rendering, cement works and sand mining.

Tourism is a major and growing industry for Nambucca Shire. During peak Christmas holiday periods the population of Scotts Head, Nambucca Heads and Valla Beach increases significantly. Key attractions to the area for tourists include its natural beauty, unpolluted beaches, low scale development, recreational fishing opportunities, water sports activities and nature reserves.

The urban area represents 1.5% of the study area and consists primarily of medium residential development and associated light commercial/industrial development.

3 Description of Nambucca's Urban Water Services

3.1 Overview

The majority of residents as well as commercial and industrial premises within the urban centres are provided with water supply, sewerage and stormwater services. NSC owns, operates and manages these services and the associated assets on behalf of the local community and the community pays a rate for this service.

The majority of the rural population have their own on-site water supply and sewerage systems and hence do not pay urban water service rates to NSC. These rural communities, however, depend on NSC's water supply system during dry/drought periods and on NSC's sewerage systems to dispose of the septic sludge. When these rural communities access NSC's water supply and sewerage systems they are charged at the point of access.

3.2 Water Supply System

There is one main water supply system in the Nambucca Shire, that being the Nambucca District Water Supply (NDWS) scheme. The NDWS Scheme was constructed in 1953 and serves all the urban centres within the Study Area. The water prior to distribution to customers is adequately buffered with lime and carbon dioxide, disinfected with chlorine and fluoridated to minimise dental caries. The scheme compromises of:

- Bowraville Borefield (containing 8 bores with a maximum pumping capacity of 23.4 ML/d) in the Nambucca River Alluvium;
- Water treatment facilities consisting of a 0.16 ML collection tank and chemical dosing facilities consisting of lime, carbon dioxide, fluoride and chlorination;
- A 13.4 ML/d pumping station pumps capable of transferring the water through 3 km of 450 mm MSCL rising main to two balance tanks to the east of Bowraville with a combined capacity of 1.45 ML;
- Water gravitates from the Bowraville balance tanks to either Nambucca reservoirs, of which there are three (combined capacity 11.2 ML), or Macksville reservoirs, of which there are three (combined capacity 6.0 ML).
- A 1.3 ML/d capacity booster pump station downstream of the South Macksville Reservoir services Scotts Head reservoir (1.4 ML capacity) during periods of high demand. All other times Scotts Head is served via gravity flow.
- Water gravitates from the Nambucca Heads reservoirs to the Valla Beach service reservoir (2.0 ML capacity);
- An off-take from the Bowraville balance tank rising main serves the Bowraville service reservoir (1.3 ML reservoir); and
- A 690 kL concrete reservoir serves the rural residential estate of Kingsworth.

Figure 3.1 outlines the major components and layout of the NDWS Scheme. The rural properties along the pipeline route are also connected to the NDWS Scheme.

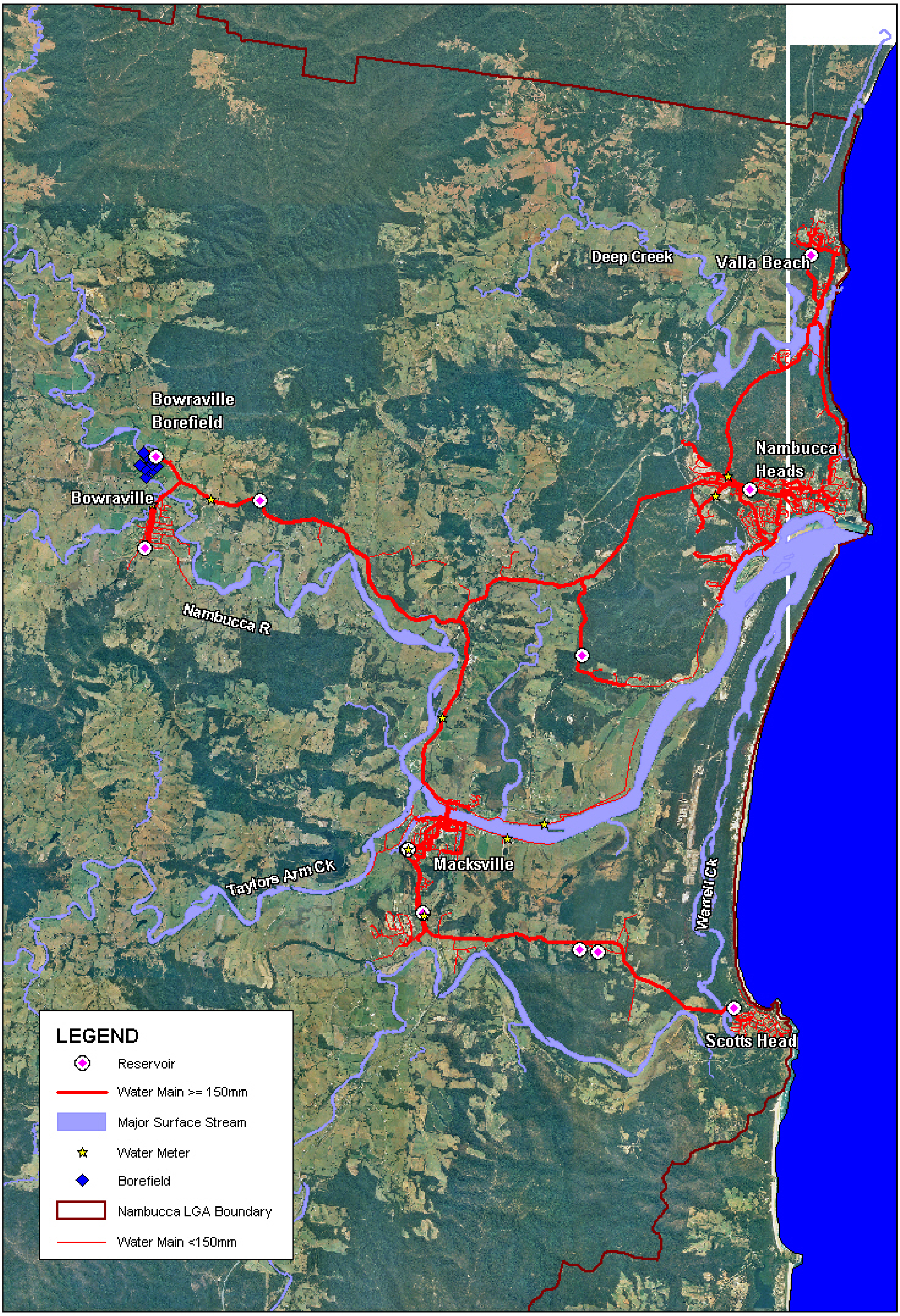

Figure 3.1 Nambucca District Water Supply Scheme

3.3 Sewerage Schemes

3.3.1 Overview

There are four sewerage schemes servicing each of the main urban centres. These systems are described in the sections below.

3.3.2 Bowraville Sewerage Scheme

The entire Bowraville population is served by the Bowraville Sewerage Scheme consisting of a centralised 1,200 EP trickling filter (TF) STP achieving secondary treated effluent. Bowraville STP and the sewer network were originally built in 1968 and in the 1990s effluent reuse facilities were added. All effluent gravitates to a wet-weather storage adjacent to the STP. 100% of ADWF is reused on a nearby dairy farm for pasture irrigation. The effluent is disinfected with chlorine prior to reuse. Overflows from the wet-weather storage are discharged into the Nambucca River. All properties connected to the Bowraville Sewerage Scheme drain within a single sewer pump station (SPS) catchment. The Bowraville Sewerage Scheme is shown in Figure 3.2

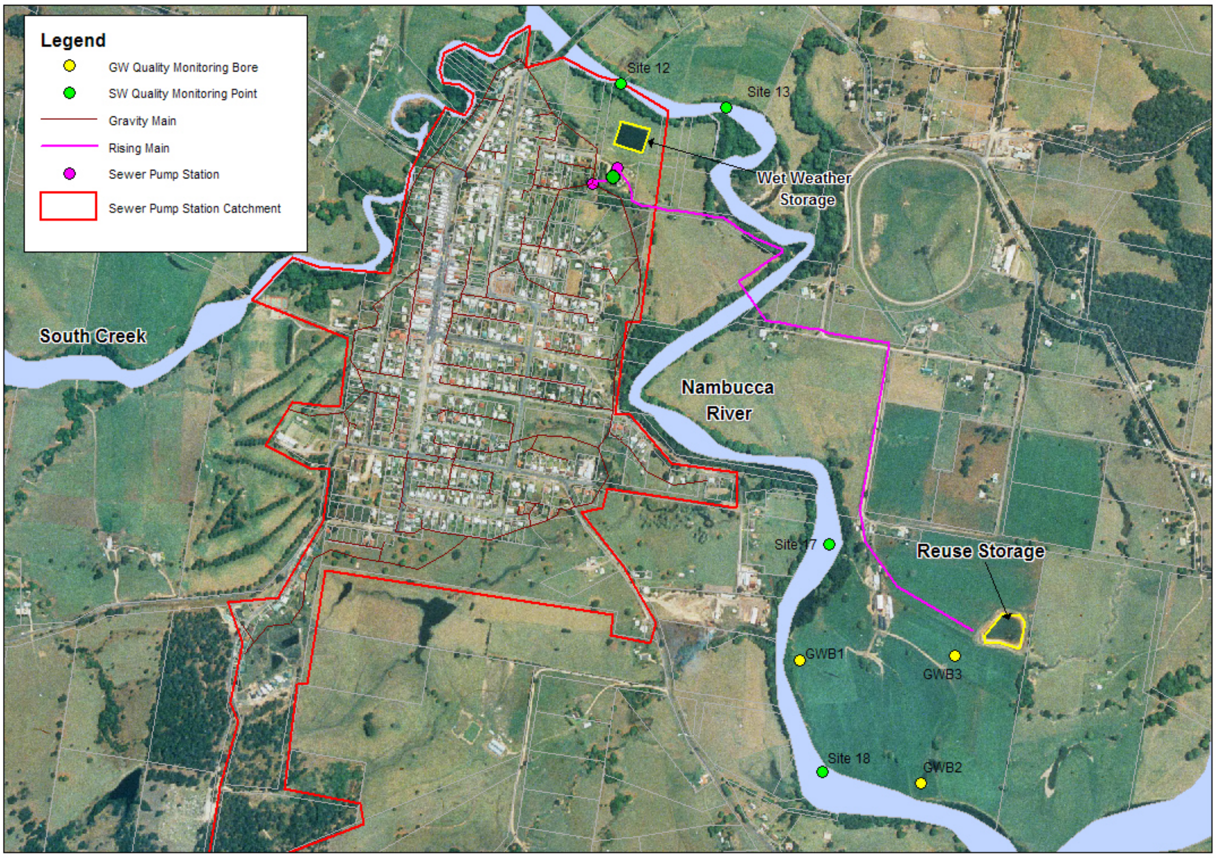

Figure 3.2 Bowraville Sewerage Scheme

3.3.3 Macksville Sewerage Scheme

The majority of Macksville residents are served by the Macksville Sewerage Scheme consisting of a centralised 5,500 EP Intermittently Decanted Extended Aeration (IDEA) STP. Two stage chemical dosing is employed before and after the reactor to reduce phosphorous levels to meet sensitive waters criteria. Following UV disinfection, the effluent is discharged to the Nambucca River and there is currently no reuse of effluent.

Properties connected to the Macksville Sewerage Scheme drain into one of 14 SPS catchments. There are a number of properties within the Macksville urban area that are connected to the NWSS but not connected to the Macksville Sewerage Scheme. The Nambucca River Tourist Park (North Macksville) pumps effluent through a private line into SPS 1 while the Macksville Showground and two adjacent rural properties (North West of Macksville) also pump through a private line and discharge into SPS 2 (personal communication with Richard Spain). Two SPS pump into the Macksville STP; SPS 8 and SPS9 while an additional two SPS (15 and 16) are proposed to account for urban expansion in South-West Macksville. The Macksville Sewerage Scheme is shown in Figure 3.3.

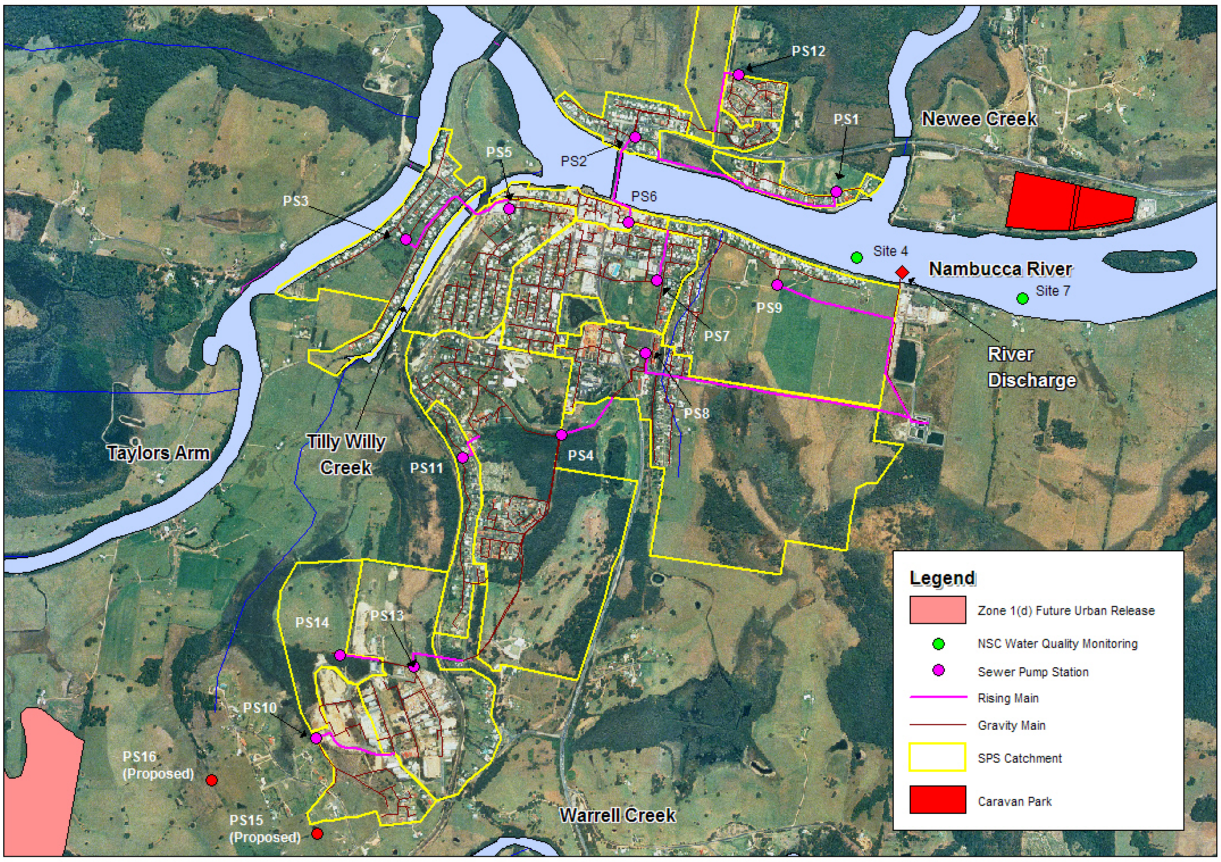

Figure 3.3 Macksville Sewerage Scheme

3.3.4 Scotts Head Sewerage Scheme

All of Scotts Head residents are served by the Scotts Head Sewerage Scheme consisting of a centralised 2,000 EP Pasveer Channel STP. Secondary treated effluent is currently discharged to exfiltration beds adjacent to Warrell Creek. The effluent is currently not disinfected and there is currently no reuse from the Scotts Head STP.

Properties connected to the Scotts Head Sewerage Scheme drain into one of 8 SPS catchments. SPS1 pumps into Scotts Head STP. The Scotts Head Sewerage Scheme is shown in Figure 3.4.

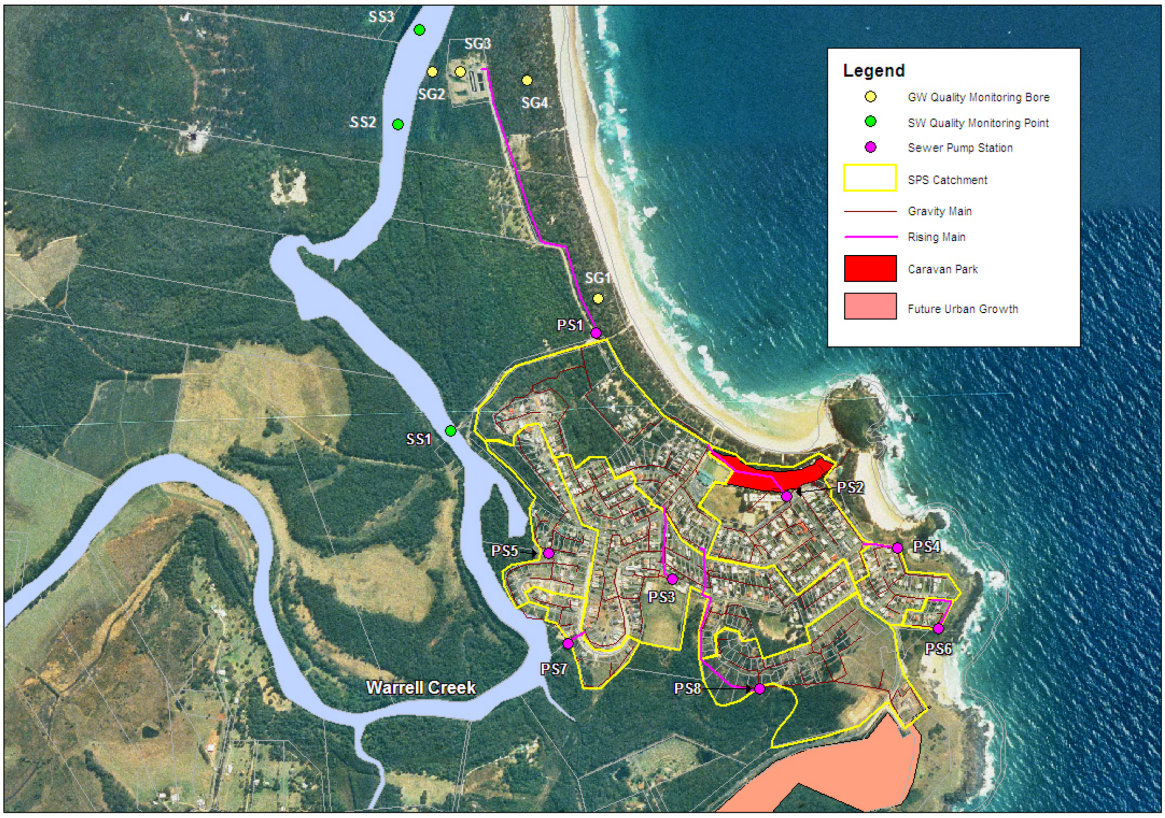

Figure 3.4 Scotts Head Sewerage Scheme

3.3.5 Nambucca Head and Valla Beach Sewerage Scheme

The majority of Nambucca Heads' residents are served by the Nambucca Heads Sewerage Scheme consisting of a centralised 10,000 EP STP. A 5,000 EP TF and a 5,000 EP IDEA unit operate together to give the 10,000 EP capacity. Tertiary treated effluent is currently discharged via overflow from treatment ponds into a forest swamp upstream of SEPP14 Wetland No. 359 and Deep Creek. The effluent undergoes passive or natural disinfection in the treatment ponds prior to discharge. There is currently no reuse from the Nambucca Heads STP. The Nambucca Heads Sewerage Scheme also serves the residents of Valla Beach and Hyland Park.

Properties within Nambucca Heads connected to the Nambucca Heads Sewerage Scheme drain into one of 15 SPS catchments. There are a number of properties within the Nambucca Heads urban area that are connected to the NWSS but not connected to the Nambucca Heads Sewerage Scheme. Two SPS pump into the Nambucca Heads STP from the Nambucca Heads component of the sewerage network; SPS4 and SPS8. The Nambucca Heads component of the Nambucca Heads Sewerage Scheme is shown in Figure 3.5. Kingsworth is not connected to any sewerage scheme but instead is served by OSS.

Properties within the Valla Beach urban that are connected to the Nambucca Heads Sewerage Scheme drain into one of 14 SPS catchments. There are a small number of properties within Valla Beach (especially the area north of Oyster Creek) that are connected to the NWSS but not connected to the Nambucca Heads Sewerage Scheme. SPS5 transfers the Valla Beach sewage across Deep Creek to SPS7 at Hyland Park. Hyland Park has 3 SPS catchments contributing to SPS7. The combined sewage is transferred to Nambucca Heads STP from SPS7. The Valla Beach urban area component of the Nambucca Heads Sewerage Scheme is shown in Figure 3.6.

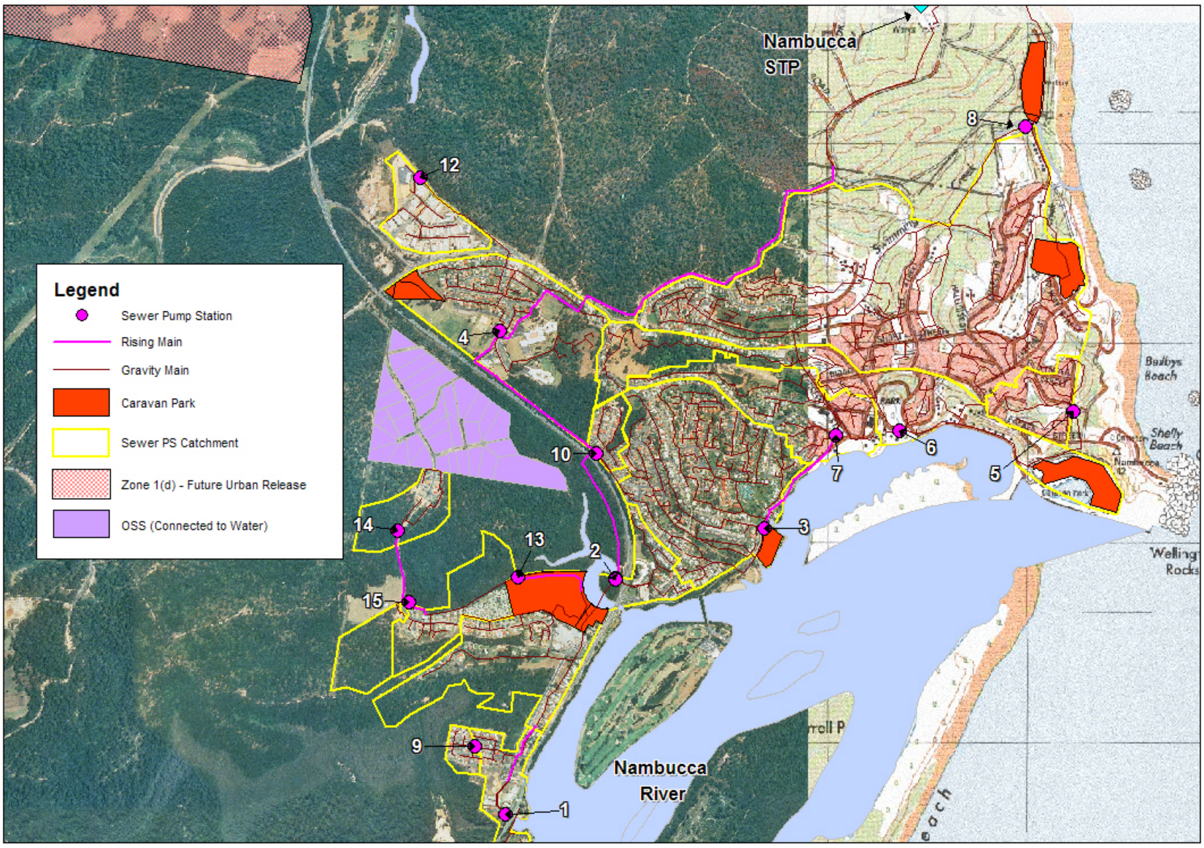

Figure 3.5 Nambucca Heads Sewerage Scheme – Nambucca Head Network

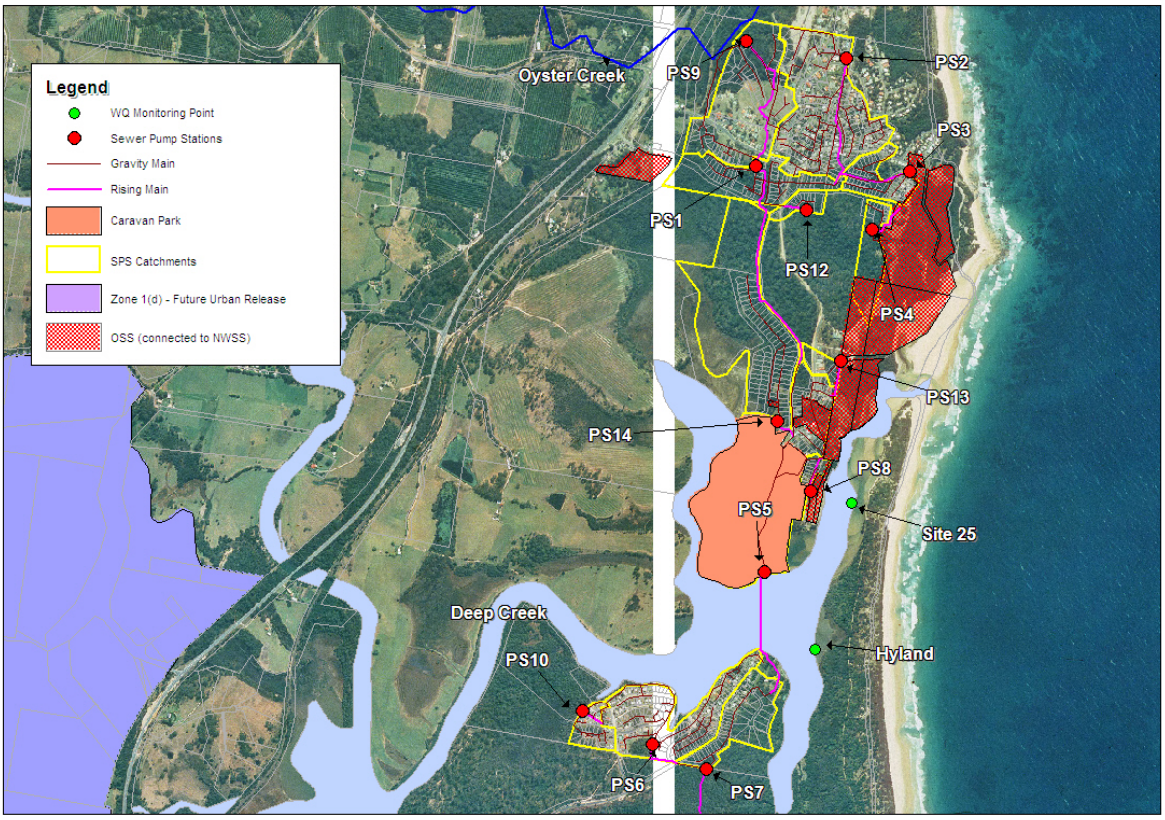

Figure 3.6 Nambucca Heads Sewerage Scheme – Valla Beach Network

3.4 Urban Stormwater Systems

3.4.1 Overview

The urban stormwater system servicing each of the main urban centres is described in the sections below.

3.4.2 Bowraville Stormwater System

The stormwater network at Bowraville consists of a network of concrete gutters and pipes which all discharge into the Nambucca River or South Creek (Ref. 15). Before discharging into these waterways, the majority of stormwater from Bowraville drains through agricultural lands which include a combination of grassed channels and small creeks. There are four stormwater sub-catchments within the town of Bowraville as can be seen in Figure 3.7.

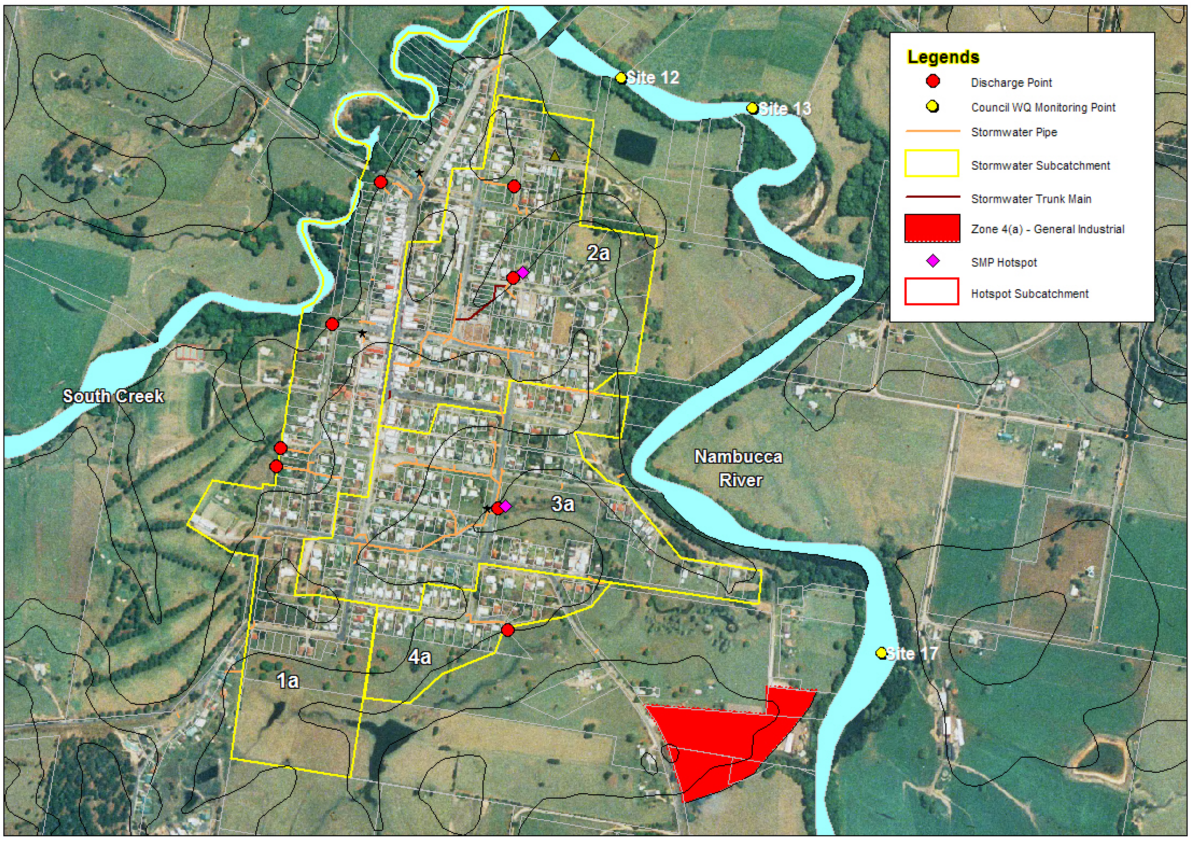

Figure 3.7 Bowraville Stormwater System

3.4.3 Macksville Stormwater System

All stormwater runoff from Macksville is ultimately discharged into the Nambucca River however there are a number of Nambucca River tributaries that are the direct receiving points for stormwater discharge. The stormwater network at Macksville consists of five separate drainage catchments; direct discharge to Nambucca River, Newee Creek (via SEPP 14 Wetland No. 383), Taylors Arm, Tilly Willy Creek and Hughs Creek.

Six sub-catchments (1a to 1c in North Macksville and 2h to 2j in Central Macksville) drain directly to the Nambucca River from both the north and south. The sub-catchments in North Macksville are a mixture of residential, rural, industrial and recreational land uses while those on the Southern side of the Nambucca River are predominantly business.

Two sub-catchments in North Macksville (1d and 1e) drain into a SEPP 14 Wetland (No. 383) and finally into Newee Creek. These two sub-catchments are dominated by residential development.

Two sub-catchments in Central Macksville (2a and 2b) drain into Taylors Arm. Parts of these sub-catchments contain residences with on-site systems (OSS) for sewage management while also being connected to the NWSS.

Nine sub-catchments in Central (2c to 2f), South (3a and 3b) and South Western (4a to 4e) Macksville drain into Tilly Willy Creek. The sub-catchments in Central and Southern Macksville have a mixture of land uses (including business, residential and recreational while those of South West Macksville are dominated by industrial land users.

Hughs Creek receives the majority of urban stormwater runoff from Macksville. Four sub-catchments (2g, 2k, 3c and 3d) are drained by a network of concrete gutters and pipes. Prior to entering Hughs Creek some stormwater passes through a detention pond in Dawkins Park (Ref. 15). Land uses within these sub-catchments consist of residential, schools, business, recreation and tourism.

The stormwater sub-catchments within Macksville can be seen in Figure 3.8.

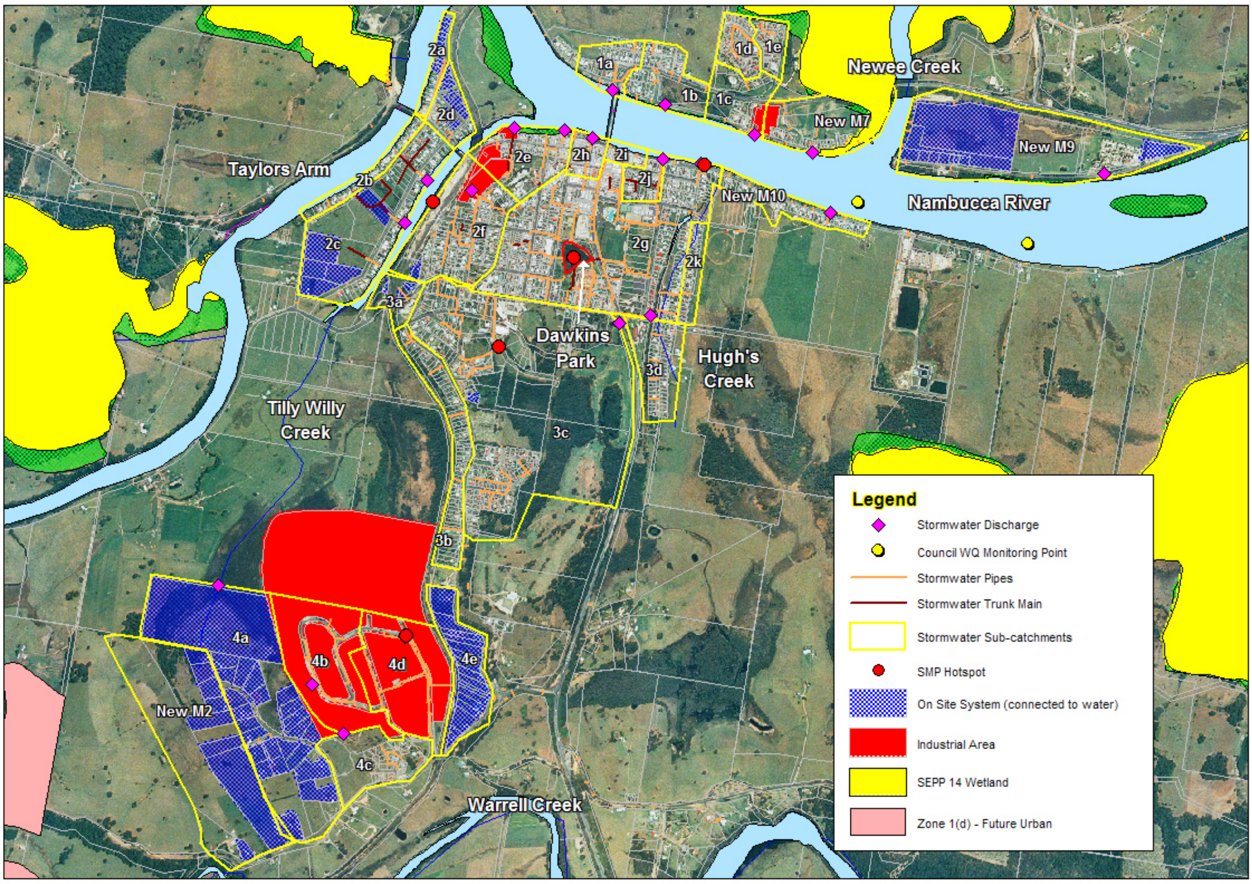

Figure 3.8 Macksville Stormwater System

3.4.4 Scotts Head Stormwater System

The stormwater network at Scotts Head consists of two separate drainage catchments. Three sub-catchments (1b, 1c and 1e) are drained by a network of concrete gutters and drains and discharge into Forsters Beach (Ref. 15). Land uses within these sub-catchments including a mixture of residential, tourist, business and recreational.

The remaining three sub-catchments (1a, 1d and 1f) drain south into a large grassed culvert which eventually discharges into Warrell Creek (Ref. 15). Land uses within these sub-catchments including a mixture of residential, tourist, business and recreational while a significant portion is also zoned rural.

The six stormwater sub-catchments within the town of Scotts Head can be seen in Figure 3.9.

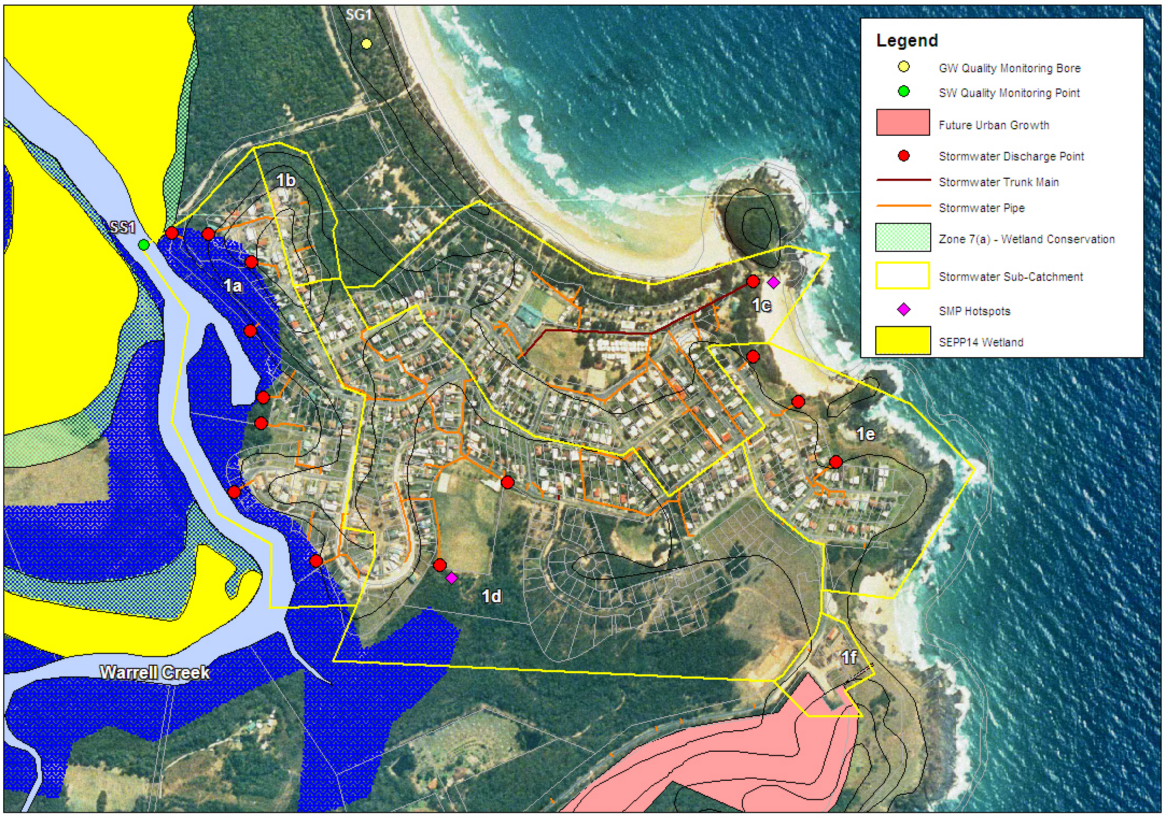

Figure 3.9 Scotts Head Stormwater System

3.4.5 Nambucca Head Stormwater System

The stormwater network at Nambucca Heads consists of four separate drainage catchments. Thirteen sub-catchments (1a, 2a to 2c, 3e, and 8a to 8f) drain directly into the Nambucca River. These sub-catchments are primarily drained by a network of concrete gutters across the southern and south-eastern sections of Nambucca Heads. The primary land use across these sub-catchments is residential, however there are significant areas containing recreation, business and tourist land users.

Seven sub-catchments (3c, 3d, 4a to 4d and New1) drain into Bellwood Creek, a tributary of the Nambucca River. Bellwood Creek discharges into SEPP 14 Wetland No. 362. The two major land uses within these sub-catchments are residential and schooling. The sub-catchment on the southern side of Bellwood Creek contains residences with OSS for sewage management while also being connected to the NWSS.

One sub-catchment (5a) drains into Cedar Creek (a tributary of Oyster Creek) in the north west of Nambucca Heads. Land use in this sub-catchment is primarily industrial and it contains the Nambucca Heads Industrial Park.

Six sub-catchments (6a to 6c and 7a to 7c) drain the north-east of Nambucca Heads into Swimming Creek. Swimming Creek discharges into the Pacific Ocean, while also containing a series of two detention ponds (Ref. 15). Land use within these sub-catchments is primarily residential, rural and recreational while there are also some significant tourist developments.

The stormwater sub-catchments within Nambucca Heads can be seen in Figure 3.10.

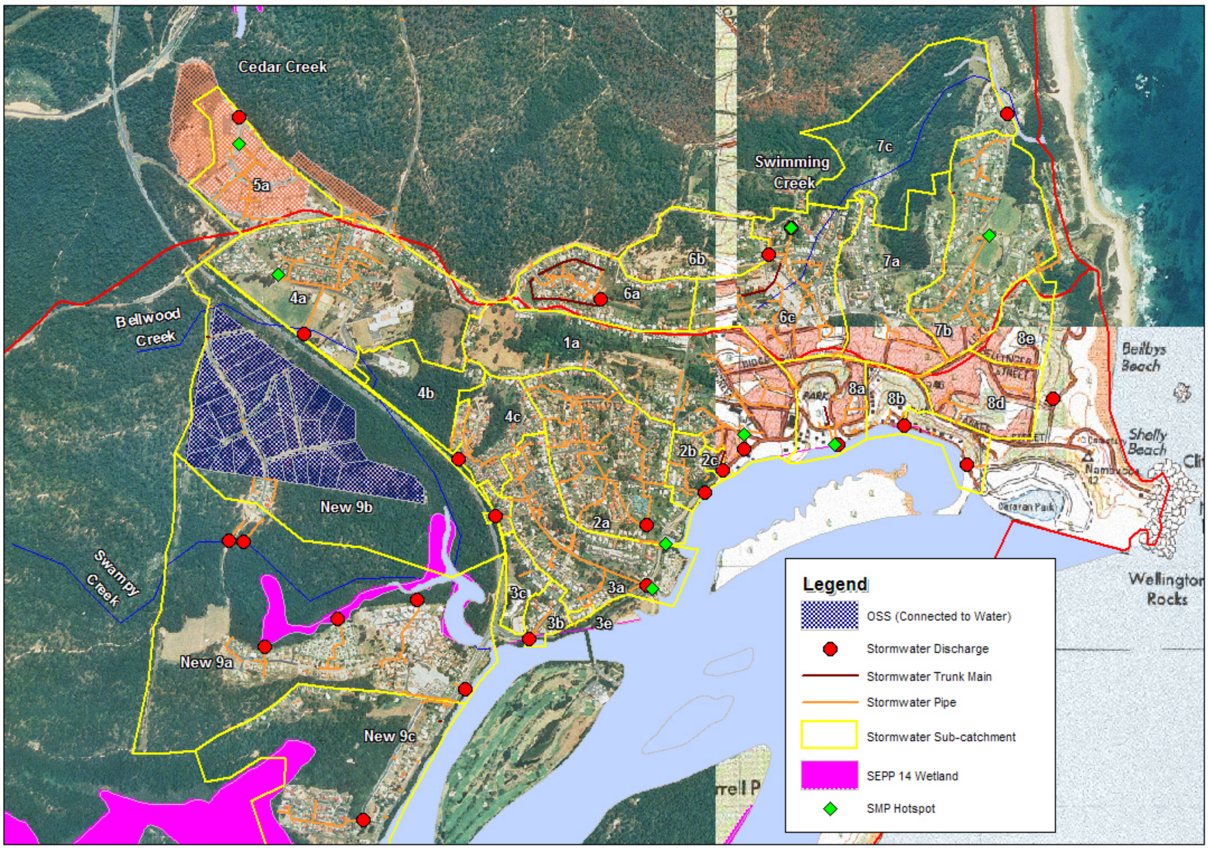

Figure 3.10 Nambucca Heads Stormwater System

3.4.6 Valla Beach Stormwater System

The stormwater network at Valla Beach consists of three separate drainage catchments. Six sub-catchments (1a to 1f) in Northern Valla Beach are drained by a network of concrete gutters and pipes and discharge into Oyster Creek (Ref. 15). Tourism is the major land user within these sub-catchments however a significant portion is defined as residential.

Four sub-catchments (1g to 1j) in Northern Valla Beach with a similar drainage infrastructure network to Oyster Creek sub-catchments drain into the Pacific Ocean. The major land use within these sub-catchments is residential while there is also a considerable amount of land zoned as recreation.

The remaining six sub-catchments in Valla Beach (1k to 2e) drain south into some natural drainage lines before discharging into Deep Creek (Ref. 15). The majority of these sub-catchments consist of environmental protection areas while approximately 11% of the land is classed as residential.

The stormwater network at Hyland Park consists of concrete gutters and pipes and drains two sub-catchments with discharge into Deep Creek. Land use in Hyland Park is classified as either residential or recreational.

The stormwater sub-catchments within Valla Beach and Hyland Park can be seen in Figure 3.11.

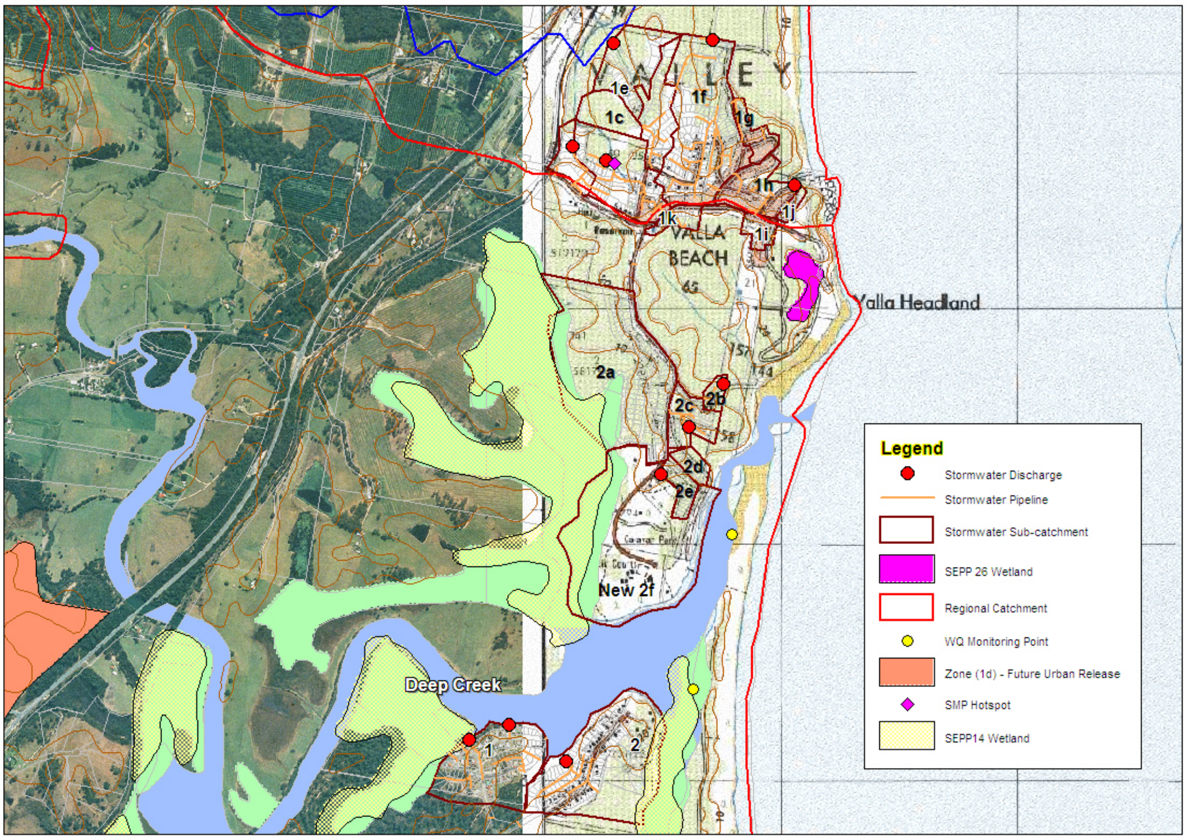

Figure 3.11 Valla Beach Stormwater System

Part C
Where Do We Want To Be?

Part C provides an overview of Council's strategic business objectives for the future management of the urban water cycle and the Community's wants and preferences with respect to future water cycle management opportunities.

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4 Strategic Business Objectives

4.1 Overview

As shown in Figure 1.1, a workshop involving the PRG was held at the beginning of the second stage of the IWCM study process to clearly define the business objectives for the future management of the urban water cycle. To assist in the development of the strategic business objectives, NSC's Management Plan and the existing water and sewerage strategic business plans (SBP) were consulted together with the State's Mid North Coast Catchment Management Blueprint and the water quality and river flow interim environmental objectives.

In order to ensure the IWCM options developed in this plan could be directly assessed against the strategic business objectives a contemporary strategy planning process was used, as in Figure 4.1 below.

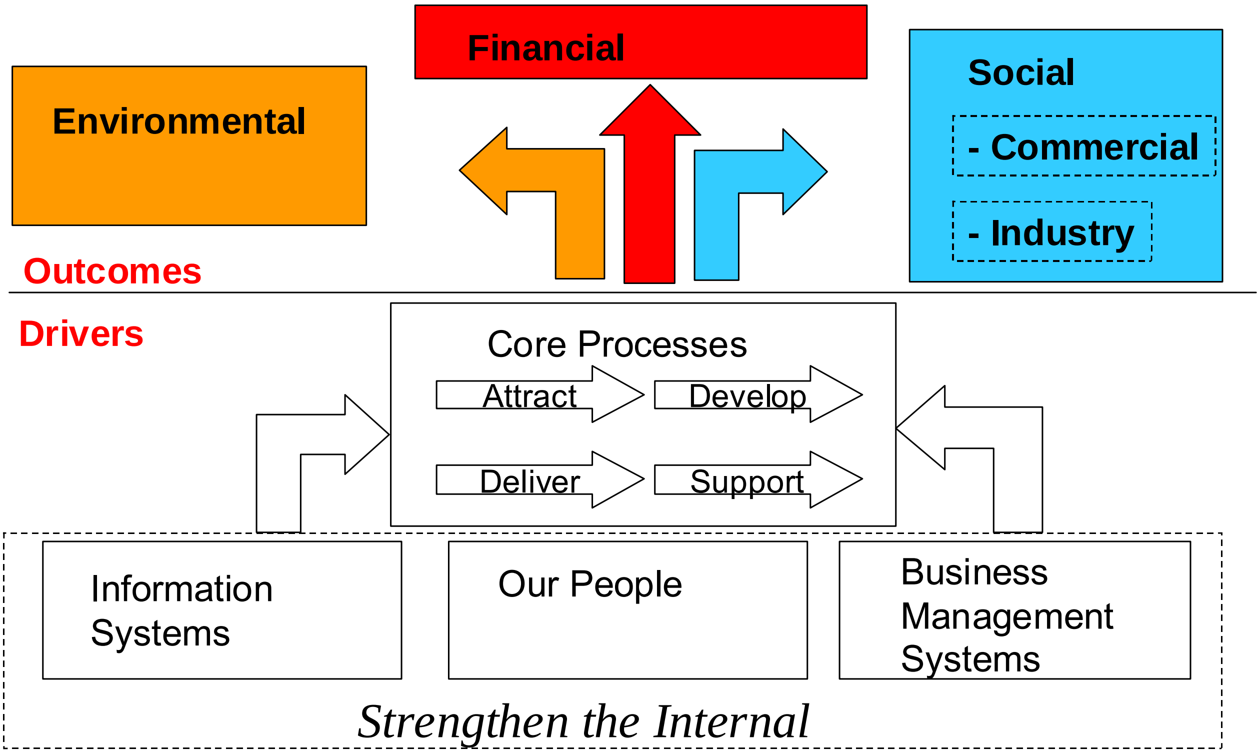

Figure 4.1 Strategic Objectives Planning Process

Figure 4.1 shows that the three main outcome reporting areas are related to the environment, society (i.e., community) and finance (or economic). The other key result areas nominated in the 'Guidelines for preparing strategic business plans for water and sewerage' are internal processes NSC has to put in place for the future management of the urban water cycle. Identifying the objectives associated with these internal processes is beyond the scope of this study.

4.2 The Business Objectives

A long list of environmental, social and financial objectives relevant to the management of urban water services (particularly in terms of solving the IWCM issues identified at the Concept Study Stage) was presented to the PRG to assist in the development of measurable targets. Each objective had one or more Key Performance Indicators (KPI) drawn from legislation, best practice guidelines, NSC's management documents and/or industry practice. This led to targets falling into one of the three following categories:

- Compliance (targets that must be met to comply with legislation);
- Best Practice (targets that should be met to comply with industry standard); and
- Aspirational (targets that would be good to meet in order to comply with community expectations).

A total of 35 environmental (12 compliance, 12 best practice and 11 aspirational) and 15 social (1 compliance, 5 best practice and 9 aspirational) targets were developed by the PRG in order to assess how each IWCM scenario addresses the identified issues. Appendix C contains the full list of strategic objectives, KPI and targets.

5 Community Wants and Preferences

5.1 *Overview*

As mentioned earlier, the PRG was consulted over two sessions (PRG meetings 2 and 3) to establish how the urban water cycle at Nambucca should be managed in the future by using a long list of sample management opportunities. This sample long list of opportunities was short-listed by the PRG using their preferences to suite the local conditions and aspirations.

5.2 *PRG Preferences*

Table 5.1 provides a summary of the PRG's preferences (during the IWCM process) with respect to the future management of the urban water cycle at Nambucca. Table 5.1 also provides the PRG's preference for each IWCM option in terms of social and environmental outcomes. These preferences were intuitively used by the PRG when short listing the long list of management opportunities. The Task 4 Paper contains the complete list of management opportunities together with the short listing process and the shortlisted management opportunities.

Table 5.1 Summarised Community Preferences for IWCM Opportunities

Issue	Management Opportunity	Community Preference	
		Social	Environmental
Reliable Water Supply	Improve security of water supply by providing a off-river storage	3	2
	Improve security of water supply by using ocean water (desalination)	3	1
	Effective potable water demand reduction programs	3	3
	Capture your water needs locally (roof water harvesting, grey water)	3	2
	Reuse with effluent and/or stormwater to reduce existing potable consumption	3	2
	Reuse with effluent and/or stormwater to reduce future potable consumption	3	2
	Use local groundwater to reduce potable consumption	2	1
	Protect our good drinking water quality by employing appropriate mitigation measures (eg, river & ORS catchment protection, storage management, river extraction methods, filtration plants)	3	2
Healthy waterways	Education	3	3
	Planning controls (water sensitive urban design)	3	3
	Improve urban stormwater quality through non-structural measures (street sweeping)	3	3
	Improve urban stormwater quality through structural measures (end of pipe treatment systems)	2	1
	Improve sewerage system integrity & effluent quality	3	3
	Reuse to reduce River discharge	3	2
	Environmental flows (leaving water in the river)	3	3

Note: 1 = Least preferred, 2 = Moderately preferred, 3 = Most preferred

Part D
What Are The Issues?

Part D provides an overview of the issues relating to water reform and legislative compliance, catchment management, urban planning, water infrastructure performance and community expectation.

6 What are Nambucca's Issues?

6.1 Overview

As outlined in Section 5 the IWCM issues were validated and prioritised by the PRG in the first stage of the IWCM study process and are described in detail in the Concept Study report. Additional issues that were identified during the second stage of the IWCM study process are discussed in detail in The Task 4 Paper. In this section the issues that are common to the operation and management of the three water services and those specific to each of the water services are described in some detail and are grouped into legislative, best practise and aspirational issues reflecting the nature of non-compliance.

6.2 Catchment Water Volume and Quality Issues

These represent issues relate to past, present and future land use activities and natural processes within the catchment that have an impact upon the provision of urban water services as well as the impact the urban water services would have upon the catchment. The identified issues and their impacts are summarised below:

- The North Arm of Nambucca River, the water source for NDWS scheme, and Upper Deep Creek sub-catchments have been identified as being hydrologically stressed particularly during the natural low river flow months when the competition for water by the agricultural and urban sectors and the environmental is high;

- The town water and other licensed water extractors can expect altered access conditions when the new licensing provisions of WMA 2000 are enacted. The implications of new access conditions for the security of the NDWS would be profound. For example, 62% of days during the 2003 reporting year (the year of the last drought in the study area) experienced flows in the Nambucca River at Bowraville at less than the 95th percentile;

- The management of extraction from the Nambucca Alluvium is being recognised as a surface water source in the draft Macro Water Plan considering the direct relationship between the surface flow and aquifer yield;

- The North Arm of Nambucca River is rated as having a high in-stream ecological value;

- The river bank in the vicinity of the Bowraville Borefield is unstable and could over time reduce the borefield area and the sustainable yield;

- The predicted climate change scenarios would have significant impact on the water supply through reduced stream flows affecting the security of supply and the associated predicted rise in sea level has the potential to affect the water quality of Bowraville aquifer;

- Erosion in upper Nambucca River catchment due to deforestation is causing elevated levels of turbidity in downstream waters particularly after rainfall events potentially limiting the direct extraction of river water;

- Uncontrolled microbiological, nutrient and sediment runoff from farms and irrigation areas could potentially enter the NDWS scheme;

- Uncontrolled access to farm animals immediately upstream of the Bowraville Borefield results in elevated microbiological and nutrient levels in the river water, which could potentially enter the district' water supply scheme;

- Septic tank discharges in upper Nambucca River catchment particularly during wet weather periods could potentially enter the NDWS scheme;

- Nutrients from land use, septic, stormwater and effluent discharges have resulted in deterioration of water quality in some waterways and groundwater systems.

- The discharge of effluent from the Macksville sewerage treatment plant and the urban stormwater discharges have the potential to impact the local oyster industry based on Nambucca River; and

- There are water quality failures of DECC Aquatic System Protection guidelines in Deep Creek downstream of discharge from Nambucca STP.

6.3 Urban Planning and Growth Issues

Existing and future urban planning and development controls have a significant influence on where future growth will occur. These planning controls, together with market and economic conditions, dictate the rate at which this growth will occur. The combination of planning controls and the rate of growth impact upon the need, timing and location of urban water infrastructure requirements.

6.3.1 Shire Population Growth

To develop a coherent IWCM strategy for the next four decades it is necessary to consider where and at what rate the population is expected to grow. Accordingly, areas of potential population growth within the existing zoned urban areas were identified and reviewed with the use of NSC planning documents and in conjunction with NSC's town planners. Additionally NSC also completed a growth management strategy with the release of the Structure Plan (Ref. 20) in March 2008 which outlines the staging of future urban releases in the Nambucca LGA. The Structure Plan incorporates NSW Planning process outcomes which are based on the Draft Mid-North Coast Planning Strategy (December 2006, Ref. 18). The Task 3 Paper shows the locations of the future release areas and contains detailed discussion relating to the assumptions used for projecting demographic growth.

Table 6.1 shows the shire population projected as part of this study and those in the Structure Plan (Ref. 20). The difference between the Structure Plan permanent population projection and that developed as part of the IWCM study is primarily due to the delay in release of future urban release areas (See Modified Assumption 2 in Task 3).

Table 6.1 Projected Shire Population

Location	2006[2]	2011	2016	2021	2026	2036	2046	Growth[3]
Permanent Total – This Study	18,219[1,2]	19,661	21,481	23,877	25,810	28,774	29,943	1.6%
Permanent Total – Structure Plan	19,880[1]	21,949	24,233		29,540			2.4%[4]

1. The 2006 ABS Shire Population was 17,897
2. Urban population was increased by 1.8% given historical error in ABS collection data (Ref. 3).
3. Population growth in % per annum between 2006 and 2046
4. Growth rate was calculated between 2006 and 2026

The projected increase in shire population over the next forty years will result in an increase in demand for the existing urban water services.

6.3.2 Growth in Population with Council Water Supply Service

Table 6.2 and Table 6.3 show the projected population and equivalent tenements that would be connected to the Nambucca District Water Supply (NDWS) Scheme over the next forty years on a spatially distributed scale.

Table 6.2 Projected Growth in Population Serviced with NDWS Scheme

Location	2006[3]	2011	2016	2021	2026	2036	2046	Growth[6]
Bowraville	992	1,009	1,031	1,036	1,036	1,036	1,036	0.1%
Macksville	2,705	3,038	3,454	3,712	3,953	4,129	4,306	1.5%
Nambucca Heads	5,984	6,368	6,848	7,140	7,385	7,875	8,366	1.0%
Valla Beach[4]	1,486	1,710	1,990	2,085	2,135	2,236	2,336	1.4%
Scotts Head	804	1,148	1,579	2,043	2,200	2,461	2,677	5.8%
Valla Urban Growth Area	0	0	0	1,089	2,178	3,921	3,921	-
Rural[2]	1,069	1,164	1,297	1,417	1,486	1,499	1,512	1.0%
Total Permanent Connected	13,040	14,438	16,199	18,523	20,374	23,160	24,151	2.1%
Visitors (Peak)	6,354	6,869	7,383	7,562	7,659	7,852	8,045	0.7%
Total Peak Connected	19,394	21,307	23,582	26,085	28,033	31,012	32,196	1.7%
Unconnected[5]	5,179	5,223	5,282	5,354	5,436	5,614	5,792	0.3%

1. The 2006 ABS Shire Population was 17,897
2. Rural growth is for Kingsworth and Gumma only
3. Urban population was increased by 1.8% given historical error in ABS collection data (Ref. 3).
4. Valla Beach includes Hyland Park
5. Unconnected population has been projected at 0.4% p.a. (as reported for rural Nambucca LGA population between 2001 and 2006 Censes) and the rural growth in Kingsworth and Gumma has been subtracted from the total
6. Population growth in % p.a. between 2006 and 2046
7. The difference between the Draft Structure Plan permanent population projection and that developed as part of the IWCM is primarily due to the delay in release of future urban release areas (See Modified Assumption 2 in Task 3)
8. Growth rate was calculate between 2006 and 2026

Table 6.3 Projected Growth in Equivalent Tenements Serviced with NDWS Scheme

Location	2006	2011	2016	2021	2026	2036	2046	Growth
Bowraville	435	444	451	453	453	453	453	0.1%
Macksville	1,526	1,770	2,059	2,187	2,261	2,340	2,423	1.5%
Nambucca Heads	3,169	3,370	3,598	3,735	3,848	4,074	4,301	0.9%
Valla Beach	680	792	923	969	989	1,029	1,069	1.4%
Scotts Head	389	546	742	943	1,009	1,131	1,221	5.4%
Valla Urban Growth Area	0	0	0	455	910	1,638	1,638	-
Rural	938	952	967	977	983	990	996	0.2%
Total Permanent Connected	7,137	7,872	8,740	9,718	10,453	11,655	12,100	1.7%

1. Valla Beach includes Hyland Park

Based on the above tables the following observations could be made:

- The NDWS Scheme would need to cater for an additional population and equivalent tenement of about 12,900 and 5,000 respectively and hence any upgrade to the existing headwork should include the necessary additional capacity to cater for this additional demand ; and

- The new release areas of Valla Urban Growth and South Scotts Head would need new infrastructure to service these areas such as trunk mains, service reservoirs and reticulation.

6.3.3 Growth in Population with Council Sewerage Service

Table 6.4 to Table 6.7 show the projected population and equivalent tenements that would be connected to the four existing sewerage Schemes over the next forty years.

Table 6.4 Projected Growth in Population & Tenement – Bowraville Sewerage Scheme

Year		2006	2011	2016	2021	2026	2036	2046
EP	Permanent	1,207	1,224	1,246	1,251	1,251	1,251	1,251
	Visitor	30	31	31	31	31	31	31
	Peak	1,237	1,255	1,277	1,282	1,282	1,282	1,282
ET	Permanent	445	452	461	462	462	462	462
	Visitor	2	2	2	2	2	2	2
	Peak	447	454	462	464	464	464	464

Table 6.4 suggests that the additional equivalent population and tenement that needs to be serviced by the Bowraville sewerage scheme is minimal but given the design capacity of the plant (1,200EP) is slightly exceeded, as discussed in Task 4 Paper, it would need some upgrade to treat the increased load.

Table 6.5 Projected Growth in Population & Tenement – Macksville Sewerage Scheme

Year		2006	2011	2016	2021	2026	2036	2046
EP	Permanent	3,611	4,228	5,011	5,477	5,778	5,954	6,130
	Visitor	596	616	642	655	665	685	705
	Peak	4,207	4,845	5,653	6,132	6,443	6,639	6,835
ET	Permanent	1,408	1,653	1,963	2,151	2,274	2,347	2,421
	Visitor	141	147	153	156	159	164	169
	Peak	1,550	1,800	2,116	2,307	2,433	2,511	2,590

Table 6.5 suggests that the Macksville sewerage scheme would need to cater for an additional equivalent population and tenement of about 2,600 and 1,000 respectively. Given the design capacity of the plant (5,500 EP) would be exceeded some time in the future (see Task 4 Paper) the plant would need to be augmented to process the additional load. Additionally the South Macksville release area would also need sewers and sewer pumping facilities to service the new area.

Table 6.6 Projected Growth in Population & Tenement – Scotts Head Sewerage Scheme

Year			2006	2011	2016	2021	2026	2036	2046
Existing Urban Area	EP	Permanent	942	1,317	1,780	1,879	1,890	1,912	1,934
		Visitor	925	1,163	1,460	1,525	1,533	1,548	1,563
		Peak	1,867	2,480	3,239	3,404	3,423	3,460	3,497
	ET	Permanent	393	557	759	802	807	817	826
		Visitor	239	310	397	416	419	423	428
		Peak	632	867	1,156	1,219	1,226	1,240	1,254
Release Area	EP	Permanent	0	0	0	369	515	757	948
		Visitor	0	0	0	0	0	0	0
		Peak	0	0	0	369	515	757	948
	ET	Permanent	0	0	0	151	211	310	388
		Visitor	0	0	0	0	0	0	0
		Peak	0	0	0	151	211	310	388

Table 6.6 suggests that the Scotts Head sewerage scheme would need to cater for an additional equivalent population and tenement of about 2,500 and 1,000 respectively. Given the design capacity of the plant (2,000 EP) would be exceeded (see Task 4 Paper) some time in the future the plant would need to be augmented to process the additional load.

Additionally the South Scotts Head release area would also need sewers, sewer pumping facilities and possibly sewage treatment plant to service this area.

Table 6.7 Projected Growth in Population & Tenement – Nambucca Head Sewerage Scheme

Year		2006	2011	2016	2021	2026	2036	2046
NAMBUCCA HEADS – Existing Urban Area								
EP	Permanent	7,771	8,207	8,758	9,078	9,323	9,813	10,304
	Visitor	3,264	3,342	3,440	3,499	3,549	3,648	3,748
	Peak	11,034	11,548	12,197	12,577	12,872	13,462	14,052
ET	Permanent	3,291	3,480	3,716	3,858	3,970	4,193	4,417
	Visitor	671	691	706	715	723	738	753
	Peak	3,962	4,171	4,422	4,573	4,692	4,931	5,170
VALLA BEACH and HYLAND PARK – Existing Urban Area								
EP	Permanent	1,560	1,808	2,129	2,241	2,291	2,391	2,491
	Visitor	1,024	1,134	1,182	1,199	1,208	1,225	1,243
	Peak	2,584	2,942	3,311	3,440	3,499	3,616	3,734
ET	Permanent	638	746	885	934	956	999	1,043
	Visitor	262	285	299	304	306	311	316
	Peak	900	1,031	1,184	1,238	1,262	1,311	1,359
NAMBUCCA STP – Existing Urban Area								
EP	Permanent	9,331	10,015	10,886	11,319	11,614	12,205	12,795
	Visitor	4,288	4,476	4,622	4,698	4,757	4,874	4,991
	Peak	13,618	14,490	15,508	16,017	16,371	17,078	17,786
ET	Permanent	3,930	4,226	4,601	4,792	4,925	5,193	5,460
	Visitor	933	976	1,005	1,019	1,029	1,049	1,069
	Peak	4,862	5,202	5,606	5,811	5,955	6,242	6,529
VALLA URBAN GROWTH - Release Area								
EP	Permanent	0	0	0	1,307	2,178	3,921	3,921
	Visitor	0	0	0	0	0	0	0
	Peak	0	0	0	1,307	2,178	3,921	3,921
ET	Permanent	0	0	0	455	910	1,638	1,638
	Visitor	0	0	0	0	0	0	0
	Peak	0	0	0	455	910	1,638	1,638

Table 6.7 suggests that the Nambucca Heads' sewerage scheme would need to cater for an additional equivalent population and tenements of about 8,000 and 3,300 respectively. Given the new design capacity of the plant (15,000 EP) would be exceeded (see Task 4 Paper) some time in the future, the plant would need to be further augmented to process the additional load. Additionally the Valla Urban Release Area would also need sewers, sewer pumping facilities and possibly a sewage treatment plant for adequate servicing.

6.3.4 Growth in Tourist Population

The shire's commitment to maintain the natural and scenic setting of the landscape combined with the mild climate and proximity to Coffs Harbour makes the area a popular tourist and holiday destination. Table 6.4 to Table 6.7 reflects this commitment through a steady growth in tourist population over the planning horizon. Available data shows that on average about 25% of the holiday/tourist accommodation is occupied year-round and during the peak Christmas / New Year school holiday's majority of the accommodation is occupied.

The varying peak tourist/holiday season load in particular at Nambucca Head and Scotts Head and the increase in the proportion of the permanent population challenges the water infrastructure planning. The challenge here is to minimise the provision of redundant infrastructure that is only utilised during peak load periods without compromising the legislative compliance, catchment and specific water services objectives. Additionally, the integrated water management strategies proposed in this plan need to be sufficiently flexible to accommodate unforeseen increases/decreases in the predicted population trends.

6.3.5 Urban Planning Instruments

The following issues have been identified with Council's planning and development control instruments:

- The development as well as the on-going protection and management of the Nambucca River catchment up-stream of the town water extraction is not adequately and explicitly covered in Council's planning instruments nor is it recognised in any State planning instruments;
- Whilst there is a well-head protection plan, the recommendations have not been fully implemented due to the planned headwork upgrade;
- The proposed off-river storage catchment area has not yet been captured in any Council planning instruments;
- None of the sewage treatment plants have well defined buffer zones identified and/or clearly defined management measures articulated in any planning instruments;
- The infrastructure design and construction standards called upon in Council's development control instruments does not cover the full suite of water management options shortlisted as part of this IWCM strategy and those in the BASIX tool box; and
- Whilst there is an urban stormwater management plan, the recommendations relating to planning and development controls have not been fully implemented.

6.4 Urban Water Management Issues

Urban water management issues are a consequence of population increase and the associated urban development. In the Task 3 Paper it is reported that Council expects the current pattern of population growth will continue to be concentrated within the existing zoned urban areas and the two nominated release areas. Therefore it is likely that current and future water cycle management impacts will reflect this pattern and be confined mainly to these nominated urban areas.

6.4.1 Urban Water Use and Discharge – Past and Present

Urban Water Use

Figure 6.1 shows the historic extraction of water from the alluvial Bowraville Borefield located adjacent to the Nambucca River from 1992 to 2007.

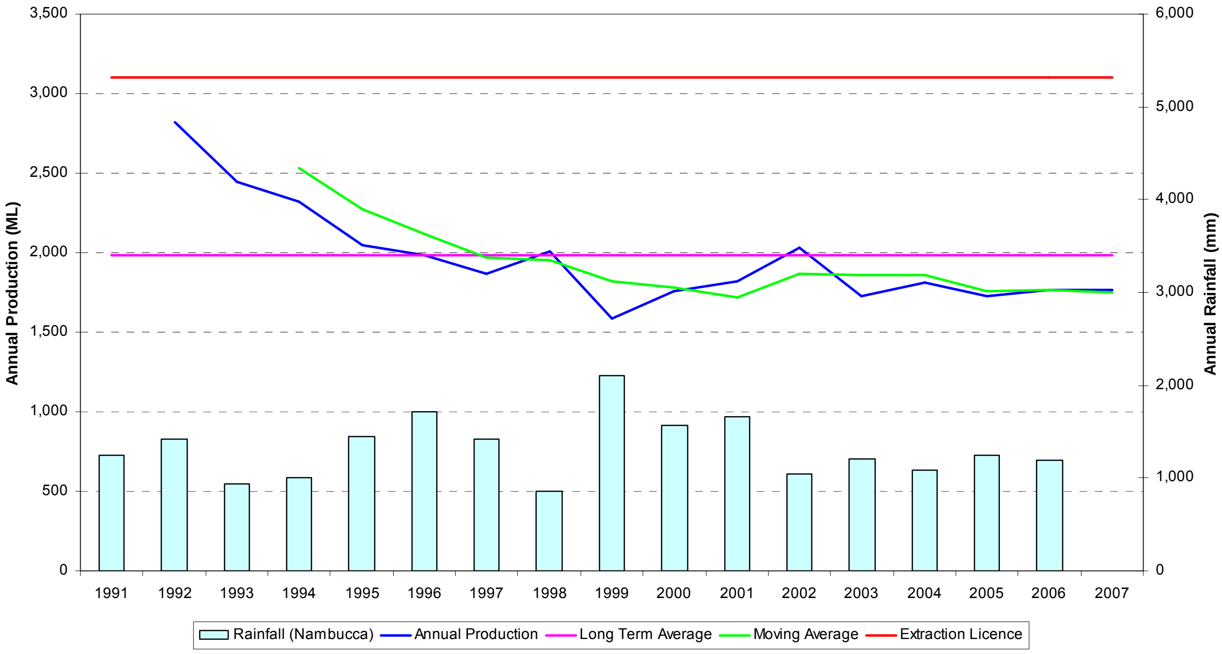

Figure 6.1 Historic Annual Extraction from Borefield

The above figure shows that the annual extraction has been steadily decreasing until year 2000 after which it has stabilised around 2,000ML. This steady decrease has been due in part to the implementation of two part water pricing in the mid 1990s, natural propagation of water efficient fittings and appliances and the significant scaling-down of MIDCO operation in year 2000.

Figure 6.2 shows the historic peak day extraction in each year from the Borefield since 1992.

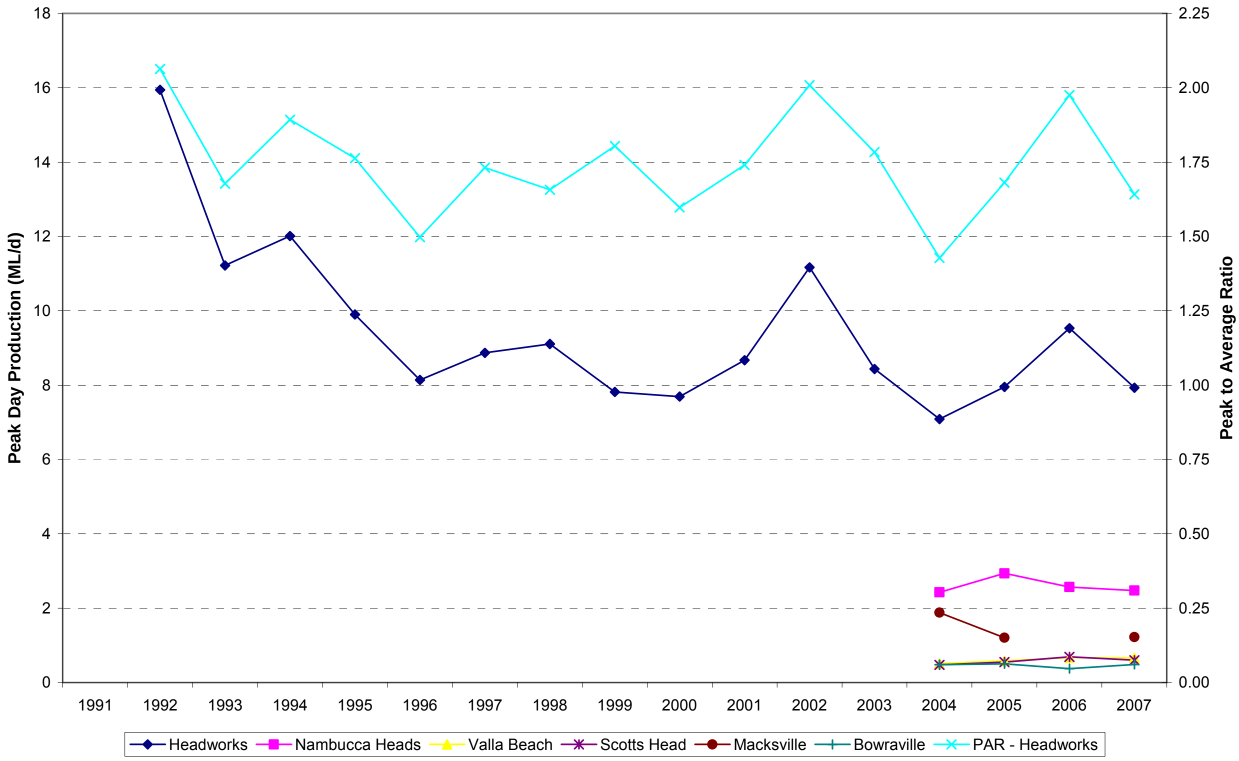

Figure 6.2 Historic Peak Day Extraction from Bowraville Borefield

Similar to the annual extraction volumes, the peak day extraction has also been decreasing and it is currently about 12ML/d (2001-02), the year preceding the latest drought when Council imposed significant restrictions on water use to prevent the district residents running-out of water.

Figure 6.3 shows customer category usage as a percentage of total production for the 2005 water year. Residential users connected to the scheme consume the majority of potable water (52%), while non-revenue water (NRW) accounts for the next largest category (16%). Estimate of the Infrastructure Leakage Index (ILI) using the IWA methods puts it at 2.66, which is relatively high compared to other Australian water utilities.

Industrial, commercial, tourist and rural consumers use approximately the same amount of water in Nambucca Shire. Although, the industrial demand supplied by the regional scheme is small, any increase in future industrial demand need to be gained by acquiring new entitlements in the market and/or by accommodating within the existing town water entitlements (see Water Management Act for further details).

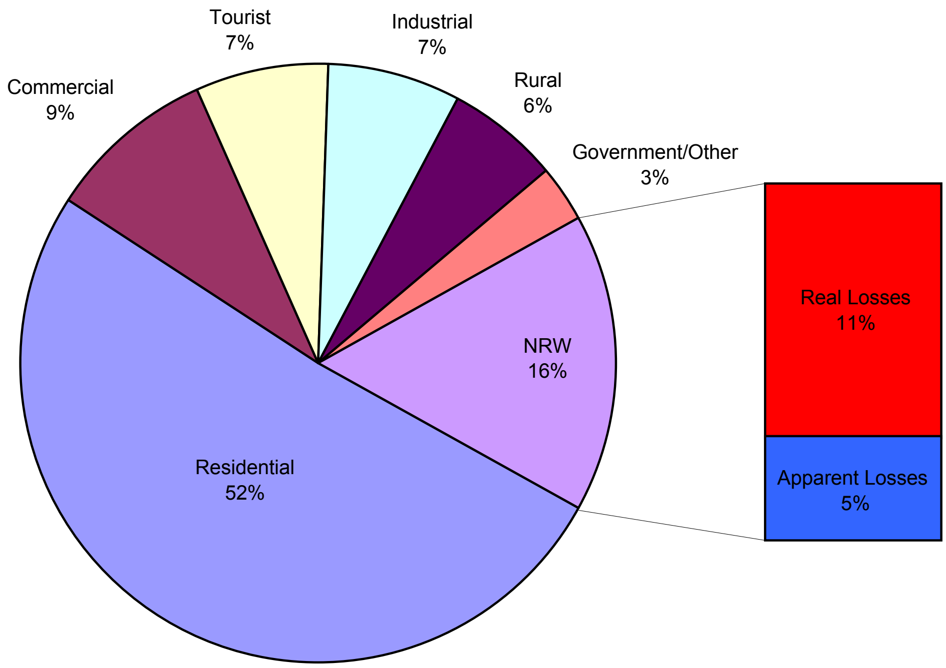

Figure 6.3 Urban Communities Water Consumption Profile

In view of the regional scheme servicing two different climatic zones, coastal and inland, separate climatic correction analysis of historic water production and consumption was undertaken. Table 6.8 summarises the results of the residential simulation. For detailed results and discussion relating to historic climate correction analysis, refer to Task Paper 2 (Ref. 5).

Table 6.8 Climate Corrected Residential Demands

System	Annual Residential Demands (kL)		
	Long-term Average	2002	Maximum
Coastal	223	254	265
Inland	249	279	294
Combined	231	261	275

Figure 6.4 shows the major non-residential water users for the 2007 water year. Note all consumptions are in ML. Figure 6.4 shows that Midco and the caravan parks are the predominant users in this group. Analysis suggests that Midco has a fairly constant consumption of about 0.3 ML/d throughout the year whilst the consumption at the caravan parks is heavily influenced by the seasonal tourist population.

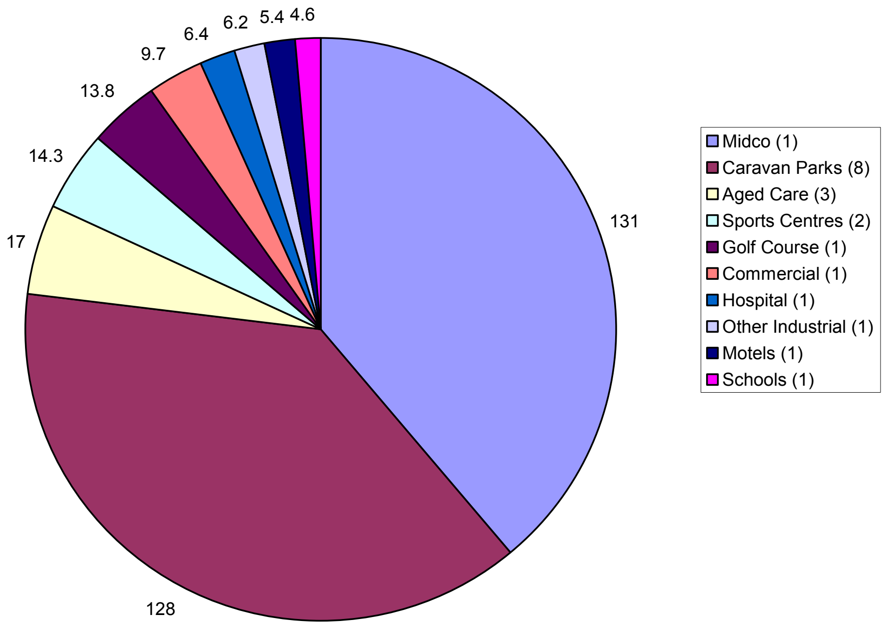

Figure 6.4 Top 20 Non-Residential Water Users in 2007

Urban Water Discharge

The wastewater produced by the urban communities has been increasing over the years with increasing population and at present it is approximately 1,800 ML/a. The majority of wastewater produced by the urban community is treated to secondary standard using NSC's four sewerage treatment plants, and approximately 250 ML/a (ie, 14%) of this treated wastewater is beneficially reused for pasture irrigation with the remaining discharged to the local waterways. The daily average wastewater treated by the four plants is approximately 4.6 ML/day, and this volume increases by approximately 20-30% during the peak holiday/tourist season. Rainfall in excess of 1 year ARI significantly influences these daily volumes.

The discharge of stormwater from the urban areas has also been increasing steadily with increasing population and expansion of the urban footprint. At present approximately, 9,100 ML per annum of urban stormwater is discharged to the environment consisting of approximately 15,000 kg per annum of total nitrogen load and 1,000 kg per annum of phosphorous load (based on median year rainfall). Testing of urban stormwater from other coastal towns and villages also suggests that urban stormwater contain significant loads of sediment, litter, bacteria and other pathogenic organisms. In Nambucca there is limited urban stormwater quality control and management before discharge, and there is no beneficial reuse of stormwater.

6.4.2 Urban Water Use and Discharge – Future

As discussed previously, the population connected to the water supply scheme is expected to increase by about 40% from the current level in the next four decades. This increase in population will correlate to a growing demand for water, which will consequently result in an increase of treated wastewater and urban stormwater.

A Traditional Scenario has been used to determine baseline water cycle projections. The Traditional Scenario includes the following existing measures that have been implemented by NSC, the NSW Government or the Federal Government:

- BASIX for all new residential dwellings achieving 40% reduction in average annual water supply consumption. The saving was assumed to be achieved through internal residential fixture efficiency and the connection of 5 kL RWT to garden watering, washing machines and toilets.
- An assumed uptake of 0.02% per annum of existing houses for retrofit of RWT based on the NSW Government Rainwater Tank Rebate Program;
- The continuation of an existing community education program targeting residential water efficiency and stormwater quality control measures;
- Natural propagation of water efficient toilet cisterns, plumbing fixtures and devices, and household white goods due to the mandatory plumbing regulation; and
- The continuation of an existing residential shower retrofit program for residential water customers.

Urban Water Use - Water Supply Projections

Table 6.9 shows the projected average year and dry year demands for the Traditional Scenario based on the growth numbers in Table 6.2 and Table 6.3. Table 6.9 also shows the impacts of climate change on the average and dry-year demands. Due to the revised population estimates of Table 6.2 and Table 6.3 and the estimated impact of climate change, the new projected dry year demands exceed those estimates as part of the previous Headworks Strategy (Ref. 8). Detailed analysis with regards to the impacts of climate change can be seen in Task Paper 3.

Table 6.9 Projected Traditional Scenario Annual Water Demands

Projected Demand (ML)		2006	2011	2016	2021	2026	2036	2046
Traditional - Av Year	Connected	1,527	1,627	1,793	2,017	2,198	2,469	2,562
	Unconnected	57	57	58	59	59	61	63
	Losses	292	323	363	415	456	518	540
	Total	1,875	2,007	2,214	2,490	2,714	3,049	3,166
Traditional - Dry Year	Connected	1,739	1,858	2,059	2,326	2,541	2,865	2,975
	Unconnected	94	95	96	97	99	102	105
	Losses	291	322	361	413	454	516	540
	Total	2,124	2,275	2,516	2,836	3,094	3,483	3,620
Traditional - CC 2050 (Av Year)	Connected	1,604	1,707	1,886	2,124	2,317	2,606	2,704
	Unconnected	60	60	61	62	63	65	67
	Losses	291	322	361	413	454	516	540
	Total	1,955	2,089	2,308	2,599	2,834	3,187	3,312
Traditional - CC 2050 (Dry Year)	Connected	1,905	2,040	2,262	2,558	2,796	3,153	3,276
	Unconnected	108	109	110	112	114	117	121
	Losses	291	322	361	413	454	516	540
	Total	2,304	2,471	2,734	3,083	3,364	3,787	3,937
Headworks Strategy	Total	2,013	2,164	2,315	2,465	2,611	2,887	3,136

- Unconnected Water demands represent rural customers that are reliant on the NWSS for potable water supply when their on-site RWT fail. The frequency of failure was ascertained using a lot-based climate driven model with 10kL RWT supplying internal demands only. A daily carting demand of 90 L/p/d was assumed during periods of failure.

Table 6.10 outlines the projected peak day demands for each of the reservoir zones as well as at the headworks. The impact of climate change on peak day demands due to climate change was quantified for dwellings without RWT through the application of peak month factors. Details of this analysis can be seen in Appendix C of Task Paper 3.

Table 6.10 Projected Traditional Scenario Peak Day Demands

	Projected Demand (ML)	2006	2011	2016	2021	2026	2036	2046
Traditional	Bowraville	0.76	0.77	0.79	0.79	0.79	0.79	0.79
	Macksville (Res1 + Res2)	3.07	3.07	3.08	3.12	3.18	3.28	3.39
	South Macksville	0.69	1.03	1.45	1.68	1.87	1.94	2.01
	Scotts Head	0.87	1.20	1.60	2.08	2.23	2.49	2.70
	Nambucca Heads	6.72	7.06	7.48	7.72	7.92	8.32	8.73
	Valla Beach	1.09	1.23	1.41	1.47	1.50	1.56	1.63
	Valla Urban Growth Area	0.00	0.00	0.00	0.91	1.82	3.28	3.28
	Midco	0.50	0.50	0.50	0.50	0.50	0.50	0.50
	Remainder of System	1.31	1.31	1.31	1.31	1.31	1.31	1.31
	Headworks	11.44	12.20	13.31	15.02	16.36	18.25	18.82
Traditional (With Climate Change)	Bowraville	0.79	0.80	0.82	0.82	0.82	0.82	0.82
	Macksville (Res1 + Res2)	3.18	3.16	3.16	3.19	3.23	3.33	3.43
	South Macksville	0.75	1.08	1.49	1.71	1.90	1.96	2.03
	Scotts Head	0.91	1.23	1.62	2.09	2.25	2.50	2.71
	Nambucca Heads	6.97	7.26	7.64	7.85	8.03	8.41	8.80
	Valla Beach	1.14	1.27	1.44	1.49	1.52	1.58	1.64
	Valla Urban Growth Area	0.00	0.00	0.00	0.91	1.82	3.28	3.28
	Midco	0.50	0.50	0.50	0.50	0.50	0.50	0.50
	Remainder of System	1.34	1.33	1.33	1.33	1.32	1.32	1.32
	Headworks	12.02	12.67	13.68	15.32	16.62	18.46	19.00

1. The Headworks Peak Day Demand has been adjusted to account for system storage and transfer delays.
2. The unit residential demands were adopted for projection; Bowraville 1.90 kL/ET/d, Macksville 3.05 kL/ET/d, Nambucca Heads and Valla Beach 2.5 kL/ET/d and Scotts Head 3.01 kL/ET/d.
3. Both new and infill dwellings with RWT were modelled with a reduced peak day demand based on standard top-up rates.
4. Nambucca Heads reservoir zone includes Hyland Park

The projected increase in potable water demand requires appropriate management to ensure that the Nambucca River environment and community well-being is not compromised. The available opportunities are discussed in Part E.

Urban Water Discharge - Wastewater Projections

Demographic growth was matched to dry and wet weather sewage flow characteristics at a sewage pump station (SPS) scale in order to project average dry weather (ADWF) during peak visitor periods. Peak Wet Weather Flows (PWWF) was established based on the highest wet-weather events in 2006 for each individual scheme (the year for which record was made available). The Annual Exceedance Probability (AEP) corresponding to these events was quantified and appears in Task Paper 3. As a comparison, the design PWWF (as outlined by the methodology in Ref. 19) was also quantified.

The potential impact on PWWF of extreme rainfall events due to climate change should be investigated in future IWCM reviews as modelling techniques improve. An initial assessment of the impact of climate change on the 2006 peak rainfall event (based on the worst case 2030 projection of 5% increase as quoted in Ref. 10) with respect to %AEP and ARI was undertaken in Task Paper 3. As an example, the peak rainfall event at Bowraville in 2006 would occur every 8.6 months as opposed to the current 9.7 months if climatic change impacts were to eventuate.

Table 6.11 shows the projection of sewer flows for the Traditional Scenario while Appendix C of Task Paper 3 contains the projections at the SPS catchment level.

Table 6.11 Projected Traditional Scenario Average Dry and Peak Wet Weather Flows

System		Parameter	2006	2011	2016	2021	2026	2036	2046
Bowraville		ADWF (kL)	242	246	250	251	251	251	251
		PWWF (L/s) A	32.8	33.3	33.9	34.0	34.0	34.0	34.0
		PWWF (L/s) D	33.0	33.5	34.1	34.2	34.2	34.2	34.2
Macksville (Existing + Release Area)		ADWF (kL)	1,115	1,317	1,570	1,711	1,823	1,897	1,970
		PWWF (L/s) A	173.8	215.6	273.9	303.6	315.9	327.3	338.6
		PWWF (L/s) D	129.4	151.0	177.1	192.5	202.2	208.4	214.5
Nambucca	Nambucca Heads	ADWF (kL)	2,137	2,252	2,395	2,488	2,566	2,723	2,880
		PWWF (L/s) A	137.6	146.0	156.4	163.4	169.2	180.8	192.2
		PWWF (L/s) D	254.3	268.6	286.3	297.1	305.8	322.9	340.0
	Valla Beach (Existing) + Hyland Park	ADWF (kL)	748	839	920	950	964	993	1,022
		PWWF (L/s) A	52.0	58.6	65.8	68.3	69.5	71.9	74.3
		PWWF (L/s) D	64.1	73.3	83.9	87.7	89.4	92.7	96.1
	Valla Urban Growth Area	ADWF (kL)	0	0	0	253	506	910	910
		PWWF (L/s) D	0.0	0.0	0.0	33.9	66.4	117.7	117.7
	Total	ADWF (kL)	2,885	3,091	3,315	3,690	4,036	4,627	4,813
		PWWF (L/s) A	189.6	204.5	222.1	265.6	305.1	370.4	384.3
		PWWF (L/s) D	318.4	341.8	370.2	418.7	461.5	533.4	553.8
Scotts Head	Scotts Head (Existing)	ADWF (kL)	410	534	687	720	724	732	740
		PWWF (L/s) A	28.7	44.7	63.8	68.0	68.6	69.8	70.9
		PWWF (L/s) D	37.8	51.2	67.4	70.9	71.3	72.1	72.8
	Scotts Head (Release Area)	ADWF (kL)	0	0	0	72	101	149	186
		PWWF (L/s) D	0.0	0.0	0.0	11.3	15.6	22.7	28.2
	Total	ADWF (kL)	410	534	687	793	825	881	926
		PWWF (L/s) A	28.7	44.7	63.8	79.3	84.2	92.4	99.1
		PWWF (L/s) D	37.8	51.2	67.4	82.2	86.9	94.7	101.0

1. A = Actual PWWF events from recorded data based on the highest daily rainfall events in 2006 for each scheme
2. D = Design Storm Allowance of 0.058 L/s/ET as per Ref. 19
3. For actual PWWF events storm allowances have been calculated for SPS sub-catchment where data has been available. Design Storm Allowance has been used when no data was available. Individual SPS results can be seen in Appendix C of Task Paper 3.
4. PWWF rates during these daily events would have been higher depending on their site specific IFD (See Appendix C2 of Task Paper 3).

The expected increase in wastewater requires appropriate management to ensure that the local environment and community health is not compromised. The opportunities available to further enhance the quality of the secondary treated effluent so as to increase its legislative compliance and beneficial reuse are discussed in Part E.

Urban Water Discharge - Stormwater Projections

Urban stormwater runoff was projected on a sub-catchment basis. Table 6.12 shows the projected urban stormwater runoff for non-climate change affected average years over the planning horizon for the Traditional Scenario (i.e. the impact of rainwater tanks for new dwellings on reduced urban runoff has been quantified on a sub-catchment basis). Climate change-impacted runoff has also been quantified and appears in Task Paper 3.

Table 6.12 Projected Traditional Scenario Average Year Stormwater Discharges by Locality

Urban Locality	2006	2011	2016	2021	2026	2031	2036	2041	2046
Bowraville	513	515	517	518	518	518	518	518	518
Macksville (existing)	2,746	2,901	3,126	3,219	3,247	3,276	3,305	3,334	3,362
Nambucca Heads	4,314	4,363	4,432	4,469	4,488	4,507	4,526	4,546	4,565
Hyland Park	208	209	211	212	212	212	212	213	213
Valla Beach (existing)	697	712	732	740	742	744	746	748	750
Scotts Head (existing)	563	580	603	608	609	609	610	611	612
Sub-Total	9,041	9,280	9,622	9,765	9,816	9,866	9,917	9,968	10,019
Macksville DCP17	74	126	269	319	345	371	397	424	450
Valla Urban Growth Area	0	0	0	1,197	2,394	3,351	4,309	4,309	4,309
Scotts Head Release	0	0	0	105	146	188	215	242	269
Sub-Total	74	126	269	1,620	2,885	3,910	4,921	4,974	5,028
Total	9,115	9,406	9,891	11,385	12,701	13,777	14,838	14,943	15,047

These increases if not managed adequately, will further impact on the local environment and may pose public safety issues. The opportunities available to further enhance the quality of stormwater discharges and to increase the potential for beneficial reuse are discussed in Part E.

6.5 Urban Water Services Pricing Issues

The following are the issues that have been identified based on a review of Nambucca Council's current pricing policy for water services:

- Whilst the existing water supply and sewerage charges embraces the NSW government best practice pricing principles and could be equitable, the revenue split from residential access and usage charges for water supply does not exactly match the criteria and the process used for establishing the non-residential water and sewerage charges and revenue split is not transparent;
- Although, the Council has established the 'true' cost of providing water and sewerage services to new developments, the current level of developer contribution is far less than the 'true' costs. This results in significant subsidy to developers by the existing rate payers and also results in revenue loss to Council(this has been confirmed in Task 7 Paper);
- The sewerage developer and access charges is different for each scheme and for the South Macksville growth area, whilst this may be justifiable, when one considers the differences in charges between the schemes and the added administrative and management cost, a business case may be made to have a uniform charge across the Shire;
- It is highly likely that the existing charges would have to increase significantly in the short-term. This is because the Strategic Business Plans, Capital Works Program, Asset Renewals Program, Asset Valuation, Asset Register, Operation and Maintenance Manual Plans, Emergency Response Plans on which the water supply and sewerage charges are based upon are all outdated and needs significant updating to current situation and to incorporate the findings of the IWCM Strategy study (this has been confirmed in Task 7 Paper);
- An effective Asset and Data Management System is non existent and hence the budgets to support price paths is compromised as it is difficult to undertake performance monitoring and benchmarking of assets and services against Council's own infrastructure performance targets and those of comparable water utilities thereby the budgets lacking the required transparency and the supporting evidence;

- Although not verified we believe that Council has the necessary insurance cover for the water service operation and that both the risk and cover is regularly reviewed with adequate contingency in the budgets that supports the price paths;
- Although there is a trade waste charge, the Trade Waste policy has not been implemented hence the revenue is not reflective of the cost; and
- There is inadequate funding for urban stormwater management and treatment measures and for catchment improvement works and there is no separate business plan for this service. This is because the cost of providing these services is funded through the general rates, which is currently 'pegged' by the state government.

6.6 Infrastructure Performance Issues

It has been identified in recent studies and IWCM Task Papers that the Nambucca urban water services face a number of infrastructure performance related issues due to population growth, climate variability, improved knowledge of the resources, system operation and land-water interactions, ageing infrastructure, etc. that need to be addressed in this IWCM strategy. The infrastructure performance related issues are summarised below for convenience under the categories of legislative, best practice and aspirational.

6.6.1 The Regional Water Supply

Legislative Compliance Issues

Summarised below is a list of legislative non-compliance:

- The current licenced allocation of 3,100 ML/a issued under the WM Act would be exceeded by about year 2027 under no climate change impact scenario but the exceedance would occur by about year 2022 with mid-range climate change scenario (see below for issues relating to security of supply and environmental flow and access sharing);
- There is no formal water quality incident emergency response plan as required under the Public Health Act;
- A very brief overview of NSC's management system, infrastructure facilities, work procedures, etc. tends to suggest that compliance with the OH&S Act and Regulations is not fully being achieved;
- The operational environmental management plan does not seem to cover the full spectrum of issues that the operation of the water supply scheme could have an impact on the environment as defined in the POEA Act;
- Recording and archiving of historical operation incidents and data is not systematic and does not meet the record keeping obligations under the Public Health and other Acts;
- Although the fluoridation plant and on-going operation and monitoring appears to be in accordance with the current Fluoridation of Public Water Supply Act, an on-going compliance review at five year intervals is highly desirable;
- It is our understanding that NSC has easement over all water supply assets and unconditional access rights to these easements; and
- As indicated in the Task 5 Paper, the current annual licenced allocation would be exceeded with the planned upgrade to the headwork with the provision of off-river storage (NSC has requested DWE for an amendment to the existing license along with the planned headwork upgrade, see Task 5 Paper for analysis).

Best Practice Compliance Issues

The best practice non-compliance issues are described in detail below:

Security of supply

Security of supply is a measurement of the reliability of the water supply headworks, in this case the Bowraville alluvial borefield located adjacent to Nambucca River, during drought periods. Supply security is considered to be adequate when reasonable customer demands can be met on most occasions without restrictions. The NSW Government has defined 'secure yield' as the maximum supply rate that can be maintained by the supply system without exceeding any one of the following three acceptability criteria (NSW Government, Water Supply and Sewerage Management Guidelines, 1991):

- Reliability – The proportion of time when supply is unrestricted. Over any extended period, restrictions should not be in place for more than 5% of the time. In Nambucca for example this would mean that based on 100 years of stream flow the total duration of water restrictions would be less than 60 months.
- Robustness – The average frequency of restriction should be less than once every 10 years. More precisely there would be less than a 1 in 10 chance of having to impose restrictions in any one year.
- Security - The storage will not be drawn down to below a critical level which would prevent Council providing even a basic supply or require alternative supply measures. The IWCM strategy guards against this scenario by ensuring that the system can supply 80% of unrestricted demand from the time restrictions are imposed. This is based on the conservative assumption that the full drought of record could recommence at this time.

The above three acceptability criteria are commonly referred to as the 5/10/20 rule. Implicit in this rule is the trade-off between risk, community costs and social expectations. This rule was developed and adopted by the NSW government in the mid 1980's and has since been used in the water supply planning for nearly all country towns in NSW. The calculation of secure yield requires modelling of the water supply source and system, which is related to the following:

- Weather pattern in the water supply catchment and the urban areas,
- The environmental needs of the rivers including access sharing rules with other water users,
- The quantity of water that can be taken and available in storage,
- The rate of storage depletion during drought and filling after drought,
- The ability to conserve water during drought.
- Although the IWCM strategy guards against storage levels being drawn to a critical level by ensuring that the system can supply 80% of unrestricted demand from the time restrictions are imposed, this margin will reduce over time with aggressive demand management.

Setting the security of supply standard defines the yield of the system, and consequently the future supply infrastructure provision requirements. For a given level of demand reduction there is a trade-off between the setting of security of supply standards and the timing and extent of supply source development.

At one end of the spectrum, an attempt to 'drought proof' the regional scheme would incur considerable capital expenditure and environmental costs, while at the other end insufficient supply source infrastructure will put the Nambucca community at increased risk of running out of water, with associated economic and social impacts. The 5/10/20 rules aims to achieve this balance and allows the comparison of different systems. The rules allow a system to be developed that would provide sufficient storage and management of water supply through a worse drought than on record. Management during a drought would be assisted by Council's restriction policy. Whatever drought it is designed for there is always a statistical possibility of a worse drought occurring. The Nambucca Shire's restriction policy aims to maintain a balance between minimising the frequency of restrictions and maximising the duration that available water can be made to last in a drought.

Performance of Bowraville Aquifer

The secure yield of the regional water scheme is dependent on the volume of water available in the Bowraville aquifer during prolonged dry weather periods. Studies undertaken in the past estimated the aquifer storage to be about 1,200ML (Ref 26) and the recent study undertaken during the 2002/03 drought estimated the storage to be about 300ML (Ref 25) with no leakage to the estuary, an assumption which is now know not to be accurate. The aquifer storage volume could be characterised as a time dependent volume that diminishes over time due to the steady leakage of water into the estuary. Figure 6.5 presented here from Ref 22 shows the average standing water level (SWL) in the aquifer during the 2002/03 drought period along with the estimated aquifer inflow. The aquifer inflow was estimated by using a simple water balance model that uses the change in aquifer storage, NSC abstraction and stream flow gauge records as input variables.

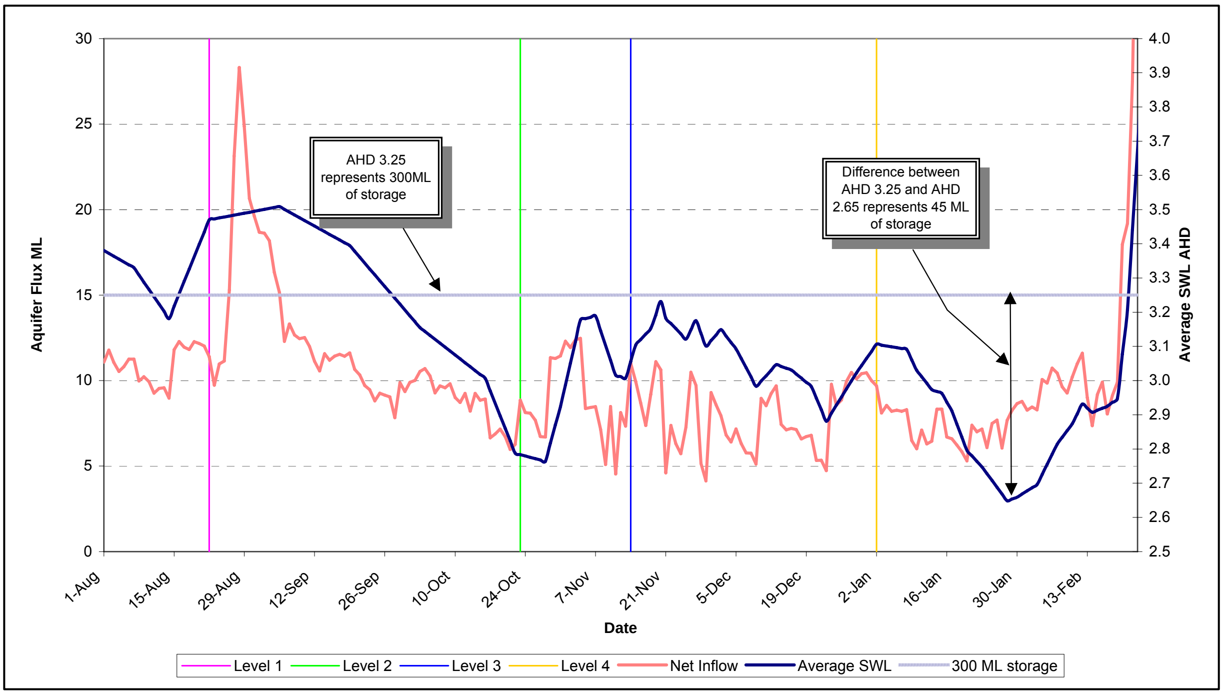

Figure 6.5 SWL versus Aquifer Inflow during 2002/03 Drought

Figure 6.5 confirms the high connectivity between the aquifer and the surface flows. Figure 6.5 also shows that when the river flow decreases the rate of depletion of the aquifer storage is extremely high and that the regional water scheme would have failed if the dry weather pattern continued for another month or two. This confirms that the sub-surface flow is continuously draining to the estuary and the aquifer storage volume cannot be relied upon to quantify with certainty the security of supply for the NDWS scheme. Further caution should be applied when using the aquifer levels as trigger for restriction levels.

Modelling of the Regional Scheme – The regional scheme was modelled using daily streamflow sequence between years 1890 to 2003, the above security of supply criteria and the current supply extraction license conditions. The modelling undertaken in Ref 23 found that the secure yield of the existing scheme as defined by the 5/10/20 rule is very sensitive to the aquifer storage and leakage rate. Figure 6.6 presents the sensitivity of the secure yield of the scheme for different storage leakage rates based on the aquifer storage volume of 300ML.

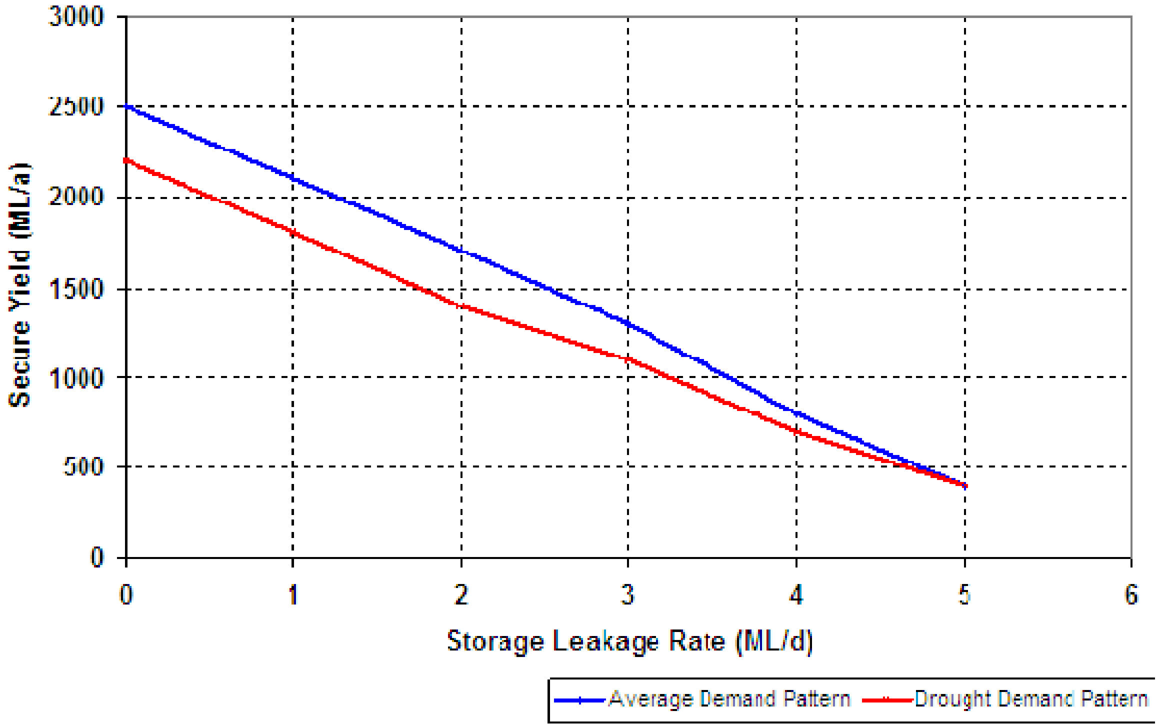

Figure 6.6 Secure Yield versus Aquifer Leakage Rate

Figure 6.6 indicates that the timing for additional security is both sensitive to the assumed storage leakage rate and the monthly urban demand pattern and that the sensitivity of the urban demand pattern diminishes with increasing leakage rate. The above figure also shows that at best the existing headwork with 300ML aquifer storage and no leakage, could only meet the current annual demands.

In Ref 23 it is reported that a review of the stream flows recorded by the DIPNR (now DWE) gauging station and those collected by Council during the 2002/03 drought indicated that whilst there was no surface flow past the borefield the gauge still recorded flows, indicating the presence of leakage from the borefield. Although, the magnitude of the leakage rate has not been quantified, based on limited analysis of the flows it could be concluded that leakage occurred and it could be up to 5ML/d, equivalent to the maximum flow recorded by the gauge when there was no surface flows past the borefield and in South Creek. Based on the results in the above figure, it is reasonable to assume that irrespective of the quantity of leakage, additional security is needed immediately to minimise the frequent implementation of the Drought Emergency Response Strategy (DERS). Further, the analysis also shows that the scheme is very sensitive to droughts and associated demands due to the relatively small aquifer storage. This means the response time to implement restrictions and other drought management measures are very short.

Figure 6.1 from Ref 23 shows the behaviour of the existing aquifer storage when supplying an unrestricted average annual demand of 2,000ML (i.e., current unrestricted urban demand) based on an assumed leakage rate of 2ML/d and the adopted urban demand pattern. This figure shows that the headwork system would have failed 5 times, if no water restrictions were imposed, for varying length of time for a repeat of the climatic conditions that occurred in the last 114 years. If draw down to 150ML were the trigger point for the DERS, then the DERS would have been implemented 13 times. In other words, it could be considered that the system has 5% chance of failing in any year with a demand of 2,000 ML and 12% chance of triggering the DERS. This situation will worsen as the annual demand increases with population growth. This current level of security is below the best practice standard level of drought security normally adopted for NSW country town water supply schemes.

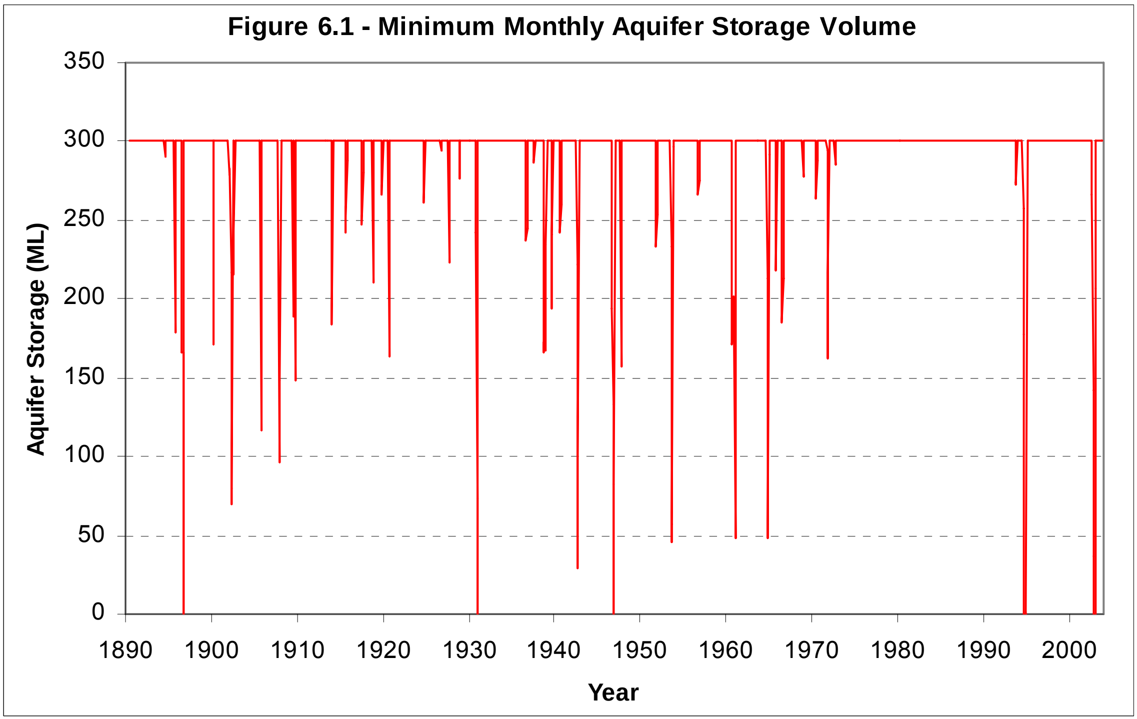

Figure 6.7 Minimum Monthly Aquifer Storage Volume

Whilst the above observations are based on system modelling outcomes, in the development of the model care has been taken to ensure that it represents the actual situation as far as practical. There are however, still areas of uncertainty and in developing the model the following assumptions have been made:

- The accuracy of the system modelling outcome is limited by the extent and accuracy of the historic stream flow and rainfall data used,
- Any changes to catchment land use and irrigation practices will not significantly alter the stream flow sequence,
- Future climate will be statistically similar to the observed historic climate,
- Future urban water use pattern will be statistically similar to observed historic usage patterns and that the current legislation and community 'consciousness and awareness' on conservation will continue,
- The population of Nambucca will continue to increase albeit at a slower rate than in the past and that it will remain a popular tourist and holiday destination.

Environmental Flow and Access Sharing

The WM Act introduced in 2000 aims, using the adaptive management principles, to achieve a better balance between water use and environmental protection by setting environmental objectives for all NSW rivers covering river flow and water quality objectives. The Act acknowledges the environment as a legitimate water user and therefore aims to ensure that it is guaranteed a certain allocation of water in the statutory Water Sharing Plans. Furthermore the Act aims to clearly identify all water users, and formalise their share and access rights. It is generally accepted that ecosystems are highly vulnerable during low flow periods, and that natural flow regime variations are important to ensure a healthy and diverse ecological community. Accordingly, it is likely that the first water sharing plan would require the lowest 5% of the flows be left for the environment (95th percentile). When the plans are reviewed after the mandated 10 year period, it is possible that in light of additional environmental data the environment may be allocated the lowest 20% of the flows (80th percentile). Of the water left in the river it is likely that only 30% will be available for extraction by all users.

Although, the WM Act in the long-term will improve the environmental health and the long term sustainability of the river and estuary; analysis shows that the regional water scheme will have no secure yield as access to the borefield will not be available on average 5% of the time. This means NSC would have to provide an off-river storage (ORS) and/or a new water source to enhance the security of supply. Although, the quantity of water required for the environmental flows has yet to be decided by the Water Management Committee; based on significant field and modelling studies and consultations initiated by NSC it has been established that the foraging and migration movement for all the native fish species and platypi could be economically accommodated by restraining pumping between dusk to dawn when the flow conditions are suitable (see Ref. 26). The adopted environmental flow-operating regime is as follows:

1. Do not pump between dusk to dawn when flow at the gauging station after extraction by upstream irrigators is between 80ML/d to 120ML/d during January to September and 40ML/d to 120ML/d during October to December.
2. Stop pumping to distribution system to meet existing demands when the flow at the gauging station reaches the 95%ile flow corresponding to that month.
3. Stop pumping to distribution system to meet future growth demands and to fill the off-river storage (ORS) when the flow at the gauging station reaches the 90%ile flow corresponding to that month.
4. The upstream irrigators and town water supply are allowed to extract up to 60% of the total daily flow provided other constraints are satisfied.
5. When off-river storage (ORS) is drawn-down to say 60% and the water supply is subject to level 4 and above restrictions, the previous rules are relaxed with pumping to water supply ceasing at 95%ile flow corresponding to that month.
6. Upstream irrigators are to cease pumping when the previous day's affected flow at the gauging station reaches the annual 95%ile flow, which is about 10ML/d.

In confirming their 'in principle' support to the above regime, DWE (formally DIPNR) and DPI also requested that an adaptive management approach be taken up in the development of the scheme, which includes allowing provision in the ORS for future raising, regular collection and review of ecological and hydrological data and development and implementation of the Shire wide IWCM Strategy.

The Quality of the Source and Reticulated Water

NSC routinely monitors the water quality of the raw water at the headworks and the distributed water at strategic locations within the reticulation. This routine monitoring is carried out in accordance with NSW Health quality assurance requirements under the Public Health Act 1991, to monitor long term trends and for operational and emergency response management.

The NSW Government has also formally ratified the latest Australian Drinking Water Quality Guidelines (ADWG) (Ref 27) as the best practise standard and hence the guideline is used as the failure criteria when assessing the medium to long term consequences and service provision risk.

The analysis found that the river water quality in the vicinity of the borefield is sometimes high in turbidity, colour, nutrients and indicator faecal coliform and low in alkalinity and dissolved oxygen. However, test results of the raw bore water located along Nambucca River showed the turbidity and colour to be within the guideline limits, thus requiring treatment only for indicator faecal coliform and low alkalinity. Test results of the raw emergency bore water located along South Creek showed additional issues such as elevated levels of iron, manganese, turbidity and colour.

Available reticulated water quality data shows that the reticulated water is occasionally outside the ADWG values for total coliforms and pH. Thus it could be concluded that whilst the combination of management procedures and barriers are effective in reducing the supply of sometimes poor water quality, they do not consistently meet the current best management practice standards.

Water quality modelling undertaken in Ref. 26 shows that the provision of an ORS to improve the security of supply could harbour the growth of both nuisance and toxic algae potentially contaminating the stored water with algae induced taste, odour and toxins. The existing treatment processes at Nambucca are unlikely to be effective against these contaminants resulting in increased non-compliance to the best management practice standards.

The ADWG (Ref 27) requires that the water authorities take a risk based approach when managing the drinking water quality and accordingly provides a template for the preparation of Drinking Water Quality Management Plan. The NDWS Scheme does not have such a Plan.

Issues in Meeting Capacity and Aspirational Targets

The issues associated with current and future capacity and those relating to aspirational target are summarised below:

- The daily supply of water to the NDWS scheme is dependent on a single source and hence any issues with this source and/or the infrastructure used in the extraction of water could adversely affect the ability to supply water to all customers;
- The headwork bore and lift pumps are reliant upon a common power supply source and hence any long power supply failure would also adversely affect the ability to supply water to all customers;
- There is less than a day's storage in South Macksville reservoir, which may result in an available minimum residual pressure lower than the aspirational target for those customers serviced by this reservoir (analysis undertaken in Task 6 Paper suggests this is unlikely to be a problem even with

the additional future demand) as well as lower fire fighting capability than the aspirational target (the fire fighting target has not been tested);

- The booster pump to Scotts Head does not have provision for an emergency power supply thus a long failure of the existing power supply would adversely affect the supply of water to Scotts Head customers during peak demand periods only;
- The existing reticulation network's ability to maintain the aspirational minimum residual pressure and fire fighting targets has not been tested at current and future demands;
- The percentage of non-revenue water is high compared to the aspirational target and the calculated Infrastructure Leakage Index is higher than the aspirational target;
- The aspirational target relating to demand reduction requires improved demand management initiatives (such as water efficient fixtures & appliances, rainwater tanks, grey water reuse), incentives to increase up-take rates and education relating to behavioural change for water use from both the permanent and tourist population;
- Preliminary studies undertaken in Ref 14 suggests that the aspirational response time targets for unplanned supply interruptions cannot be met in certain areas and circumstances;
- Analysis undertaken in Task 6 Paper indicates that with the additional demands the aspirational minimum residual pressure target will not be met in all the urban centres except for Bowraville unless the existing trunk mains were augmented.

6.6.2 Sewerage Schemes

Legislative Compliance Issues

Summarised below is a list of legislative non-compliance:

- Bowraville STP is operating at or above plant capacity resulting in effluent exceeding DECC Licence conditions for BOD and total dissolved solids (TSS) concentration;
- The disinfection system has been non-functional for majority of the time since installation resulting in un-disinfected effluent being transferred for agricultural reuse, a public health and OH&S non-compliance;
- There is anecdotal evidence (Bowraville STP operational staff) of potential illegal dumping of chemicals and/or trade waste into the sewer network, resulting in damage to biological media in the TF requiring some time to return to normal operation, a period of non-compliance;
- The DECC licence for Bowraville STP is due for renewal in 2011 and the revised license conditions may be more stringent potentially requiring improved treatment;
- Although, an operational Environmental Management Plan (o-EMP) for the reuse area exists, the effectiveness and compliance is not regularly reviewed nor is the long term sustainability of the reuse area assessed;
- The Macksville STP has recorded non-compliance for TSS, BOD, ammonia, TP and FC against the DECC licence in recent reporting years (2005-07). It is reported that the recent installation of variable speed effluent pumps and maintenance of low water levels in the wet weather storage has to some extent addressed this non-compliance issue;
- The continued increase in population would cause the hydraulic loading on the UV unit to exceed the design capacity in the next few years potentially resulting in Faecal coliform counts exceeding the DEC license limit;
- The Scotts Head STP has recorded a number of non-compliance for TSS and BOD against the DECC licence in recent reporting years (2005-2007);
- The load on Nambucca STP has exceeded the design capacity resulting in a number of non-compliance for TSS, total nitrogen and FC against the DECC licence in recent reporting years (2005-2007);
- A very brief overview of NSC's management system, infrastructure facilities, work procedures, etc. tends to suggest that the OH&S Act and Regulations is not fully compliant;

- The operational environmental management plan, a requirement of the development consent under EP&A and POEA Acts, does not seem to cover the full spectrum of issues that the operation of the sewerage schemes could have an impact on the environment;
- Recording and archiving of historical operation incidents and data is not systematic and does not meet the record keeping obligations under the POEA and other Acts; and
- It is our understanding that NSC has easement over all sewerage assets and unconditional access rights to these easements.

Best Practice Compliance Issues

The best practice non-compliance issues are summarised below:

- The Bowraville STP wet weather storage and parts of the drying beds are periodically inundated with flood flows in Nambucca River resulting in the accumulation of debris/sediments in the storage and the release of partially treated, but diluted, sewage into the waterways. This is not best practice in design standards;
- There are a number of residences within close proximity to the Bowraville STP (less than 500 m), which is non-compliance to best practice standard for buffer zone around STPs;
- With the exception of MSPS4, the stand-by pumps in all MSPS are configured to operate when the water in the wet well reaches a pre-determined high level. Although this is acceptable, the best practice in design standards is to have 100% stand-by, that is, the capacity of each pump to be at least equal to the respective pump station catchment's PWWF plus the capacity of contributing pump stations (there is similar issues across the other three schemes as well);
- Although, telemetry is used for majority of the sewer pumping facility operation in all the schemes the pump operations are not synchronised. Best practice in operation is to have a synchronised scheme operation to minimise overflows, etc.;

Issues in Meeting Capacity and Aspirational Targets

The issues associated with current and future capacity and those relating to aspirational target were reported in the Concept Study Report and Task 4 Paper and are summarised below for convenience:

- There is significant wet weather inflow into the Bowraville sewer network and analysis shows that the pumping capacity is approached during rainfall events in excess of 45 mm. While there is no recorded information with regards to sewage overflows from the sewer network and pump station, NSC staff indicated that overflows do occur at the pump station during high rain fall events;
- Infiltration is also an issue with the Bowraville scheme as analysis indicates that the dry weather flow of 196 L/EP/d is considerably higher than the estimated internal residential water demand of 169 L/EP/d;
- The current permanent population loading on the Bowraville STP is slightly in excesses of the design capacity of the plant and the anticipated growth whilst small could have an impact on plant performance, and in addition the plant is nearing its economic life;
- Although, the current permanent population loading on the Macksville STP (3,611 EP) is within the design capacity of the plant (5,500 EP) the design capacity of the STP is projected to be exceeded by permanent loads in 2022, and by peak visitor loads (Christmas and Easter) in 2015;
- The handrails and walkways in the inlet and grit chamber of Macksville STP have corroded and the storm by-pass pipework from the inlet works to the wet weather storage is inadequate resulting in overflows;
- The drying bed capacity of Macksville STP seems inadequate given the rainfall pattern of the area;
- Although the recent effluent quality test results from Macksville STP generally meet the licence requirements, there is both a need to ensure that the effluent quality consistently meets the quality standards at all times due to the presence of the oyster leases in the vicinity of discharge and a need to plan for a more stringent quality requirements in subsequent license reviews;

- Although, there is no recorded information with regards to sewage overflows from the sewer network and pump station at Macksville, NSC staff indicated that surcharging does occur during high rain events especially at MSPS8 and MSPS9. The following specific issues have been identified with regards to Macksville Sewerage Scheme inflow:
  - MSPS 1, 2, 3, 8, 9 and 13 are currently approaching or having their pumping capacities exceeded during wet-weather events;
  - Potential odour issues at MSPS1, MSPS8 and MSPS10;
  - There is anecdotal evidence of possible illegal sewer connections within SPS 6 which may be contributing to wet-weather inflows; and
  - Inflow and infiltration issues at MSPS catchments 2, 3, 4, 5, 7, 9, 13 and 14 are classified as a high priority (see Task 4 Paper Appendix D1 for classification).
- Infiltration is also believed to be an issue across the Macksville Sewerage Scheme reticulation network. Analysis indicates that the ADWF of 245 L/EP/d at the STP inlet is considerably higher than the estimated internal residential water demand of 173 L/EP/d;
- The MSPS 3, 5, and 9 have exhibited extended pump run times during dry weather, suggesting that the design capacity may have been reached;
- There are two single rising main river crossings in the Macksville Sewerage Scheme; the Pacific Highway across the Nambucca River and Joffre Street across Tilly Willy Creek. If an operational event were to occur at either of these crossings then there would be an increased risk of sewage overflows at both MSPS 2 (North Macksville) and MSPS 3 (located between Taylors Arm and Tilly Willy Creek) respectively;
- The design capacity of Scotts Head plant is projected to be exceeded by permanent loads in 2018, and by peak visitor loads in 2009;
- Potential odour issues at SHSPS8;
- Inflow and infiltration issues at Scotts Head pumping station catchments 7 and 8 are classified as a high priority (see Task 4 Paper Appendix D1 for classification).
- Although, the current permanent population loading on the Nambucca Head STP is within the design capacity the holiday loadings significantly exceed the design capacity of the plant and with the projected increase in population the permanent load would also exceed the design capacity by 2011 (NSC is addressing this issue with the planned augmentation of the plant to 15,000EP);
- The augmented capacity of Nambucca Head STP would be exceeded by about 2016 with the continued increase in population from both the Valla Urban growth area and within the existing serviced area;
- Although, there is no recorded information with regards to sewage overflows from the sewer network and pump station at Nambucca Head and Valla Beach, NSC staff indicated that surcharging does occur during high rain events especially at NHPS8 and NHPS12. The following specific issues have been identified with regards to Nambucca Head Sewerage Scheme inflow:
  - NHSPS 1 and 8 pumping capacities are currently exceeded during wet-weather events;
  - Inflow and infiltration issues in the NHSPS13, VBSPS5 and VBSPS7 catchments are classified as a high priority (see Task 4 Paper Appendix D1 for classification); and
  - VBSPS 1, 5, 6 and 7 pumping capacities are currently exceeded and/or approached during wet-weather events.
- Based on analysis infiltration is also believed to be an issue across the Nambucca Heads (ADWF of 211 L/EP/d against an estimated internal residential water demand of 179 L/EP/d) and Valla Beach (ADWF of 257 L/EP/d against an estimated internal residential water demand of 164L/EP/d) sewerage reticulation network;
- There is currently no water quality monitoring program to establish background levels of TP in Deep Creek;

- There may be potential odour and / or septicity issues at SPS2, SPS7 and SPS9 due to suspected high residence times (>4 hours) of sewage in the rising mains leaving these pump stations;
- There is a single gravity main water crossing in the Nambucca Heads sewer reticulation network; west of the Pacific Highway across Bellwood Creek. If an operational event were to occur at this crossing then there would be an increased risk of sewage overflows at SPS13;
- Long power supply failure would have a significant impact on all the schemes as most of the pumping stations and critical processes within the STP do not have alternate grid and/or emergency power supply;
- There are a number of properties within the urban areas that are connected to the NWSS but not connected to the respective sewerage scheme as listed below:
    - Properties north of Oyster Creek area in Valla Beach;
    - About 62 properties in the Macksville urban area; and
    - About 34 properties in the Nambucca Head urban area.
- As a licensing stakeholder of urban water services, DEC formally requested that the potential beneficial use of treated wastewater be assessed using the wastewater management hierarchal framework for all the schemes.

6.6.3 Urban Stormwater Issues

Issues relating to stormwater management and the infrastructure used for its management are summarised under the respective urban area. Task 4 Paper discusses in detail these issues.

Bowraville

- A lack of water quality monitoring for stormwater discharge into South Creek and nearby agricultural land;
- Incidences of elevated nutrients at Alberta Street stormwater outlet (Sub-catchment 2a Low Priority – Ref. 15);
- Nature and state of the infrastructure is unknown;
- Incidences of litter at William St stormwater outlet (Sub-catchment 3a Low Priority – Ref. 15); and
- As a licensing stakeholder of urban water services, DEC formally requested that the potential beneficial use of stormwater be assessed using the stormwater management hierarchal framework.

Macksville

- A lack of water quality monitoring for stormwater discharge into Newee Creek (via SEPP14 Wetland No. 383), Tilly Willy Creek, Hughs Creek, Taylors Arm and the Nambucca River;
- Incidences of elevated nutrients, turbidity, heavy metals and oils and grease at an Industrial Estate stormwater outlet (Sub-catchment 4d Low Priority – Ref. 15);
- Incidences of elevated nutrients and turbidity at an outlet near Macksville High School (Sub-catchment 3c Medium/Low Priority – Ref. 15);
- Incidences of elevated nutrients, turbidity and litter at an outlet near Macksville Train Station (Sub-catchment 2f Medium/Low Priority – Ref. 15);
- Incidences of elevated nutrients, turbidity and litter at Dawkins Park Lake (Sub-catchment 2g Medium Priority – Ref. 15);
- Incidences of elevated nutrients, turbidity, bacteria, litter, altered stream flow and barriers to aquatic life in Hughs Creek (Sub-catchment 2g High Priority – Ref. 15);
- Nature and state of the infrastructure is unknown;

- There are 62 properties in the Macksville urban area that are connected to the NWSS but not the Macksville Sewerage Scheme. The majority of these properties with OSS are concentrated in sub-catchments 4a (24 OSS) and 4e (17 OSS); and
- As a licensing stakeholder of urban water services, DEC formally requested that the potential beneficial use of stormwater be assessed using the stormwater management hierarchal framework.

Scotts Head

- A lack of water quality monitoring for stormwater discharge into the Pacific Ocean at Forsters Beach;
- Incidences of nutrients, turbidity, bacteria and litter at the Forsters Beach stormwater outlet (Sub-catchment 1c High Priority – Ref. 15);
- Incidences of litter at an outlet in Sporting Fields in South Scotts Head (Sub-catchment 1d Medium/Low Priority – Ref. 15);
- Nature and state of the infrastructure is unknown;
- As a licensing stakeholder of urban water services, DEC formally requested that the potential beneficial use of stormwater be assessed using the stormwater management hierarchal framework.

Nambucca Heads

- A lack of water quality monitoring for stormwater discharge into Bellwood Creek, Swampy Creek, Cedar Creek, Swimming Creek and the Nambucca River;
- Incidences of nutrients, turbidity, bacteria and litter at Bellwood Park (Sub-catchment 3a Medium Priority – Ref. 15);
- Incidences of nutrients and turbidity at an outlet in Seaview Street (Sub-catchment 2a Medium/High Priority – Ref. 15);
- Incidences of nutrients, turbidity, litter and barriers to aquatic life in Beer Creek (Sub-catchment 1a Medium/High Priority – Ref. 15);
- Incidences of litter and altered stream flow at Gordon Park (Sub-catchment 8a Medium Priority – Ref. 15);
- Incidences of nutrients, turbidity, litter, erosion and altered stream flow at Coronation Park / Swimming Creek (Sub-catchment 7b Medium/High Priority – Ref. 15);
- Incidences of nutrients, turbidity, bacteria, litter, altered stream flow and barrier to aquatic life at Merry Park / Swimming Creek (Sub-catchment 6c High Priority – Ref. 15);
- Incidences of nutrients, turbidity, bacteria and litter at Newville Park / Bellwood Creek (Sub-catchment 4a Low Priority – Ref. 15);
- Incidences of turbidity and altered stream flow at the Nambucca Heads Industrial Park (Sub-catchment 5a Medium Priority – Ref. 15);
- Nature and state of the infrastructure is unknown;
- There are 34 properties in the Nambucca Heads urban area that are connected to the NWSS but not the Nambucca Heads Sewerage Scheme. All of these properties with OSS are located in Sub-catchment New 9b which discharges to Bellwood Creek; and
- As a licensing stakeholder of urban water services, DEC formally requested that the potential beneficial use of stormwater be assessed using the stormwater management hierarchal framework.

Valla Beach and Hyland Park

- A lack of water quality monitoring for stormwater discharge into Deep Creek, Oyster Creek and the Pacific Ocean;

- Incidences of nutrients, turbidity, bacteria, erosion, litter and altered stream flow at Kuta Road (Sub-catchment 1b Medium/High Priority – Ref. 15);
- Nature and state of the infrastructure is unknown;
- Properties north of Oyster Creek area are connected to the NWSS but not the Nambucca Heads Sewerage Scheme; and
- As a licensing stakeholder of urban water services, DECC formally requested that the potential beneficial use of stormwater be assessed using the stormwater management hierarchal framework.

Part E
How to Fix the Issues?

Part E develops solutions to the IWCM issues. Solutions are developed at regional, local and shire wide level.

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7 Overview for Part E

In this Part, the ‘how to fix’ or in other words ‘how to get to where we want to be’ question is considered and addressed using the IWCM concept.

Since the urban areas are distributed and the issues are unique to each area, this requires unique solutions to meet the aspirations and demands of each community and the local environment. Furthermore, there is a need to consider the ‘how to’ at both the regional and local area level. The IWCM options identified at both levels are then combined to form shire wide scenarios.

Accordingly, the PRG in a workshop session considered a long list of independent water supply, sewerage and stormwater opportunities to solve the identified issues in each water service on an independent basis for each local area and short-listed for each area some of the opportunities in the long list for feasibility assessment. Once the feasibility assessment was completed on an independent basis for each local area, the remaining opportunities were matched against the respective water services issues to see if there is more than one opportunity to solve the issue. The matching showed that more than one opportunity could be used to solve the respective water services issue and hence these opportunities were costed and the advantages and disadvantages were identified from a TBL perspective. These opportunities were considered by the PRG in a workshop session and the opportunities with the greatest benefits were shortlisted for bundling into the shire wide scenarios. The Task 4 Paper describes in detail each opportunity and the shortlisting process. This Part of the report provides for convenience a summary of these opportunities from the Task 4 Paper but develops and describes in detail the shire wide scenarios and the benefits of addressing the respective water services issues in an integrated manner using the IWCM concept.

It should also be noted that the shire wide scenarios do not necessarily rely solely on the provision of new infrastructure and hence the ‘how to’ solution consists of both structural and non-structural solutions.

This Part of the report also provides a qualitative description of the relative pros and cons of each opportunity from a triple bottom line (environment, social and economic) perspective.

8 Feasible Regional and Local Opportunities

As mentioned above, this section provides for convenience a summary of the feasible opportunities in each water service from Task 4 Paper and the opportunities that were shortlisted from the feasible opportunity list.

8.1 Regional Water Supply Opportunities

8.1.1 Opportunities for Managing the Regional Water Demands

Status of Current Measures

NSC has already implemented a number of demand management measures and these are summarised below.

- *Education programs such as participation in 'water week' activities,* distribution of information leaflets , regular water meter reading and water bills with usage comparison and saving tips;
- *Water* on a cost recovery basis;
- *Water pricing that embraces the* Best Practice guidelines;
- Permanent Level 1 water restrictions, which bans the use of sprinklers and unattended fixed hoses in residential gardens between the hours of 8am and 4pm;
- *Drought Management Plan* with clearly defined 'trigger' points for each restriction level together with the associated response and management measures;
- Voluntary retrofit program with a small financial incentives in the form of rebate to replace existing high water using appliance/fixture with a low water using fixture/appliance (take-up rate has not been high);
- *Water meter replacement program* to repair and replace faulty meters;
- *Non revenue water management* by fixing major leaks, installing water meters on most public and community properties and employing effective strategies to manage the demand on the system by the water carters; and
- DCP 3 – Residential Development (2000) and DCP 17 – South Macksville Urban Release Area (2005), both mandating water use and discharge minimisation strategies at household level (the water use minimisation strategies are now covered under BASIX).

Future Opportunities

Additional demand side management measures are required as the current demand side management measures are not sufficient to meet the aspirational targets and in addition anecdotal evidence suggests that when there is a need to upgrade the headwork, as is the situation with NDWS scheme, it is often cost effective to implement water use efficiency programs to reduce demands. The demand side management programs are outlined below:

Residential Retrofit Program – Cost benefit analysis undertaken in Task 4 Paper had shown that when a number of individual measures at the household level were bundled into programs significant permanent water savings could be achieved. Accordingly, two residential Retrofit programs with the best overall cost benefit ratio and targeting 50% of existing dwellings were shortlisted for bundling to the shire wide scenario. The programs benefits and costs are outlined in Table 8.1 below:

Table 8.1 Shortlisted Residential Retrofit Program

	Program Elements	Annual Average Water Saved (ML/a)	NSC Cost over 10 year life of Program[1]	Total Cost over 10 year life of Program
Basic Tune-up Retrofit	▪ 3A Shower head; ▪ Cistern Displacement Unit; ▪ 3A Tap Aerators; ▪ Quick leakage check; ▪ Visual audit and rectification of all minor fixture leakage; and ▪ All work undertaken by a licensed plumber.	46	$0.78M	$1.0M
Enhanced Tune-up Retrofit	▪ Basic Tune-up Retrofit Program elements; ▪ Micro-irrigation unit; ▪ Efficient washing machine; and ▪ Cistern replacement.	77	$4.34M	$5.75M

Note 1 – To achieve 50% uptake by existing dwelling owners it is expected NSC would have to provide a rebate of 75% of the total cost.

Non-Residential Water Audit Program – Analysis has shown that a water audit program targeting 10% of customers, especially NSC premises and activities, MIDCO and caravan parks, is estimated to save about 9.0 ML/a at a total cost of about $14,200.

System Leakage Reduction Program – This program in addition to reducing demands would also address the issue of high ILI. The program is estimated to save about 71 ML/a of water at an initial cost of $110,000 and an on-going cost of $43,000 and includes the following elements:

- The installation of correct telemetry to relay metered data;
- The installation of flow switches on all reservoir overflow lines;
- The installation of adequate alarms to monitor reservoir level drop, reverse flow and other such suspicious events;
- Water balances and minimum nightly flow and reservoir drop tests can be undertaken at a reducing scale to narrow the leakage search area;
- Physical detection equipment can be employed at individual pipeline level to detect and locate leaks; and
- High pressure areas can be identified allowing for the installation of pressure reducing valves (PRV). It is noted that NSC has already installed 5 PRV in the NWSS distribution network.

8.1.2 Opportunities for Developing the Local Supply Sources

Task 4 Paper evaluated all the feasible local supply source opportunities available at both the household and urban area levels. The evaluation indicated that the local supply sources cannot fully overcome the security of supply issue on their own but are good supplementary sources to the existing Nambucca River source. The sources evaluated at the household level and shortlisted for inclusion in the shire wide scenarios included roofwater harvesting in rainwater tanks and grey water reuse.

Analysis showed that the harvesting of roof water and storing in a 5 kL rainwater tank for the provision of garden, toilet and washing machine is the most cost efficient option for the existing residential customers of NDWS scheme (all new dwellings are covered by BASIX). This provides average household water saving of about 83 kL compared to the household average annual demand of about 220 kL. Two programs were developed, one with an uptake target of 25% with NSC subsiding 75% of the total cost and the other with an uptake target of 50% with NSC subsiding 90% of the total cost. Table 8.2 presents the cost and the water savings of both programs.

Table 8.2 Shortlisted Residential Rainwater Tank Refit Program

Program Description	Number of Houses	Annual Average Water Saved	NSC Cost over life of Program[2]	Total Cost over life of Program[1]
25% RWT Refit Program	1,285	103 ML	$2.55M	$3.40M
50% RWT Refit Program	2,569	206 ML	$6.12M	$6.80M

1. State Government Rebates have not been included as they are not participating customer nor NSC costs
2. NSC costs do not include program set-up and on-going administration costs
3. Total cost is the sum of NSC and participating customer costs

The shortlisted greywater reuse program to meet the aspirational target of 5% take-up by the residential consumers would result in annual water saving of 1.5 ML at a cost of $3.2M.

8.1.3 Opportunities for Developing the Regional Supply Sources

Headwork Opportunities to Meet Secure Yield

As mentioned earlier the demand management and local supply source opportunities cannot on their own fully overcome the security of supply (i.e. secure yield) and environmental flow and access sharing issues, and hence there is a need to augment the existing headwork with regional supply side sources. Listed below for convenience are the regional supply side sources evaluated in detail in Refs 8 and 26.

- Enhancement of the existing Nambucca River source.
- Local groundwater supply;
- Local surface water sources;
- Desalination of sea and/or brackish water;
- Surface water supply from the Lower Bellinger scheme;
- Surface water supply from the Coffs Harbour regional scheme;

As mentioned in Task Paper 4, six scheme options out of about fourteen options developed based on the above sources were shortlisted based on a formal multi-criteria analysis (see Ref 8 for outcomes). The six short-listed regional supply side scheme options were:

- Scheme Option A – Single scheme with off-river storage at Bowra Creek, surface water extraction and stored water released to Nambucca River;

- Scheme Option B – Single scheme with off-river storage at Bowra Creek, surface water extraction and stored water fed directly into reticulation system, a variation to Scheme Option A;
- Scheme Option C – Single scheme with off-river storage at Bowra Creek, groundwater and/or sub-surface water extraction and stored water allowed to infiltrate into aquifer. Infiltration would be achieved through the use of pipe laterals;
- Scheme Option D - Single scheme with off-river storage at Bowra Creek, groundwater and/or sub-surface water extraction and stored water fed directly into reticulation system;
- Scheme Option E – Off-river storage at Bowra Creek (Stage 1) with groundwater and/or sub-surface water extraction and stored water fed directly into system followed by southern off-river storage based on Warrell Creek (Stage 2); and
- Scheme Option F – Scheme based on existing Nambucca River headwork facility with seawater desalination plant replacing the off-river storage at Bowra Creek.

The six scheme options were then subject to public consultation and feedback between December 2005 and March 2006, NSC based on the study findings and community feedback adopted Scheme Option D as the preferred regional supply side scheme option.

Scheme D consists of a 5,500 ML off-river storage on the upper reaches of Bowra Creek and an additional 40 ML/d Borefield capacity along Nambucca River and South Creek. Additional Pipework is required for the harvesting and transfer of medium to high river flows to the off-river storage. This headwork system has the ability to supply an annual demand of 3,200 ML/a on a secure yield basis.

The baseline annual demand projections in the Task 3 Paper indicate that the headwork capacity proposed in Scheme D above would be exceeded around 2030 under historic climatic conditions and by about 2024 if mid-scenario climatic change were to eventuate. Task 4 Paper outline two opportunities to address this risk:

- Opportunity HW1 – Build up-front an off-river storage and Borefield capacity that meets the projected 2046 demands as opposed to the capacities proposed in Scheme D. Allow provision in the off-river storage foundation and embankment for future raising to the ultimate capacity of 14,000ML. The required up-front size for each scenario was determined in Task Paper 5.
- Opportunity HW2 – Continue with the current planned headwork capacity and augment with a desalination plant or by enlarging the off-river storage and river/borefield capacity. The time and size of augmentation would depend on the population and water demand growth rates, climate change impacts, etc. Allow provision in the off-river storage foundation and embankment for future raising to the ultimate capacity of 14,000ML. Also allow for the collection of developer charges for the future augmentation.

Table 8.3 presents the qualitative TBL comparison between the two headwork opportunities from Task 4 Paper.

Table 8.3 Qualitative TBL Comparison of Headwork Opportunities

Headwork Opportunity	TBL Criteria		
	Economic	Environmental	Social
Opportunity HW1	▪ NSC would need to raise significant funds up-front (this is off-set to some extent by economies of scale) ▪ The impact of filling the storage on the rural sector.	▪ Increased inundation of habitat ▪ Increased risk of upstream salinity migration and impact of freshwater dependent ecosystems ▪ Population growth distorts environmental sustainability	▪ Increased local employment opportunities in the short term ▪ Increased impact on other water users ▪
Opportunity HW2	▪ Capital outlay is synchronized with growth but costs would be greater than for HW1 ▪ Substantial developer charges revenue would be available to reduce the debt level ▪ The impact of filling the storage on the rural sector (off-river storage only) ▪ Potential for renewable energy development for local economy (desalination plant only) ▪ Loss of opportunity cost by not raising the storage height (desalination plant only).	▪ Increased levels of brine causing potential impact on aquatic ecology (desalination plant only) ▪ Increased energy use (desalination plant only) ▪ Increased inundation of habitat (off-river storage only) ▪ Increased risk of upstream salinity migration and impact of freshwater dependent ecosystems (off-river storage raising only)	▪ Depending on plant location, potential increased recreational disturbance ▪ Increased economic activity over a longer period due to phased augmentation providing ongoing employment opportunities ▪ Increased impact on other water users (off-river storage raising only)

Based on the information presented in the above table, it appears that the solution to overcome the deficiencies with inadequate secure yield is to proceed with HW1, when one considers the solution to this deficiency in isolation to the other urban water cycle measures. If one considers the benefits of integration of all the urban water cycle measures, then HW2 becomes attractive (through delayed augmentation). Furthermore, since the community expressed the desire to have the supply side headwork augmentation complimented by demand side water conservation and alternative local supply opportunities, both HW1 and HW2 should be shortlisted for scenario analysis. However, since HW1 reflects the costs and benefits of integration more transparently it was decided to adopt HW1 in all scenario analysis but recognising that there is sufficient flexibility even if NSC proceeded to build only 5,500 ML off-river storage.

Water Quality Improvement Opportunities

As mentioned earlier the reticulated water does not consistently meet the current best management practice standards due to occasional exceedance of ADWG trigger values for faecal coliform, pH and alkalinity. Furthermore, analysis has also shown that the bore-water quality in the South Creek aquifer could be high in iron and manganese and that the off-river storage would be at risk of blue-green algal blooms with the intensity and duration depending on storage management, natural processes and other factors.

Three opportunities were evaluated in Task 4 Paper to address the water quality issues, they are:

- Opportunity WTP1 – Implement a comprehensive and effective catchment management plan including fencing and river bank stabilisation (up to 4 km). Implement a well-head protection plan and storage aerators and storage management plan. Plan to build a water filtration plant (WFP) in 2023 and allow for the immediate collection of developer charges.
- Opportunity WTP2 – Undertake catchment protection works in the vicinity of the Borefield (about 1 km of fencing and river bank stabilisation). Implement a well-head protection plan and storage aerators and storage management plan. Plan to build a WFP in 2020 and allow for the immediate collection of developer charges.
- Opportunity WTP3 – Undertake no catchment protection works (i.e. no fencing but river bank stabilisation in the vicinity of the Borefield). Implement a well-head protection plan and storage aerators and storage management plan. Build a WFP at the same time as the off-river storage.

Table 8.4 presents the present value and qualitative TBL comparison between the three water quality management opportunities.

Table 8.4 Cost and Qualitative TBL Comparison of Water Treatment Opportunities

Water Treatment Opportunity	NPV ($M @ 7%)	TBL Criteria		
		Economic	Environmental	Social
Opportunity WTP1	$12.1	▪ No immediate capital outlay and reduced loan requirement due to collection of developer charges ▪ Increased risk of adverse water quality affecting visitor numbers (until WFP is built)	▪ Increased water treatment chemical use (after 2023) ▪ Improved river water quality due to better river bank and catchment management	▪ Decreased risk of adverse water quality events in the potable distribution system (once WFP is built) ▪ Increased recreational (swimming) impacts due to fencing
Opportunity WTP2	$13.3	▪ No immediate capital outlay and reduced loan requirement due to collection of developer charges ▪ Increased risk of adverse water quality affecting visitor numbers (until WFP is built)	▪ Increased water treatment chemical use (after 2020) ▪ Improved river water quality due to better river bank and catchment management	▪ Decreased risk of adverse water quality events in the potable distribution system (once WFP is built) ▪ Increased recreational (swimming) impacts due to fencing
Opportunity WTP3	$24.8	▪ High immediate capital outlay ▪ Increased potential to attract new development and business	▪ Increased water treatment chemical use ▪ No improvement in river water quality due to no additional catchment management works	▪ Excellent water quality for residents, business and visitors

Based on the information presented in Table 8.4, it appears that the solution to overcome the water quality deficiencies is to proceed with WTP3, when one considers the solution to this deficiency in isolation to the other measures. However, if one considers the benefits of integration of all the urban water cycle measures, then both WTP1 and WTP2 become attractive. In view of this, all three water quality improvement opportunities are shortlisted for scenario bundling.

8.2 Bowraville

8.2.1 Wastewater Treatment Opportunities

As described in Task 4 Paper majority of the issues relating to the sewage treatment could be overcome by one of the three opportunities listed below:

1. Opportunity B1 – Optimise current STP operation and dose with coagulant chemicals.
    - Based on studies and operational experience at other STP, these measures enhance the solids settlement rate enabling the treatment of more biological load. These measures, together with per capita reduction in water usage due to increased internal water consumption efficiency and inflow / infiltration management, would allow the STP to accommodate a load of up to 1,500 EP;
    - Install an odour bed and scrubber to minimise the smell at the STP inlet works; and
    - Complete the following immediate works:
        - Undertaking a process study to improve the operational performance of the STP; and
        - Recommissioning the chlorine dosing plant and/or installing a new UV plant to ensure the microbiological quality of effluent consistently complies with licence condition.

2. Opportunity B2 – Install immediately a new STP of 1,500 EP capacity allowing sufficient buffer zone from current and future urban development.
    - A new STP has been costed based on a 1,500 EP IDEA process located near the existing reuse site;
    - The existing site including the wet-weather storage would be abandoned and the site rehabilitated;
    - There should be an introduction or amendment of policies to protect the STP buffer zone from future encroachment; and
    - Complete the following immediate works:
        - Undertaking a process study to improve the operational performance of the STP; and
        - Recommissioning the chlorine dosing plant and/or installing a new UV plant to ensure the microbiological quality of effluent consistently complies with licence condition.

3. Opportunity B3 – Optimise current plant performance and plan to build a new plant by 2015
    - The current plant would be optimised to improve performance (as outlined in Opportunity B1);
    - Allow for the immediate collection of charges for a planned renewal of the existing STP with a new 1,500 EP STP and wet weather storage at a new location by 2015; and
    - Complete the following immediate works:
        - Undertaking a process study to improve the operational performance of the STP; and
        - Recommissioning the chlorine dosing plant and/or installing a new UV plant to ensure the microbiological quality of effluent consistently complies with licence condition.

Table 8.5 presents the cost estimate and the social and environmental aspects of the Bowraville wastewater treatment opportunities.

Table 8.5 Bowraville Waterwater Treatment Opportunities – TBL Aspects

Opportunity	Social	Cost Estimate		Environmental
		Capital ($M)	PV @ 7% ($M)	
Opportunity B1	▪ Continued odour impacts on residents adjacent to Bowraville STP	$0.27	$1.20	▪ Continued contaminant loading on Nambucca River during wet-weather (due to the inundation of the wet weather storage and parts of the drying beds) ▪ Increased chemicals in the biosolids reducing their beneficial use
Opportunity B2	▪ No odour impacts due to relocation of STP	$5.73	$6.38	▪ Reduced contaminant loading on Nambucca River during wet-weather due to relocated wet-weather storage
Opportunity B3	▪ No odour impacts due to relocation of STP	$6.01	$4.07	▪ Reduced contaminant loading on Nambucca River during wet-weather due to relocated wet-weather storage (after 2015) ▪ reduced chemicals in the biosolids increasing their beneficial use beyond 2015

Based on the information presented in the above table, it is recommended that Opportunity B3 be shortlisted for scenario analysis as this option overcomes all the deficiencies associated with the sewage treatment plant in a staged and cost effective manner.

8.2.2 Stormwater Management Opportunities

Table 8.6 presents the cost estimate and the social and environmental aspects of the shortlisted Bowraville stormwater quantity and quality management measures.

Table 8.6 Bowraville Stormwater Management Opportunities – TBL Aspects

Measure	Social	Cost Estimate		Environmental
		Capital ($M)	PV @ 7% ($M)	
Alberta St		$0.00	$0.40	▪ 30% reduction in TN load ▪ 30% reduction in TP load
William St	▪ Improved visual amenity	$0.04	$0.57	▪ 44% reduction in gross pollutant load

Unlike the urban stormwater that flows into South Creek, the associate issues which have been addressed as a matter of high priority along with the water supply catchment improvement measures, the above local specific measures have been given a low priority based on their impact on the local environment and community.

8.3 Macksville

8.3.1 Wastewater Treatment Opportunities

As described in Task 4 Paper majority of the issues relating to the sewage treatment could be overcome by one of the two opportunities listed below:

1. Opportunity M1 – Optimise current STP operation by operating at high MLSS during peak load periods and then add a new reactor by 2017.
    - Optimisation measures would include UV disinfection augmentation in 2011 (due to hydraulic loading) and operating the STP at high MLSS loads during peak periods. These measures would allow treatment of up to 5,900 EP;
    - Implement comprehensive internal water consumption efficiency and I/I improvement measures to reliably treat a load of about 5,900 EP;
    - Add a new 3,000 EP reactor by 2017 to take the full capacity to 7,000 EP. This also requires the downgrading of the existing STP capacity to 4,000 EP to improve the reliability of treatment;
    - As part of the augmentation, add tertiary filtration (if continuing with river discharge) to improve effluent quality; and
    - Complete the following immediate works:
        - Undertake a process study to further enhanced and optimise the operational performance of the STP such that the effluent quality consistently meets licence conditions;
        - Reconfigure the wet weather storage inlet/outlet arrangement such that they are at opposite ends;
        - Install a bigger bypass pipe from the inlet works to the wet weather storage;
        - Develop solutions to rectify the design configuration of the catch/balance pond to overcome settlement, cleaning and algal growth problems;
        - Replace the corroded handrails and walkways in the inlet and grit chamber; and
        - Provide additional drying bed capacity.

2. Opportunity M2 – Install a new reactor in parallel to the existing reactor at least by 2014:
    - Augment the UV disinfection facility in 2011;
    - Add a new 3,000 EP reactor by 2014 to take the full capacity to 7,000 EP. This also requires the downgrading of the existing STP capacity to 4,000 EP to improve the reliability of treatment;
    - As part of the augmentation, add tertiary filtration (if continuing with river discharge) to improve effluent quality; and
    - Complete the following immediate works:
        - Undertake a process study to further enhanced and optimise the operational performance of the STP such that the effluent quality consistently meets licence conditions;
        - Reconfigure the wet weather storage inlet/outlet arrangement such that they are at opposite ends;
        - Install a bigger bypass pipe from the inlet works to the wet weather storage;
        - Develop solutions to rectify the design configuration of the catch/balance pond to overcome settlement, cleaning and algal growth problems;
        - Replace the corroded handrails and walkways in the inlet and grit chamber; and
        - Provide additional drying bed capacity.

Table 8.7 presents the cost estimate and the social and environmental aspects of the Macksville wastewater treatment opportunities.

Table 8.7 Macksville Wastewater Treatment Opportunities – TBL Aspects

Opportunity	Social	Cost Estimate		Environmental
		Capital ($M)	PV @ 7% ($M)	
Opportunity M1	▪ Improved water quality outcomes in Nambucca River with regards to primary contact recreation and aquaculture	$10.33	$8.17	▪ Reduced TSS, nutrient and BOD loading on Nambucca River ▪ Increased chemical usage and reduced treatment reliability
Opportunity M2		$9.52	$8.68	▪ Reduced TSS, nutrient and BOD loading on Nambucca River ▪ Minimal chemical usage and enhanced treatment reliability

Based on the information presented in Table 8.7, it is recommended that M1 be shortlisted for scenario analysis as this option overcomes all the deficiencies associated with the sewage treatment plant in a staged and cost effective manner.

8.3.2 Water Management Opportunities

Table 8.8 presents the cost estimate and the social and environmental aspects of the water management opportunities at Macksville.

Although, the $/kL of all the above water management opportunity is high in comparison to potable water due to the high social and environmental aspects and the benefits of integration as shown in Table 8.8, it is recommended that the following water management options be shortlisted for scenario bundling:

- Centralised reuse with treated wastewater from the STP for Macksville Park and HS Playing Fields, and Golf course; and
- Centralised reuse with treated wastewater from the STP to regenerate SEPP 14 Gumma Wetlands and rehabilitation of decommissioned STP site into an ecotourism wetland.

In both the options, NSC could consider providing on an opportunistic basis treated wastewater to the property adjoining the STP for pasture irrigation.

Table 8.8 Macksville Water Management Opportunities – TBL Aspects

Opportunity	Social	Cost Estimate			Environmental
		Capital ($M)	NPV @ 7% ($M)	$/kL [1]	
Macksville Park by Harvesting Stormwater from Sub-catchment 2g	▪ Improved water quality outcomes in Hughs Creek and Nambucca River with regards to primary contact recreation and aquaculture	$0.40	$1.97	$21.55	▪ Reduced potable water consumption by 7.4 ML/a ▪ Reduced nutrient, sediment and bacteria loading on high priority stormwater hot-spot (Hughs Creek 2g)
Macksville Park by Sewer Mining from SPS7	▪ Guaranteed source of water for public space irrigation in dry periods	$1.16	$2.24	$24.18	▪ Reduced potable water consumption by 7.5 ML/a ▪ Reduced effluent discharge to Nambucca River
Macksville Park by harvesting local groundwater	▪ Similar to other options keeps the park green possibly except in dry periods	$0.15	$0.16	$1.75	▪ Reduced potable water consumption by 7.5 ML/a ▪ Increased risk of salt-water intrusion (Not subject to water Licence embargo)
Macksville HS Playing Fields and Macksville Golf Course by Harvesting Stormwater from Sub-catchment 3c	▪ Improved water quality outcomes in wetland near Macksville HS with regards to visual amenity	$0.70	$2.20	$67.03	▪ Reduced potable water consumption by 2.6 ML/a ▪ Reduced nutrient and sediment loading on medium priority stormwater hot-spot (Macksville HS)
Macksville HS Playing Fields and Macksville Golf Course by Sewer Mining from SPS4	▪ Guaranteed source of water for public space irrigation in dry periods	$0.73	$1.33	$40.23	▪ Reduced potable water consumption by 2.7 ML/a ▪ Reduced effluent discharge to Nambucca River
Macksville HS Playing Fields and Macksville Golf Course by harvesting local groundwater	▪	$0.15	$0.17	$5.10	▪ Reduced potable water consumption by 2.7 ML/a ▪ Increased risk of salt-water intrusion (Not subject to water Licence embargo)
Macksville Park and HS Playing Fields, and Golf course from Macksville STP	▪ Guaranteed source of water for public space irrigation in dry periods	$1.21	$1.42	$3.51	▪ Reduced potable water consumption by 10.2 ML/a ▪ Reduced effluent discharge to Nambucca River
Agricultural reuse – irrigated pasture adjacent to Macksville STP	▪ Improved dairy / beef production through irrigated pasture ▪ New job creation ▪ Reliable supply of water for irrigation	$4.30	$5.00	N/A	▪ 90% reduction in effluent discharge to river with corresponding nutrient and TSS load reductions ▪ Potential groundwater impacts through raised water table
Reuse to regenerate SEPP 14 Gumma Wetlands and rehabilitation of decommissioned STP site into an ecotourism wetland	▪ Creation of ecotourism ▪ Creation of employment	$2.25	$2.61	N/A	▪ Potential groundwater impacts through raised water table ▪ No direct discharge to river ▪ >95% reduction in nutrient and TSS loads
Kancon Concrete Plant Process Water by Sewer Mining from SPS5	▪ Guaranteed source of water for industrial purposes in dry periods	$0.55	$1.00	$82.69	▪ Reduced potable water consumption by 1.0 ML/a ▪ Reduced effluent discharge to Nambucca River

1. $/kL cost is based on the annualised opportunity cost divided by average annual potable water savings

8.3.3 Stormwater Management Opportunities

Table 8.9 presents the cost estimate and the social and environmental aspects of the shortlisted stormwater quantity and quality management measures.

Table 8.9 Macksville Stormwater Management Opportunities – TBL Aspects

Measure	Priority	Social	Cost Estimate		Environmental
			Capital ($M)	NPV @ 7% ($M)	
Hughs Creek	High	▪ Improved water quality outcomes in Hughs Creek and Nambucca River with regards to primary contact recreation, visual amenity and aquaculture	$0.27	$1.60	▪ 30% reduction in TN load ▪ 30% reduction in TP load ▪ 86% reduction in sediment load ▪ 44% reduction in gross pollutant load
Macksville High School	Medium	▪ Improved water quality outcomes in wetland near Macksville HS with regards to visual amenity	$0.08	$0.82	▪ 30% reduction in TN load ▪ 30% reduction in TP load ▪ 86% reduction in sediment load
Macksville Train Station		▪ Improved water quality outcomes in Tilly Willy Creek with regards to primary contact recreation	$0.15	$0.51	▪ 47% reduction in TN load ▪ 51% reduction in TP load ▪ 81% reduction in sediment load ▪ 83% reduction in gross pollutant load
Dawkins Park Lake		▪ Improved water quality outcomes in Dawkins Park Lake with regards to visual amenity	$0.08	$1.03	▪ 30% reduction in TN load ▪ 30% reduction in TP load ▪ 86% reduction in sediment load
Industrial Estate	Low	▪	$0.31	$2.36	▪ 30% reduction in TN load ▪ 30% reduction in TP load ▪ 86% reduction in sediment load

The urban stormwater management measures for each location have been given a high, medium and low priority based on the level of impact on the local environment and community.

8.4 Scotts Head

8.4.1 Wastewater Treatment Opportunities

As described in Task 4 Paper majority of the issues relating to the sewage treatment could be overcome by one of the four opportunities listed below:

1. Opportunity SH1 – Urban Reuse Option 1 (Sewer Mining for Release Area and Treatment Enhancement of SH STP through Chemical Dosing)
    - Undertake a process study to enhanced and optimise the operational performance and capacity of the existing STP;

- Add chemical dosing facility to Scotts Head STP in 2010 to treat an additional biological capacity of up to 2,500 EP during peak periods. This would be adequate up to 2011.
- Add a new 1,500 EP Reactor to Scotts Head STP by 2011 to cater for in-fill development. As part of the augmentation, provide STP inlet works of a sufficient capacity to receive the future hydraulic load from the South Scotts Head Release Area. Add UV disinfection as part of the STP augmentation.
- Flows greater than 2xADWF (i.e. storm flows) will be directed to the Scotts Head STP via SPS8 and SPS1. These SPS will require upgrading by 2016 to transfer and receive these storm flows.
- Build a 1,000 EP sewer mining facility in South Scotts Head by 2017 to cater for release area load and to provide urban residential reuse for BASIX compliance within the release area
- The dual reticulation network will require suitable non-potable reservoir storage.
- Allow provision for the future addition of tertiary filters at the existing STP. The tertiary filters would only become necessary if future effluent quality discharge requirements increase and/or if the existing STP is unable to meet future licence conditions.

2. Opportunity SH2 – Urban Reuse Option 2 (Sewer Mining for Release Area and an Additional Reactor at SH STP in lieu of chemical enhancement)
   1 Undertake a process study to enhanced and optimise the operational performance and capacity of the existing STP;
   - As for SH1 but with additional 1,500 EP reactor at Scotts Head STP immediately instead of chemical dosing for infill development.

3. Opportunity SH3 – Upgrade existing STP capacity by 2,500 EP (to 4,500 EP)
   1 Undertake a process study to enhanced and optimise the operational performance and capacity of the existing STP;
   - If a MBR plant were not to be built for the South Scotts Head Urban Release Area, then an additional 2,500 EP capacity (Stage 1 – Add 1,500 in 2011, Stage 2 – Add 1,000 EP in 2016) would be required. Add UV disinfection at both stages of the STP augmentation.
   - SPS 1 and SPS 8 as well as the Scotts Head STP inlet works would require significant upgrading
   - Allow provision for the future addition of tertiary filters at the existing STP. The tertiary filters would only become necessary if future effluent quality discharge requirements increase and/or if the existing STP is unable to meet future licence conditions.

4. Opportunity SH4 – South Scotts Head IDEA STP
   1 Undertake a process study to enhanced and optimise the operational performance and capacity of the existing STP;
   - Build a separate 1,000 EP STP (IDEA Process) for South Scotts Head urban release area in 2016. Discharge of filtered effluent would be to Warrell Creek.
   - Add a chemical dosing facility at Scotts Head STP in 2010 to treat an additional biological capacity of up to 2,500 EP during peak periods. This would be adequate up to 2011. Add UV disinfection as part of the STP augmentation.
   - Add a new 1,500 EP Reactor at Scotts Head STP by 2011 to cater for in-fill development.
   - Allow provision for the future addition of tertiary filters at the existing STP. The tertiary filters would only become necessary if future effluent quality discharge requirements increase and/or if the existing STP is unable to meet future licence conditions.

Table 8.10 presents the cost estimate and the social and environmental aspects of the Scotts Head wastewater treatment opportunities.

Table 8.10 Scotts Head Waterwater Treatment Opportunities – TBL Aspects

Opportunity	Social	Cost Estimate		Environmental
		Capital ($M)	PV @ 7% ($M)	
Opportunity SH1	▪ Potential odour & traffic movement from sewer mining plant. ▪ Guaranteed source of water for residential non-potable usage in dry periods	$16.23	$12.97	▪ Improved water quality outcomes for local Coastal Sands Groundwater Source ▪ Increased chemical usage but improved treatment reliability ▪ Reduced potable water consumption by 30 ML/a ▪ Reduced effluent discharge to Nambucca Coastal Sands Groundwater Source
Opportunity SH2	▪ Potential odour & traffic movement from sewer mining plant. ▪ Guaranteed source of water for residential non-potable usage in dry periods	$15.87	$13.89	▪ Improved water quality outcomes for local Coastal Sands Groundwater Source ▪ No chemical usage and with enhanced treatment reliability
Opportunity SH3	▪ Increased traffic movement to existing plant	$11.74	$10.15	▪ Improved water quality outcomes for local Coastal Sands Groundwater Source
Opportunity SH4	▪ There may be a perception in the community that a second STP for such a small population as Scotts Head may not be warranted; ▪ Increased odour complaints due to availability of inadequate buffer zones.	$14.04	$11.52	▪ Improved water quality outcomes for local Coastal Sands Groundwater Source ▪ Infrastructure allows for potential future reuse; and ▪ Increased flexibility in treatment due to two plant

Based on the information presented in Table 8.10, it appears that the solution to overcome the deficiencies associated with the sewage treatment plant is to proceed with SH3, when one considers the solution to this deficiency in isolation to the other measures. However, if one considers the benefits of integration of all the urban water cycle measures, then SH1 becomes attractive. In view of this it is recommended that both SH1 and SH3 be shortlisted for scenario analysis.

8.4.2 Water Management Opportunities

Table 8.11 presents the cost estimate and the social and environmental aspects of the water management opportunities at Scotts Head.

Table 8.11 Scotts Head Water Management Opportunities – TBL Aspects

Opportunity	Social	Cost Estimate			Environmental
		Capital ($M)	NPV @ 7% ($M)	$/kL [1]	
Scotts Head Bowling Club by sewer mining from SPS2	▪ Guaranteed source of water for public space irrigation in dry periods	$0.40	$0.72	$41.55	▪ Reduced potable water consumption by 1.4 ML/a ▪ Reduced effluent discharge to Nambucca Coastal Sands Groundwater Source
Scotts Head Bowling Club by harvesting groundwater	▪	$0.13	$0.13	$8.12	▪ Reduced potable water consumption by 1.4 ML/a ▪ Increased risk of salt-water intrusion (Not subject to water License embargo)
Opportunity SH1 / SH2 – Residential Non-potable effluent reuse in South Scotts Head Urban Release Area	▪ Potential odour & traffic movement from sewer mining plant. ▪ Guaranteed source of water for residential non-potable usage in dry periods	$7.71	$5.09	$4.24	▪ Improved water quality outcomes for local Coastal Sands Groundwater Source ▪ Increased chemical usage and improved treatment reliability ▪ Reduced potable water consumption by 30 ML/a ▪ Reduced effluent discharge to Nambucca Coastal Sands Groundwater Source

Although, the $/kL of all the above water management opportunity is high in comparison to potable water due to the high social and environmental aspects and the benefits of integration as shown in Table 8.8, it is recommended that opportunity SH1 be shortlisted for scenario analysis.

8.4.3 Stormwater Management Opportunities

Table 8.12 presents the cost estimate and the social and environmental aspects of the shortlisted stormwater quantity and quality management measures.

Table 8.12 Scotts Head Stormwater Management Opportunities – TBL Aspects

Measure	Priority	Social	Cost Estimate		Environmental
			Capital ($M)	NPV @ 7% ($M)	
Forsters Beach	High	▪ Improved water quality outcomes at Forsters Beach with regards to primary contact recreation and visual amenity ▪ Enhanced tourism value of Forsters Beach	$0.09	$0.90	▪ 30% reduction in TN load ▪ 30% reduction in TP load ▪ 86% reduction in sediment load ▪ 44% reduction in gross pollutant load
South Scotts Head Sporting Fields	Medium	▪ Improved visual amenity	$0.05	$0.19	▪ 44% reduction in gross pollutant load

The urban stormwater management measures for each location have been given a high and medium priority based on the level of impact on the local environment and community.

8.5 Nambucca Heads and Valla Beach

8.5.1 Wastewater Treatment Opportunities

As described in Task 4 Paper majority of the issues relating to the Nambucca Head sewage treatment servicing the Nambucca Heads, Valla Beach and the future Valla Urban growth areas could be overcome by one of the four opportunities listed below:

1. Opportunity NH1 – Urban Reuse 1 (Sewer Mining for Release Area. Treatment Enhancement of NH STP through Chemical Dosing)
   - Decommission the existing trickling filter plant (5,000 EP). Proceed with the building of a new 10,000 EP IDEA reactor to give a total biological capacity of 15,000 EP (including chemical dosing).
   - Increase chemical dosing and operate at higher MLSS during peak periods (to achieve a temporary capacity of 16,500 EP) from 2014 to 2028.
   - Augment Nambucca Heads STP in 2028 by an additional 3,000 EP to give a total treatment capacity of 18,000 EP.
   - Build 2 x 2,000 EP new sewer mining plants (MBR package units) to service the Valla Urban Growth Area by 2017 to cater for release area load and to provide urban residential reuse for BASIX compliance within the release area (staging of MBR reactors could be possible depending on realised growth rates at the release area)
   - Flows greater than 2xADWF (i.e. storm flows from the Valla Urban Growth Area) will be directed to the existing STP via VBSPS7. VBSPS7 and NH STP inlet works will require upgrading to receive additional storm flows from 2017.
   - The dual reticulation network will require a suitable non-potable reservoir storage.
   - Allow provision for future addition of tertiary filters at Nambucca Heads STP.

2. Opportunity NH2 – Urban Reuse 2 (Sewer Mining for Release Area. Additional Reactor at NH STP in lieu of chemical enhancement)
   - As for NH1 but with additional 3,000 EP reactor by 2014 instead of chemical dosing for infill development. This would give a total Nambucca Heads STP capacity of 18,000 EP.

3. Opportunity NH3 – Upgrade Nambucca Heads STP to 22,000 EP capacity
    - Decommission the existing trickling filter plant (5,000 EP). Proceed with the building of a new 10,000 EP IDEA reactor to give a total biological capacity of 15,000 EP (including chemical dosing).
    - Increase chemical dosing and operate at higher MLSS during peak periods (to achieve a temporary capacity of 16,500 EP) from 2014 to 2016.
    - Augment Nambucca Heads STP in 2016 by an additional 7,000 EP to give a total treatment capacity of 22,000 EP. This augmentation will cater for the Valla Urban Growth Area as well as growth in the existing Nambucca Heads and Valla Beach urban areas;
    - Augment VB-SPS 5 and 7 by 2017 to accommodate Valla Urban Growth Area loads
    - Allow provision for future addition of tertiary filters at Nambucca Heads STP. These filters would only become necessary if the effluent quality requirements increase and/or if the existing STP is unable to consistently meet the current licence requirements.

4. Opportunity NH4 – Valla Urban Growth Area IDEA STP
    - Decommission the existing trickling filter plant (5,000 EP). Proceed with the building of a new 10,000 EP IDEA reactor to give a total biological capacity of 15,000 EP (including chemical dosing).
    - Increase chemical dosing and operate at higher MLSS during peak periods (to achieve a temporary capacity of 16,500 EP) from 2014 to 2028.
    - Augment Nambucca Heads STP in 2028 by an additional 3,000 EP to give a total treatment capacity of 18,000 EP.
    - Build a new 4,000 EP IDEA STP by 2016 with chemical dosing near Boggy/Cow Creek to cater for the Valla Urban Growth Area with treated and filtered effluent released to Deep Creek near the proposed plant site.
    - Allow provision for future addition of tertiary filters at Nambucca Heads STP.

Table 8.13 presents the cost estimate and the social and environmental aspects of the Scotts Head wastewater treatment opportunities.

Table 8.13 Nambucca Heads Waterwater Treatment Opportunities – TBL Aspects

Opportunity	Social	Cost Estimate		Environmental
		Capital ($M)	PV @ 7% ($M)	
Opportunity NH1	▪ Potential odour & traffic movement from sewer mining plant. ▪ Guaranteed source of water for residential non-potable usage in dry periods ▪ Improved primary contact outcomes in Deep Creek	$50.97	$42.76	▪ Reduced potable water consumption by 148 ML/a ▪ Reduced effluent discharge to Deep Creek ▪ Increased chemical usage but improved treatment reliability ▪ Improved water quality outcomes in receiving water
Opportunity NH2	▪ Potential odour & traffic movement from sewer mining plant. ▪ Guaranteed source of water for residential non-potable usage in dry periods ▪ Improved primary contact outcomes in Deep Creek	$50.94	$46.41	▪ Reduced potable water consumption by 148 ML/a ▪ Reduced effluent discharge to Deep Creek ▪ Minimum chemical usage and with enhanced treatment reliability ▪ Improved water quality outcomes in receiving water
Opportunity NH3	▪ Increased traffic movement to existing plant ▪ Improved primary contact outcomes in Deep Creek	$40.55	$38.76	▪ Improved water quality outcomes in receiving water ▪ No effluent reuse
Opportunity NH4	▪ Improved primary contact outcomes in Deep Creek	$50.87	$42.76	▪ Improved water quality outcomes for local Coastal Sands Groundwater Source ▪ No effluent reuse and effluent after tertiary filtration released directly to Deep Creek. ▪ Unlike in NH3, this plant is closer to potential future reuse markets (eg, industrial, agriculture, etc) and hence could attract such developments. ▪ Increased flexibility in treatment due to two plant

Based on the information presented in Table 8.13, it appears that the solution to overcome the current and future issues associated with the sewage treatment plant is to proceed with NH3, when one considers the solution to these issues in isolation to the other measures. However, if one considers the benefits of integration of all the urban water cycle measures, then NH1 becomes attractive. In view of this it is recommended that both NH1 and NH3 be shortlisted for scenario analysis.

8.5.2 Water Management Opportunities

Table 8.14 presents the cost estimate and the social and environmental aspects of the water management opportunities in Nambucca Heads, Valla Beach and the future Valla Urban growth areas.

Table 8.14 Nambucca Heads & Valla Beach Water Management Opportunities – TBL Aspects

Opportunity	Social	Cost Estimate			Environmental
		Capital ($M)	NPV @ 7% ($M)	$/kL [1]	
Nambucca Heads Golf Course by harvesting stormwater from Sub-catchment 3a	▪ Improved water quality outcomes in and Nambucca River with regards to primary contact recreation and visual amenity ▪ Enhanced tourism value of Nambucca Beach Foreshore	$1.15	$3.07	$12.79	▪ Reduced potable water consumption by 19.4 ML/a ▪ Reduced nutrient, sediment and bacteria loading on medium priority stormwater hot-spot (Bellwood Park 3a)
Nambucca Heads Golf Course by sewer mining from SPS3	▪ Guaranteed source of water for public space irrigation in dry periods	$2.13	$3.59	$14.78	▪ Reduced potable water consumption by 19.6 ML/a ▪ Reduced effluent discharge to Deep Creek
Nambucca Heads Golf Course by harvesting local groundwater	▪	$0.32	$0.36	$1.49	▪ Reduced potable water consumption by 19.6 ML/a ▪ Increased risk of salt-water intrusion (Not subject to Water Licence Embargo)
Nambucca Heads Bowling Club by harvesting stormwater from Sub-catchment 1a	▪ Improved water quality outcomes in Beer Creek and Nambucca River with regards to primary contact recreation and visual amenity ▪ Enhanced tourism value of Nambucca Beach Foreshore	$0.26	$0.94	$41.10	▪ Reduced potable water consumption by 1.8 ML/a ▪ Reduced nutrient and sediment loading on high priority stormwater hot-spot (Beer Creek 1a)
Nambucca Heads Bowling Club by sewer mining from SPS7	▪ Guaranteed source of water for public space irrigation in dry periods	$0.48	$0.88	$37.84	▪ Reduced potable water consumption by 1.9 ML/a ▪ Reduced effluent discharge to Deep Creek
Nambucca Heads Bowling Club by harvesting local groundwater	▪	$0.13	$0.15	$6.34	▪ Reduced potable water consumption by 1.9 ML/a ▪ Increased risk of salt-water intrusion Not subject to Water Licence Embargo)
EJ Biffin Playing Fields by harvesting stormwater from Sub-catchment 4a	▪ Improved water quality outcomes in Bellwood Creek with regards to primary contact recreation and visual amenity	$0.43	$2.58	$205.97	▪ Reduced potable water consumption by 1.4 ML/a ▪ Reduced contaminant loading on Bellwood Creek
Nambucca HS Playing Fields by harvesting stormwater from Sub-catchment 4a		$0.46	$2.62	$490.89	
EJ Biffin Playing Fields and	▪ Guaranteed source of water for public space irrigation in	$0.91	$1.70	$93.92	▪ Reduced potable water consumption by 1.5 ML/a

Opportunity	Social	Cost Estimate			Environmental
		Capital ($M)	NPV @ 7% ($M)	$ / kL [1]	
Nambucca HS Playing Fields by sewer mining from SPS4	dry periods				▪ Reduced effluent discharge to Deep Creek
EJ Biffin Playing Fields and Nambucca HS Playing Fields by harvesting local groundwater	▪	$0.19	$0.22	$12.12	▪ Reduced potable water consumption by 1.5 ML/a ▪ Increased risk of salt-water intrusion (Not subject to Water Licence Embargo)
Coronation Park by harvesting stormwater from Sub-catchment 7b	▪ Improved water quality outcomes in Swimming Creek with regards to visual amenity ▪ Enhanced tourism value of Swimming Creek	$0.28	$1.67	$183.79	▪ Reduced potable water consumption by 0.7 ML/a ▪ Reduced nutrient and sediment loading on high priority stormwater hot-spot (Coronation Park 7b)
Coronation Park by sewer mining from SPS5	▪ Guaranteed source of water for public space irrigation in dry periods	$0.58	$0.89	$97.23	▪ Reduced potable water consumption by 0.7 ML/a ▪ Reduced effluent discharge to Deep Creek
Coronation Park by harvesting local groundwater	▪	$0.19	$0.22	$23.82	▪ Reduced potable water consumption by 0.7 ML/a ▪ Increased risk of salt-water intrusion (Not subject to Water License Embargo)
Valla Beach Resort by Sewer Mining from SPS5	▪ Guaranteed source of water for public space irrigation in dry periods	$0.56	$1.04	$34.17	▪ Reduced potable water consumption by 2.5 ML/a ▪ Reduced effluent discharge to Deep Creek
Valla Beach Resort by harvesting local groundwater	▪	$0.14	$0.15	$5.02	▪ Reduced potable water consumption by 2.5 ML/a ▪ Increased risk of salt-water intrusion (Not subject to Water License Embargo)
Opportunity NH1 / NH2	▪ Guaranteed source of water for residential non-potable usage in dry periods	$13.38	$8.82	$1.49	▪ Reduced potable water consumption by 148 ML/a ▪ Reduced effluent discharge to Deep Creek
Residential Non-potable stormwater reuse in the Valla Urban Growth Area	▪ Improved water quality outcomes in Boggy Creek, Cow Creek and Deep Creek with regards to primary contact recreation	$12.31	$19.92	$9.51	▪ Reduced potable water consumption by 148 ML/a ▪ Reduced nutrient and sediment loading on Deep Creek

Although, the $/kL of all the above water management opportunity is high in comparison to potable water use at each end use site, it is recommended that opportunity NH1 be shortlisted for scenario analysis due to the high social and environmental aspects and the benefits of integration as shown in Table 8.14.

8.5.3 Stormwater Management Opportunities

Table 8.12 presents the cost estimate and the social and environmental aspects of the shortlisted stormwater quantity and quality management measures for the Nambucca Heads and Valla Beach areas.

Table 8.15 Nambucca Heads & Valla Beach Stormwater Management Opportunities – TBL Aspects

Location	Priority	Social	Cost Estimate		Environmental
			Capital ($M)	PV @ 7 % ($M)	
Nambucca Head & Kingsworth Area					
Merry Park		▪ Improved water quality outcomes in Swimming Creek with regards to primary contact recreation and visual amenity ▪ Enhanced tourism value of Swimming Creek	$0.96	$3.66	▪ 60% reduction in TN load ▪ 60% reduction in TP load ▪ 85% reduction in sediment load ▪ 96% reduction in gross pollutant load
Seaview St		▪ Improved water quality outcomes in Nambucca River with regards to aquaculture ▪ Enhanced tourism value of Nambucca River Foreshore	$0.65	$2.18	▪ 60% reduction in TN load ▪ 60% reduction in TP load ▪
Beer Creek	High	▪ Improved water quality outcomes in Beer Creek and Nambucca River with regards to aquaculture ▪ Enhanced tourism value of Nambucca River Foreshore	$0.80	$2.70	▪ 60% reduction in TN load ▪ 60% reduction in TP load ▪ 81% reduction in sediment load ▪ 95% reduction in gross pollutant load
Coronation Park		▪ Improved water quality outcomes in Swimming Creek with regards to primary contact recreation and visual amenity	$0.43	$1.32	▪ 60% reduction in TN load ▪ 60% reduction in TP load ▪ 85% reduction in sediment load ▪ 96% reduction in gross pollutant load
Gordon Park		▪ Improved water quality outcomes in Nambucca River with regards to visual amenity ▪ Enhanced tourism value of Nambucca River Foreshore	$2.84	$9.86	▪ 83% reduction in gross pollutant load
Bellwood Park	Medium	▪ Improved water quality outcomes in Nambucca River with regards to primary contact recreation and visual amenity ▪ Enhanced tourism value of Nambucca River Foreshore	$0.04	$0.48	▪ 30% reduction in TN load ▪ 30% reduction in TP load ▪ 48% reduction in sediment load ▪ 96% reduction in gross pollutant load
Industrial Estate			$0.11	$0.88	▪ 87% reduction in sediment load
Valla Beach Area					

Location	Priority	Social	Cost Estimate		Environmental
			Capital ($M)	PV @ 7% ($M)	
Kuta Road	High	▪ Improved water quality outcomes in Oyster Creek with regards to primary contact recreation and visual amenity ▪ Enhanced tourism value of Valla Beach	$0.14	$0.59	▪ 30% reduction in TN load ▪ 30% reduction in TP load ▪ 87% reduction in sediment load ▪ 86% reduction in gross pollutant load

The urban stormwater management measures for each location have been given a high and medium priority based on the level of impact on the local environment and community.

9 Shire Wide IWCM Scenarios

9.1 *Overview*

In the previous chapters/sections of this report all available opportunities both at the regional and local individual town level has been evaluated and shortlisted using the balanced planning approach. In this section, the shortlisted opportunities/options that have been combined by the PRG into Shire wide IWCM scenarios using the bundling process are described and evaluated. The PRG in building the Shire wide scenarios used the definition shown in Table 9.1 below.

Table 9.1 Shire Wide IWCM Scenario Definition

Scenario	Definition
Traditional	The implementation of opportunities that achieve compliance through current practice and/or traditional practice. This results in no planned integration of urban water services.
Scenario 1	The implementation of opportunities that with the lowest level of integration that achieve the best environmental and social outcome.
Scenario 2	The implementation of opportunities that with a moderate level of integration that achieve the best environmental and social outcome.
Scenario 3	The implementation of opportunities that with the highest level of integration that achieve the best environmental and social outcome.

The four Shire wide Scenarios addresse all of the identified issues, and at a minimum, solves all of the compliance issues. The extent to which best practice and aspirational issues are met differs between scenarios.

9.2 *Measures and Works Common to all Shire Wide IWCM Scenarios*

The issues associated with data, information and asset management needs to be addressed immediately, which could be done using common management systems across the three water services for all the scenarios. Table 9.2 presents these common management system measures and it is recommended NSC implement these measures as a matter of priority.

Table 9.2 Common Management System Measures for Shire Wide IWCM Scenarios

Issue	Type	Common Management System Measure
▪ Whilst the existing water supply and sewerage charges embraces the NSW government best practice pricing principles and could be equitable, the revenue split from residential access and usage charges for water supply does not exactly match the criteria and the process used for establishing the non-residential water and sewerage charges and revenue split is not transparent;	WS S	▪ Costs have been allocated in the 40 year financial plan to review and update existing tariff structure based on the adopted IWCM strategy for both water supply and sewerage and to carry out an on-going review (these costs are reflected in the TRB for the shire wide scenarios).
▪ Although, the Council has established the 'true' cost of providing water and sewerage services to new developments, the current level of developer contribution is far less than	WS S	▪ Costs have been allocated in the 40 year financial plan to review and update the existing water supply and sewerage developer charges based on the adopted IWCM strategy and to carry out an on-going review (these costs are reflected in the TRB for the

Issue	Type	Common Management System Measure
the 'true' costs. This results in significant subsidy to developers by the existing rate payers and also results in revenue loss to Council (this has been confirmed in Task 7 Paper);		shire wide scenarios).
▪ The sewerage developer and access charges is different for each scheme and for the South Macksville growth area, whilst this may be justifiable, when one considers the differences in charges between the schemes and the added administrative and management cost, a business case may be made to have a uniform charge across the Shire;	WS S	▪ The proposed review of the existing developer charges would also review and resolve this issue (these costs are reflected in the TRB for the shire wide scenarios).
▪ It is highly likely that the existing charges would have to increase significantly in the short-term. This is because the Strategic Business Plans, Capital Works Program, Asset Renewals Program, Asset Valuation, Asset Register, Operation and Maintenance Manual Plans, Emergency Response Plans on which the water supply and sewerage charges are based upon are all outdated and needs significant updating to current situation and to incorporate the findings of the IWCM Strategy study (this has been confirmed in Task 7 Paper);	WS S	▪ Costs have been allocated in the 40 year financial plan to prepare/update the following plans for water supply and sewerage and to carry out on-going reviews (these costs are reflected in the TRB for the shire wide scenarios): • Strategic Business Plans; • Capital Works Program (the IWCM strategy); • Asset Renewals Program (new established as part of IWCM strategy needs regular review); • Asset Valuation; • Asset Register; • Operation and Maintenance Manual Plans; and • Emergency Response Plans.
▪ An effective Asset and Data Management System is non existent and hence the budgets to support price paths is compromised as it is difficult to undertake performance monitoring and benchmarking of assets and services against Council's own infrastructure performance targets and those of comparable water utilities thereby the budgets lacking the required transparency and the supporting evidence;	WS S	▪ Costs have been allocated in the 40 year financial plan to upgrade the existing data and asset management systems for both the water supply and sewerage services and to carry out on-going monitoring and updates (these costs are reflected in the TRB for the shire wide scenarios):
▪ Although not verified we believe that Council has the necessary insurance cover for the water service operation and that both the risk and cover is regularly reviewed with adequate contingency in the budgets that supports the price paths;	WS S	▪ Costs have been allocated in the 40 year financial plan to undertake the necessary risk studies and it is assumed that Council's minimum cash policy is adequate contingency (the cost and contingency is reflected in the TRB for the shire wide scenarios).
▪ Although there is a trade waste charge, the Trade Waste policy has not been implemented hence the revenue is not reflective of the cost; and	WS S	▪ Costs have been allocated in the 40 year financial plan to implement and monitor the Trade Waste policy (these costs are reflected in the TRB for the shire wide scenarios).
▪ There is inadequate funding for urban stormwater management and treatment measures and for catchment improvement works and there is no separate business plan for this service. This is because the cost of providing	SW	▪ No costs have been allocated in this strategy as it needs to be addressed outside of the IWCM strategy.

Issue	Type	Common Management System Measure
these services is funded through the general rates, which is currently 'pegged' by the state government.		
▪ There is no formal water quality incident emergency response plan as required under the Public Health Act;	WS	▪ Costs have been allocated in the 40 year financial plan to develop and update both these plans on an on-going basis (these costs are reflected in the TRB for the shire wide scenarios).
▪ Drinking Water Quality Management Plan	WS	
▪ A very brief overview of Council's management system, infrastructure facilities, work procedures, etc. tends to suggest that the OH&S Act and Regulations is not fully compliant;	WS S	▪ Costs have been allocated in the 40 year financial plan to update the existing management system and procedures on an on-going basis and to undertake regular audits (no cost has been established for any remedial works) (these costs are reflected in the TRB for the shire wide scenarios).
▪ The operational environmental management plan does not seem to cover the full spectrum of issues that the operation of the water supply scheme could have an impact on the environment as defined in the POEA Act;	WS	▪ Costs have been allocated in the 40 year financial plan to update the existing plan on an on-going basis and to undertake regular audits (these costs are reflected in the TRB for the shire wide scenarios)
▪ Recording and archiving of historical operation incidents and data is not systematic and does not meet the record keeping obligations under the Public Health and other Acts;	WS	▪ Costs have been allocated in the 40 year financial plan to develop and maintain a data management system on an on-going basis (these costs are reflected in the TRB for the shire wide scenarios).
▪ Although the fluoridation plant and on-going operation and monitoring appears to be in accordance with the current Fluoridation of Public Water Supply Act, an on-going compliance review at five year intervals is highly desirable;	WS	▪ Costs have been allocated in the 40 year financial plan to undertake regular audits (these costs are reflected in the TRB for the shire wide scenarios)
▪ It is our understanding that Council has easement over all water supply and sewerage assets and unconditional access rights to these easements;	WS S	▪ Council to verify this assertion at no extra cost
▪ Although, an operational Environmental Management Plan (o-EMP) for the reuse area exists, the effectiveness and compliance is not regularly reviewed nor is the long term sustainability of the reuse area assessed;	S	▪ Costs have been allocated in the 40 year financial plan to undertake regular audits (these costs are reflected in the TRB for the shire wide scenarios)
▪ The operational environmental management plan, a requirement of the development consent under EP&A and POEA Acts, does not seem to cover the full spectrum of issues that the operation of the sewerage schemes could have an impact on the environment;	S	▪ Costs have been allocated in the 40 year financial plan to update the existing plan on an on-going basis and to undertake regular audits (these costs are reflected in the TRB for the shire wide scenarios)
▪ Recording and archiving of historical operation incidents and data is not systematic and does not meet the record keeping obligations under the	S	▪ Costs have been allocated in the 40 year financial plan to develop and maintain a data management system on an on-going basis (these costs are reflected in the TRB for the shire wide scenarios).

Issue	Type	Common Management System Measure
POEA and other Acts; and		
▪ All identified issues with Council's planning and development control instruments	WS S	▪ Costs have been allocated in the 40 year financial plan to update the existing plans on an on-going basis to resolve the issues (these costs are reflected in the TRB for the shire wide scenarios)

Table 9.3 below presents the measure (or works) that are common to all Shire wide scenarios and it is recommended that NSC implement these measures as a matter of priority.

Table 9.3 Works that are Common to all Shire Wide IWCM Scenarios

Issue	Type	Measure (or Works)
▪ The existing reticulation network's ability to maintain the aspirational minimum residual pressure and fire fighting targets has not been tested at current and future demands;	WS	▪ Costs have been allocated in the 40 year financial plan to update the existing reticulation model and to undertake analysis on an on-going basis to review and revise the targets using cost benefit analysis (these costs are reflected in the TRB for the shire wide scenarios)
▪ Preliminary studies suggests that the aspirational response time targets for unplanned supply interruptions cannot be met in certain areas and circumstances;	S	
▪ Although, telemetry is used for majority of the sewer pumping facility operation in all the schemes the pump operations are not synchronised. Best practice in operation is to have a synchronised scheme operation to minimise overflows, etc.;	S	▪ Costs have been allocated in the 40 year financial plan to upgrade the existing telemetry system and to renew it on an on-going basis (these costs are reflected in the TRB for the shire wide scenarios)
▪ Potential odour and/or septicity issues at ▪ SHSPS8; ▪ VBSPS2, VBSPS7 and VBSPS9; and ▪ MSPS1, MSPS8 and MSPS10		▪ Allowances in the 40 year financial plan have been made for an odour/septicity study and for on-going management such as odour bed, deodorant dosing (these costs are reflected in the TRB for the shire wide scenarios). ▪ Costs have been allocated in the 40 year financial plan to develop a sewer reticulation model and to undertake analysis on an on-going basis to review and revise the targets using cost benefit analysis (these costs are reflected in the TRB for the shire wide scenarios)
▪ There is currently no water quality monitoring program to establish background levels of TP in Deep Creek;		▪ On-going costs have been allocated in the 40 year financial plan to monitor and review the data (these costs are reflected in the TRB for the shire wide scenarios)
▪ There is a single gravity main water crossing in the Nambucca Heads sewer reticulation network; west of the Pacific Highway across Bellwood Creek. If an operational event were to occur at this crossing then there would be an increased risk of sewage overflows at SPS13;		▪ Costs for additional storage tanks at each SPS have been included in the 40 year financial plan (these costs are reflected in the TRB for the shire wide scenarios)
▪ There are two single rising main river crossings in the Macksville Sewerage Scheme; the Pacific Highway across		

Issue	Type	Measure (or Works)
the Nambucca River and Joffre Street across Tilly Willy Creek. If an operational event were to occur at either of these crossings then there would be an increased risk of sewage overflows at both MSPS 2 (North Macksville) and MSPS 3 (located between Taylors Arm and Tilly Willy Creek) respectively;		
▪ The headwork bore and lift pumps are reliant upon a common power supply source and hence any long power supply failure would also adversely affect the ability to supply water to all customers;		▪ Cost for a study to quantify this risk and to identify alternative costed solutions has been allocated in the 40 year financial plan.
▪ The booster pump to Scotts Head does not have provision for an emergency power supply thus a long failure of the existing power supply would adversely affect the supply of water to Scotts Head customers during peak demand periods only;		
▪ Long power supply failure would have a significant impact on all the schemes as most of the pumping stations and critical processes within the STP do not have alternate grid and/or emergency power supply;		
▪ There are a number of properties within the urban areas that are connected to the NWSS but not connected to the respective sewerage scheme.		▪ No costs have been allocated in the 40 year financial plan as the 'Septic Safe' program would identify any issues with property owner given direction to connect to NSC sewer system at owners cost if the on-site management becomes an issue.

9.3 *Shire Wide IWCM Scenario Building*

Table 9.4, Table 9.5 and Table 9.6 show the scenarios as identified by the PRG and segregated for convenience into headworks, water conservation and wastewater management categories respectively. The issues that are being addressed by each option are also listed. As mentioned earlier, the scenario building process used the definition in Table 9.1.

Table 9.4 Shire Wide IWCM Scenarios for Headwork Augmentation

Relevant IWCM Issue: Issue	Type	Priority	Location	Opportunity Type	Opportunity	Scenario T	Scenario 1	Scenario 2	Scenario 3
• A number of subcatchments are under high hydrologic stress during periods of low flow, when the potential competition for water is greatest.	WR	H	All	Shire Water Supply - Security of Supply Improvement Works	Opportunity HW1 – Build upfront a storage and Borefield to meet projected future demands. Note: Future storage size will differ depending on projected demand.	x	x	x	x
• A number of subcatchments are noted as having high conservation value.	WR	H							
• Climate change impacting on water quality, quantity and rainfall/streamflow distribution, frequency and intensity, flooding and salt-water intrusion.	WR	M							
• Potential over-extraction of surface and groundwater leading to salt water intrusion.	WR	H							
• Nambucca Water Supply System has shown to be susceptible to drought at the current population.	WS	H							
• A number of subcatchments are noted as having high conservation value.	WR	H							
• Climate change impacting on water quality, quantity and rainfall/streamflow distribution, frequency and intensity, flooding and salt-water intrusion.	WR	M							
• Climate change impacting on water quality, quantity and rainfall/streamflow distribution, frequency and intensity, flooding and salt-water intrusion.	WR	M		Shire Water Supply - Water Quality Improvement Works	Opportunity WTP1 – Implement a comprehensive and effective catchment management plan including fencing and river bank stabilisation (up to 4 km). Implement a well-head protection plan and storage aerators and storage management plan. Plan to build a water filtration plant (WFP) in 2023 and allow for the immediate collection of developer charges.				x
• Potential over-extraction of surface and groundwater leading to salt water intrusion.	WR	H			Opportunity WTP2 – Undertake catchment protection works in the vicinity of the Borefield (about 1 km of fencing and river bank stabilisation). Implement a well-head protection plan and storage aerators and storage management plan. Plan to build a WFP in 2020 and allow for the immediate collection of developer charges.		x	x	
					Opportunity WTP3 – Undertake no catchment protection works (i.e. no fencing but river bank stabilisation in the vicinity of the Borefield). Implement a well-head protection plan and storage aerators and storage management plan. Build a WFP at the same time as the off-river storage.	x			

Table 9.5 Shire Wide IWCM Scenarios for Water Conservation

Relevant IWCM Issue			Location	Opportunity Type	Opportunity	Scenario				Notes
Issue	Type	Priority				T	1	2	3	
• A need for improved demand management initiatives, incentives and education relating to behavioural change for water use including tourist focus.	WS	M	All	Shire Water Supply - Demand Management	Basic Residential Tuneup Retrofit Program consisting of: • 3A Showerhead; • Cistern Displacement Unit; • 3A Tap Aerators • Quick leakage check; and • Visual audit and rectification of all minor fixture leakage		x	x	x	50% of existing dwellings over 10 years. 75% of cost is met by NSC.
					Enhanced Residential Tuneup Retrofit Program consisting of: • Micro-irrigation Unit; • Water efficient washing machine rebate; and • Cistern Replacement rebate.			x	x	50% of existing dwellings over 10 years. 75% of cost is met by NSC.
					Non-Residential Water Efficiency Program (Council Premises only)		x	x	x	Cost met by NSC
					Non-Residential Water Efficiency Program (The remaining non-residential sector)			x	x	Cost met by owner
• Moderately high reported Infrastructure Leakage Index suggests excessive water supply system leakage.	WS	M			System Leakage Reduction consisting of: • Mains Replacement; • Improved Response Times; and • Improved telemetry and metering.		x	x	x	
					Enhanced System Leakage Reduction consisting of: • Pressure Reduction				x	
				Alternative Household Water Supply	BASIX compliance with harvesting of roof water into RWT - All new developments in existing urban areas. (Refer to individual future urban release areas for the application of BASIX)	x	x	x	x	
• A need for improved demand management initiatives, incentives and education relating to behavioural change for water use including tourist focus.	WS	M			RWT Refit program covering 25% of existing homes with a tank			x		Program over 10 years with 75% of cost met by NSC
• The low level of use of stormwater and rainwater.	SW	M			RWT Refit program covering 50% of existing homes with a tank				x	Program over 10 years with 90% of cost met by NSC
• The low level of reuse from STP and grey water.	WW	M			Greywater rebate program covering 5% of existing homes with a recycling and treatment unit				x	Program over 10 years with 50% of cost met by NSC
			Macksville	BASIX compliance for South Macksville DCP17 area	Alternative M3A - Harvesting of roof water into RWT with town water top-up	x	x	x	x	
• Nambucca Water Supply System has shown to be susceptible to drought at the current population.	WS	H		Reuse / Substitution to Reduce Existing Potable Consumption	Alternative M1C - Macksville Park by harvesting local groundwater		x			Cost met by owner
					Alternative M2C - Macksville HS Playing Fields and Macksville Golfcourse by harvesting local groundwater		x			Cost met by owner
					Reticulated reuse scheme from Macksville STP - Macksville Park, Macksville HS Playing Fields and Macksville Golfcourse				x	Cost of common infrastructure works met by NSC (2016)
• Reduced quantity and improved quality of effluent discharging to Nambucca River.				Reuse to reduce Nambucca River discharge	Agricultural reuse – irrigated pasture adjacent to Macksville STP (as part of reticulated scheme)				x	
• Flood mitigation, urban development & drainage have degraded natural wetlands & exposed acid sulphate soils (ASS), degrading water quality in rivers, estuaries and groundwater systems. • Nutrients from land use, septic, stormwater & effluent discharge have resulted in deterioration of water quality in some waterways and groundwater systems.	C C	H H			Reuse to regenerate SEPP 14 Gumma Wetlands and rehabilitation of decommissioned STP site into an ecotourism wetland			x		All cost met by NSC
			Scotts Head	BASIX compliance for South Scotts Head Release area	Harvesting of roof water into RWT with town water top-up	x	x	x		
• The low level of reuse from STP and grey water.	WW	M		Reuse to Reduce Future Potable Consumption	Residential Non-potable reclaimed water reuse in South Scotts Head Urban Release Area for BASIX compliance using a local sewer mining plant; see Option SH1				x	Cost of sewer mining and non-potable rising main and reservoir met by NSC. Reticulation cost met by developer.
• Nambucca Water Supply System has shown to be susceptible to drought at the current population.	WS	H	Nambucca Heads and Kingsworth	Reuse / Substitution to Reduce Existing Potable Consumption	Alternative NH1C - Nambucca Heads Golf Course by harvesting local groundwater				x	Cost met by owner
			Valla Beach and Valla Urban Growth Area	BASIX compliance for the Valla Urban Growth Area	Harvesting of roof water into RWT with town water top-up	x	x	x		
• Nambucca Water Supply System has shown to be susceptible to drought at the current population.	WS	H		Reuse / Substitution to Reduce Future Potable Consumption	Alternative VB1B - Valla Beach Resort by harvesting local groundwater				x	Cost met by owner
• The low level of reuse from STP and grey water.	WW	M			Residential Non-potable reclaimed water reuse in the Valla Urban Growth Area for BASIX compliance using a local sewer mining plant; see Option NH1				x	Cost of MBR and non-potable rising main and reservoir met by NSC. Reticulation cost met by developer.

Table 9.6 Shire Wide IWCM Scenarios for Wastewater Management

Relevant IWCM Issue			Location	Opportunity Type	Opportunity	Scenario			
Issue	**Type**	**Priority**				**T**	**1**	**2**	**3**
• Increased flow into sewerage systems due to infiltration during wet weather.	WW	M	All Sewerage Schemes	**Inflow and Infiltration Reduction** - High Priority SPS Catchments	A physical and age audit of the sewer network and premises to identify problem hotspots	x	x	x	x
• Some stormwater quality issues relating to litter, contaminated material, turbidity, dissolved pollutants and lack of treatment.	SW	M			Smoke testing of individual properties where necessary and issuing notice to premises owners to fix the problem (service line)	x	x	x	x
• Reported microbial contamination from a range of sources may affect the quality of water for a range of uses.	C	M			Continuous monitoring of sewage flows at strategic locations where possible (network)	x	x	x	x
• Climate change impacting on water quality, quantity and rainfall/streamflow distribution, frequency and intensity, flooding and salt-water intrusion.	WR	M			CCTV inspection starting with hotspot sections (network)	x	x	x	x
					Rehabilitating the sewer pipes; either by relining the existing pipes and/or by replacing the pipes	x	x	x	x
					Evaluating alternative measures to minimise urban flooding such as encouraging the implementation of rainwater tanks with on-site detention volume, water sensitive urban design principles or measures to increase the stormwater conveyance capacity	x	x	x	x
				Inflow and Infiltration Reduction - Medium Priority SPS Catchments	Regular monitoring of sewage flows at strategic locations where possible (network)			x	x
					CCTV inspection starting with higher I/I SPS catchments			x	x
					Rehabilitating the sewer pipes; either by relining the existing pipes and/or by replacing the pipes			x	x
				Inflow and Infiltration Reduction - Low Priority SPS Catchments	Intermittent Monitoring of sewage flows at strategic locations where possible (network)				x
• Bowraville STP is approaching design capacity and exceeding DEC Licence volume loading resulting in effluent with high TSS concentration.	WW	H	Bowraville	Augment Sewerage System Components	**Opportunity B3** – Optimise current STP operation to improve performance and allow for the immediate collection of charges for a planned renewal of the existing STP with a new 1,500 EP plant and a wet weather storage at a new location by 2015.	x	x	x	x
• Nutrients from land use, septic, stormwater & effluent discharge have resulted in deterioration of water quality in some waterways and groundwater systems.	WW	H	Macksville	Augment Sewerage System Components	Increase emergency storage at SPS2	x	x	x	x
• Macksville STP has recorded non-compliance for TSS, nitrite, TP and FC for DEC Licence in 2005.	WW	H			Increase emergency storage at SPS3	x	x	x	x
					Opportunity M1 – Optimise current STP operation by operating at higher MLSS during peak load periods and then add a new 3,000 EP reactor in 2017	x	x	x	x
• Nutrients from land use, septic, stormwater & effluent discharge have resulted in deterioration of water quality in some waterways and groundwater systems.	C	H	Scotts Head	Augment Sewerage System Components	**Opportunity SH1** – Urban Reuse 1 (Initial Treatment Enhancement of SH STP through Chemical Dosing. Upgrade SH STP in 2012 by 1,500 EP to cater for growth in the existing urban areas. Build a Sewer Mining Plant in 2016 for dual reticulation reuse at South Scotts Head Urban Release. Transfer Wet weather flows from Sewer Mining Plant to SPS 8)				x
• Scotts Head STP has recorded non-compliance for TSS and BOD for DEC Licence in 2004.	WW	H			**Opportunity SH3** – Upgrade existing STP capacity by 2,500 EP (to 4,500 EP) to cater for both the existing Scotts Head Urban Area and the South Scotts Head Release Area. Stage 1 upgrade (1,500 EP) in 2011 and Stage 2 Upgrade (1,000 EP) in 2016.	x	x	x	
• Nutrients from land use, septic, stormwater & effluent discharge have resulted in deterioration of water quality in some waterways and groundwater systems.	C	H	Nambucca Heads / Valla Urban Growth Area	Augment Sewerage System Components	**Opportunity NH1** – Urban Reuse 1 (Upgrade existing STP capacity to 18,000 EP to cater for Nambucca Heads and Valla Beach only. Stage 1 upgrade (10,000 EP) in 2010 and Stage 2 Upgrade (3,000 EP) in 2028. Build a Sewer Mining Plant in 2016 for dual reticulation reuse at the Valla Urban Growth Area. Transfer Wet weather flows from Sewer Mining Plant to VB SPS 7.)				x
• Nambucca STP is approaching design capacity. • There are failures of DEC Aquatic System Protection guidelines in Deep Ck downstream of Nambucca STP.	WW WW	H H			**Opportunity NH3** – Upgrade existing STP capacity to 22,000 EP to cater for Nambucca Heads, Valla Beach and Valla Urban Growth Area. Stage 1 upgrade (10,000 EP) in 2010 and Stage 2 Upgrade (7,000 EP) in 2014	x	x	x	

9.4 Description of the Shire Wide IWCM Scenarios

9.4.1 Traditional Scenario

In addition to the common measures and works listed in Table 9.2 and Table 9.3, this scenario consists of the following major water supply and sewerage works:

- Continue with current water conservation measures;
- 6,400 ML off-river storage on the upper reaches of Bowra Creek with provision in the storage foundation and embankment for future raising to the ultimate capacity of 14,000 ML and an additional 40 ML/d borefield capacity along Nambucca River and South Creek;
- Opportunity WTP3 with no catchment protection works (i.e. no fencing but river bank stabilisation in the vicinity of the borefield) but implement well-head protection and storage management plans, install storage aerators and initially build a 15 ML/d water filtration plant (WFP) along with the off-river storage construction (the WFP will require upgrading by a further 3.8 ML/d in 2030);
- BASIX compliance with harvesting of roof water into rainwater tanks for all new developments in both the existing urban and new release areas;
- Upgrade the distribution mains from Wirimbi Junction to Pacific Highway near Nambucca Heads and the PRV north of Nambucca River at Macksville (2025);
- Upgrade the distribution main from South Macksville to Scotts Head (2025);
- Construct a new reservoir and main from each of the urban growth areas (2016);
- Inflow and infiltration reduction measures for high priority SPS catchments in all sewerage schemes;
- Optimise current Bowraville STP performance and build a new plant by 2015 (Opportunity B3);
- Optimise current Macksville STP operation by operating at high MLSS during peak load periods and then add a new reactor by 2017 (Opportunity M1);
- Upgrade existing Scotts Head STP capacity by 2,500 EP in stages (2011 and 2016) to 4,500 EP (Opportunity SH3)
- Upgrade existing Nambucca Heads STP capacity in stages (10,000 EP reactor in 2009 and 7,000 EP reactor in 2016) to 22,000 EP (Opportunity NH3).

Figure 9.1 shows how Traditional Scenario measures impact upon the water demand and supply components over the planning horizon. For example, in Figure 9.1 it can be seen that the amount of water supplied from RWT in new dwellings grows over time due to BASIX, hence reducing the amount of water required from the Nambucca River (via the Bowraville Borefield) in order to meet the water usage.

Figure 9.2 shows how the Traditional Scenario measures impact on the amount of inflow to the four STP, as well as how much treated effluent is discharged to receiving waters (Nambucca River for Bowraville STP and Macksville STP; Deep Creek for Nambucca Heads STP; Warrell Creek via exfiltration trench for Scotts Head STP) and how much is reused. It can be seen in Figure 9.2 that only Bowraville STP achieves reuse for irrigation purposes.

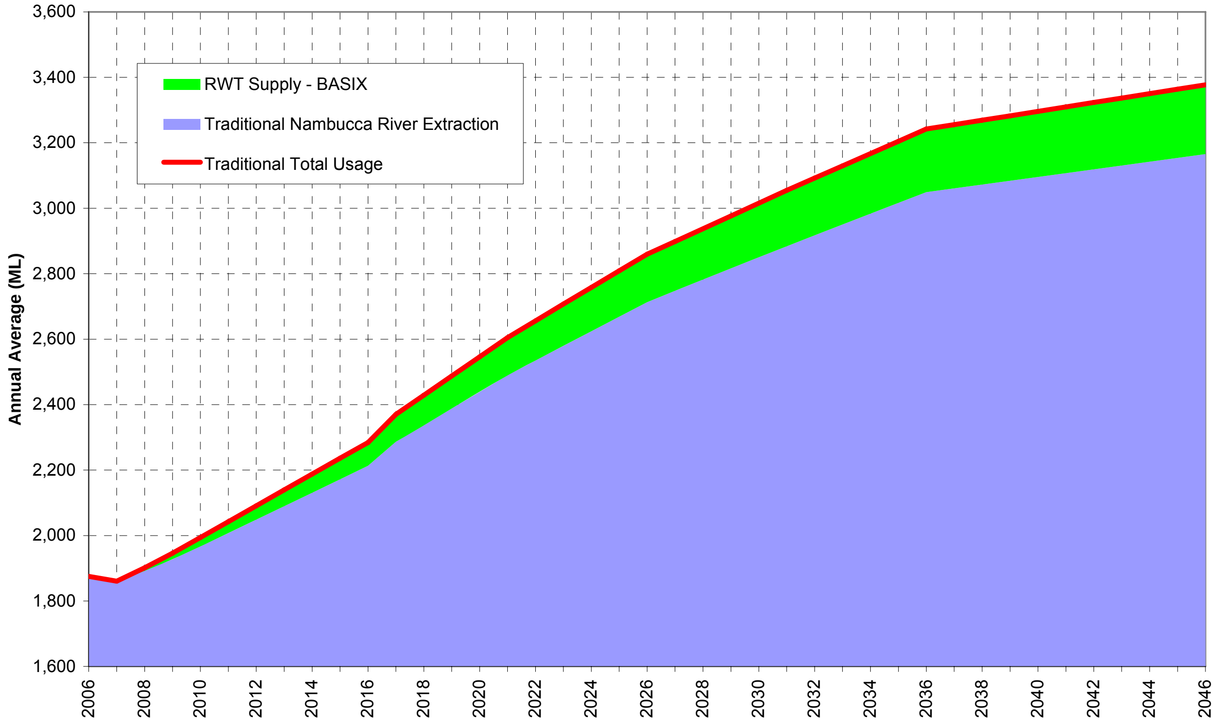

Figure 9.1 Traditional Scenario Water Supply and Demand

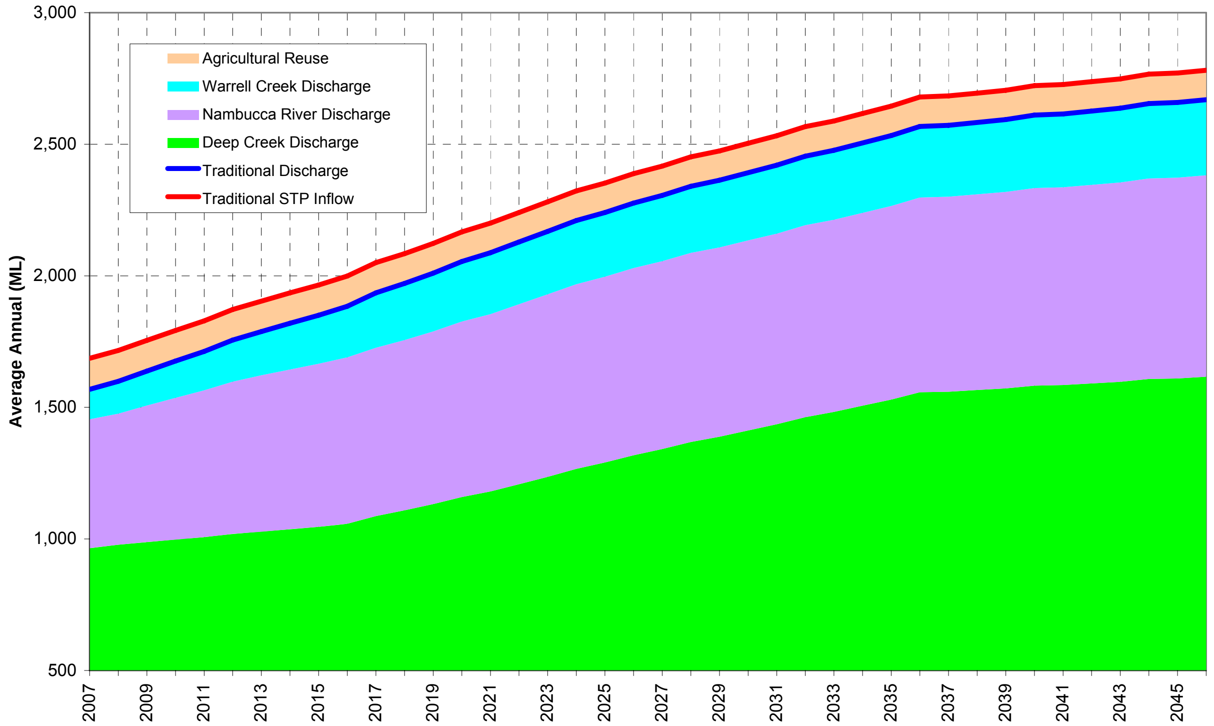

Figure 9.2 Traditional Scenario Wastewater Inflow, Discharge and Reuse

9.4.2 Integrated Scenario 1

In addition to the common measures and works listed in Table 9.2 and Table 9.3, this scenario consists of the following major water supply and sewerage works:

- Basic residential tune-up retrofit program targeting 50% of existing residences with 75% rebate from NSC;
- Non-residential water efficiency program targeting Council premises only;
- System leakage reduction program consisting of mains replacement, improved response time, telemetry and metering;
- 6,200 ML off-river storage on the upper reaches of Bowra Creek with provision in the storage foundation and embankment for future raising to the ultimate capacity of 14,000 ML and an additional 40 ML/d borefield capacity along Nambucca River and South Creek;
- Opportunity WTP2 with catchment protection works in the vicinity of the borefield (about 1 km of fencing and river bank stabilisation) and implement well-head protection and storage management plans and storage aerators and build a 18.6 ML/d WFP in 2020 but allow for the immediate collection of developer charges;
- BASIX compliance with harvesting of roof water into rainwater tanks for all new developments in both the existing urban and new release areas;
- Upgrade the distribution mains from Wirimbi Junction to Pacific Highway near Nambucca Heads and the PRV north of Nambucca River at Macksville (2025);
- Upgrade the distribution main from South Macksville to Scotts Head (2025);
- Construct a new reservoir and main from each of the urban growth areas (2016);
- Inflow and infiltration reduction measures for high priority SPS catchments in all sewerage schemes;
- Inflow and infiltration reduction measures for high priority SPS catchments in all sewerage schemes;
- Optimise current Bowraville sewage plant performance and build a new plant by 2015 (Opportunity B3);
- Optimise current Macksville STP operation by operating at high MLSS during peak load periods and then add a new reactor by 2017 (Opportunity M1);
- Upgrade existing Scotts Head STP capacity by 2,500 EP in stages (2011 and 2016) to 4,500 EP (Opportunity SH3)
- Upgrade existing Nambucca Heads STP capacity in stages (10,000EP reactor in 2009 and 7,000EP reactor in 2016) to 22,000 EP (Opportunity NH3).

Figure 9.3 shows how the Integrated Scenario 1 measures impact upon the water demand and supply components over the planning horizon. It can be seen in Figure 9.3 how the additional water conservation measures (i.e. The Basic Tuneup Program, the restricted non-residential efficiency program and the system leakage reduction program) impact on the usage for Integrated Scenario 1 as opposed to the Traditional Scenario.

Figure 9.4 shows how the Integrated Scenario 1 measures impact on the amount of inflow to the four STP, as well as how much treated effluent is discharged to receiving waters and how much is reused. Figure 9.4 also shows the impact of the Basic Refit Program on reduced STP inflow through improved internal water efficiency in the residential sector.

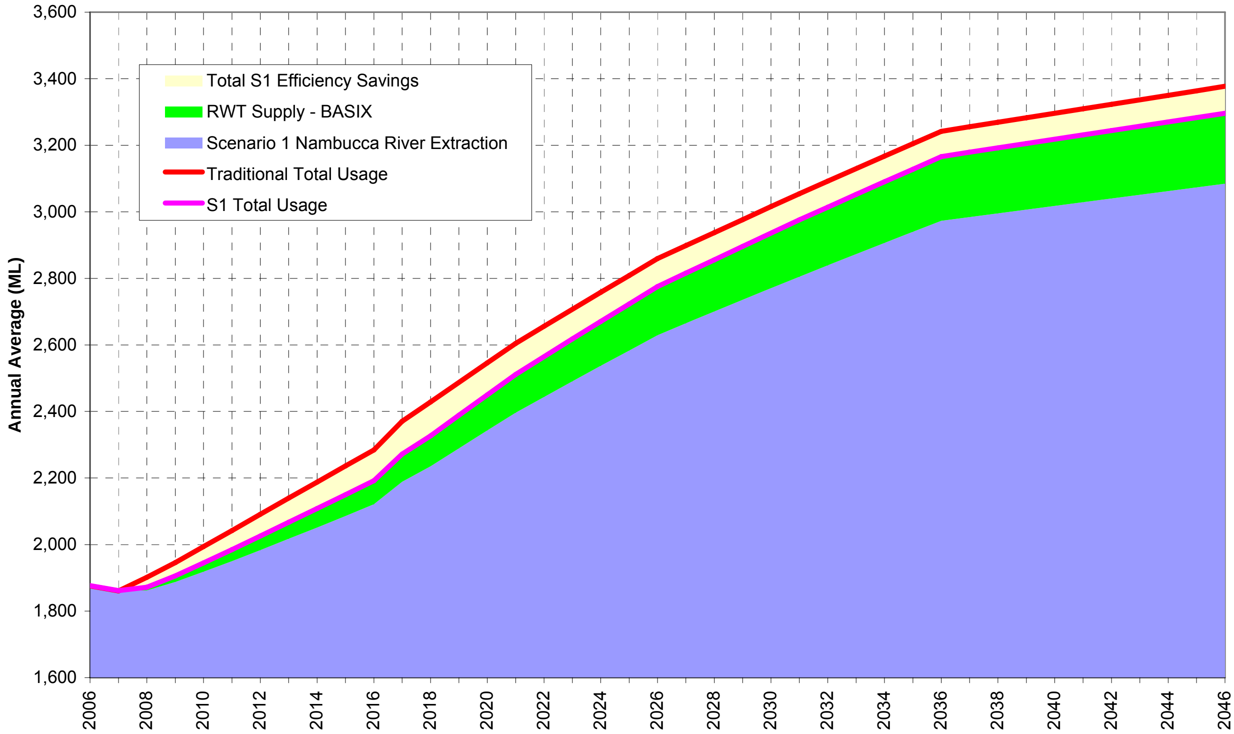

Figure 9.3 Integrated Scenario 1 Water Supply and Demand

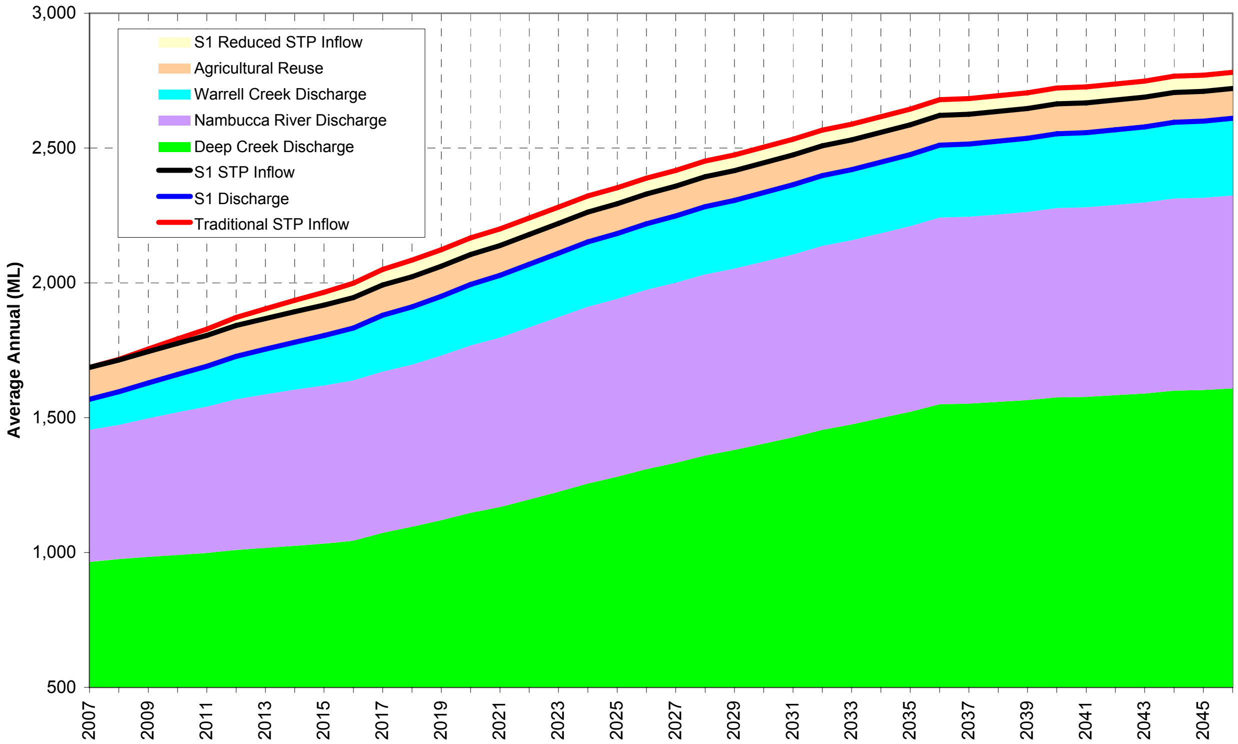

Figure 9.4 Integrated Scenario 1 Wastewater Inflow, Discharge and Reuse

9.4.3 Integrated Scenario 2

In addition to the common measures and works listed in Table 9.2 and Table 9.3, this scenario consists of the following major water supply and sewerage works:

- Enhanced residential tune-up retrofit program consisting of the Basic residential tune-up retrofit program measures plus additional measures such as micro-irrigation, water efficient washing machine and cistern replacement units targeting 50% of existing residences with 75% rebate from NSC;
- Non-residential water efficiency program targeting both the NSC premises and other high water users;
- System leakage reduction program consisting of mains replacement, improved response time, telemetry and metering;
- Rain water tank (RWT) refit program targeting 25% of existing homes with 75% rebate from NSC;
- 6,000 ML off-river storage on the upper reaches of Bowra Creek with provision in the storage foundation and embankment for future raising to the ultimate capacity of 14,000ML and an additional 40 ML/d borefield capacity along Nambucca River and South Creek;
- Opportunity WTP2 with catchment protection works in the vicinity of the borefield (about 1 km of fencing and river bank stabilisation) and implement well-head protection and storage management plans and storage aerators and build a 17.7 ML/d WFP in 2020 but allow for the immediate collection of developer charges;
- BASIX compliance with harvesting of roof water into rainwater tanks for all new developments in both the existing urban and new release areas;
- Inflow and infiltration reduction measures for high and medium priority SPS catchments in all sewerage schemes;
- Upgrade the distribution mains from Wirimbi Junction to Pacific Highway near Nambucca Heads and the PRV north of Nambucca River at Macksville (2025);
- Upgrade the distribution main from South Macksville to Scotts Head (2025);
- Construct a new reservoir and main from each of the urban growth areas (2016);
- Optimise current Bowraville sewage plant performance and build a new plant by 2015 (Opportunity B3);
- Optimise current Macksville STP operation by operating at high MLSS during peak load periods and then add a new reactor by 2017 (Opportunity M1);
- Upgrade existing Scotts Head STP capacity by 2,500 EP in stages (2011 and 2016) to 4,500 EP (Opportunity SH3);
- Upgrade existing Nambucca Heads STP capacity in stages (10,000EP reactor in 2009 and 7,000EP reactor in 2016) to 22,000 EP (Opportunity NH3); and
- Centralised reuse with treated wastewater from the Macksville STP to regenerate SEPP 14 Gumma Wetlands and rehabilitation of decommissioned STP site into an ecotourism wetland.

Figure 9.5 shows how the Integrated Scenario 2 measures impact upon the water demand and supply components over the planning horizon. Apart from the increased water savings for Integrated Scenario 2. Figure 9.5 also shows the impact of the RWT retrofit program in terms of reduced extraction from the Nambucca River (via Bowraville Borefield).

Figure 9.6 shows how the Integrated Scenario 2 measures impact on the amount of inflow to the four STP, as well as how much treated effluent is discharged to receiving waters and how much is reused. Figure 9.6 shows a sharp drop in the amount of effluent discharged directly to Nambucca River. This is due to the implementation of Macksville STP reuse for the rehabilitation of Gumma Wetland. Note also in Figure 9.6 the marked reduction in amount of STP inflow as compared to Integrated Scenario 1 (Figure 9.4). This is primarily attributable to inflow and infiltration reduction measures for medium priority SPS catchments.

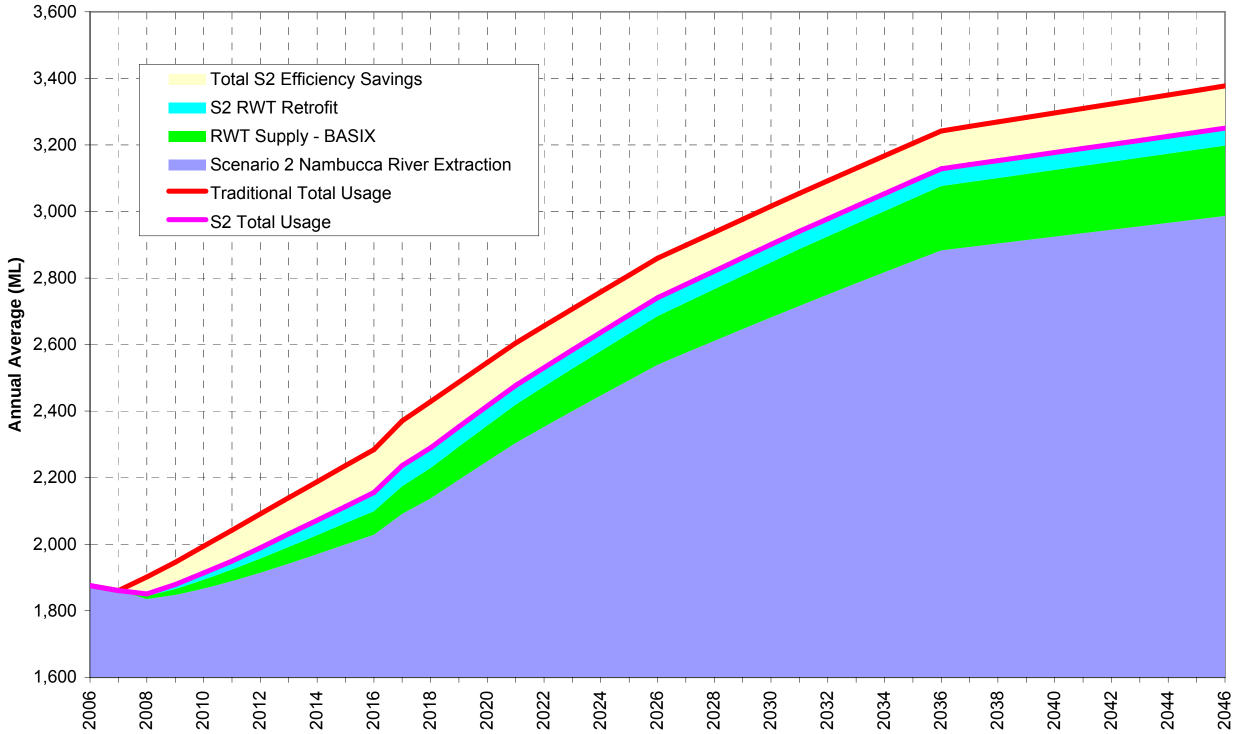

Figure 9.5 Integrated Scenario 2 Water Supply and Demand

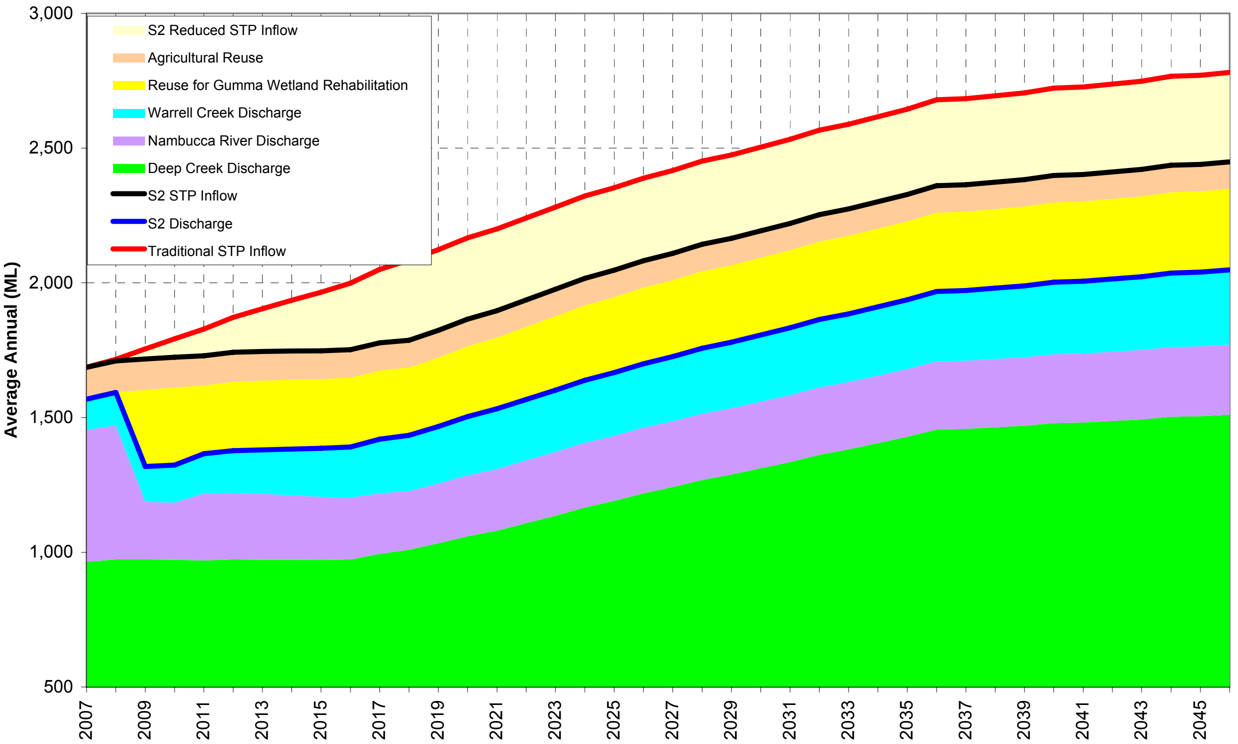

Figure 9.6 Integrated Scenario 2 Wastewater Inflow, Discharge and Reuse

9.4.4 Integrated Scenario 3

In addition to the common measures and works listed in Table 9.2 and Table 9.3, this scenario consists of the following major water supply and sewerage works:

- Enhanced residential tune-up retrofit program consisting of the Basic residential tune-up retrofit program measures plus additional measures such as micro-irrigation, water efficient washing machine and cistern replacement units targeting 50% of existing residences with 75% rebate from NSC;
- Non-residential water efficiency program targeting both the NSC premises and other high water users;
- Enhanced system leakage reduction program consisting of mains replacement, improved response time, telemetry, metering and pressure management;
- Rain water tank (RWT) refit program targeting 50% of existing homes with 90% rebate from NSC;
- Grey water rebate program targeting 5% of homes with 50% rebate from NSC;
- Upgrade the distribution mains from Wirimbi Junction to Pacific Highway near Nambucca Heads and the PRV north of Nambucca River at Macksville (2025);
- Upgrade the distribution main from South Macksville to Scotts Head (2025);
- Construct a new reservoir and main from each of the urban growth areas (2016);
- 5,000 ML off-river storage on the upper reaches of Bowra Creek with provision in the storage foundation and embankment for future raising to the ultimate capacity of 14,000ML and an additional 40 ML/d borefield capacity along Nambucca River and South Creek;
- Opportunity WTP1 with comprehensive and effective catchment management plan including fencing and river bank stabilisation (up to 4 km), well-head protection and storage management plans and storage aerators and build a 16.75 ML/d WFP in 2023 but allow for the immediate collection of developer charges;
- BASIX compliance with harvesting of roof water into rainwater tanks for all new developments in existing urban areas only;
- Inflow and infiltration reduction measures for high, medium and low priority SPS catchments in all sewerage schemes;
- Optimise current Bowraville sewage plant performance and build a new plant by 2015 (Opportunity B3);
- Optimise current Macksville STP operation by operating at high MLSS during peak load periods and then add a new reactor by 2017 (Opportunity M1);
- Upgrade existing Scotts Head STP capacity to 3,500EP through chemical dosing and adding a reactor in 2011 plus provide a sewer mining plant and reclaimed water reuse system for the south Scotts Head release area for BASIX compliance (Opportunity SH1);
- Upgrade existing Nambucca Heads STP capacity to 18,000EP in stages (10,000EP reactor in 2009 and 3,000EP reactor in 2028) plus provide a sewer mining plant and reclaimed water reuse system for the Valla Urban Growth area for BASIX compliance (Opportunity NH1); and
- Centralised reuse with treated wastewater from the Macksville STP for Macksville Park, High School Playing Fields and Golf course.

Figure 9.7 shows how the Integrated Scenario 3 measures impact upon the water demand and supply components over the planning horizon. Apart from the increased water savings for Integrated Scenario 3. Figure 9.7 also shows the impact of reusing effluent at South Scotts Head and the Valla Urban Growth Area in terms of reduced extraction from the Nambucca River (via Bowraville Borefield).

Figure 9.8 shows how the Integrated Scenario 3 measures impact on the amount of inflow to the four STP, as well as how much treated effluent is discharged to receiving waters and how much is reused. Figure 9.8 shows how reuse at the two urban growth areas reduces discharge to Warrell Creek and Deep Creek.

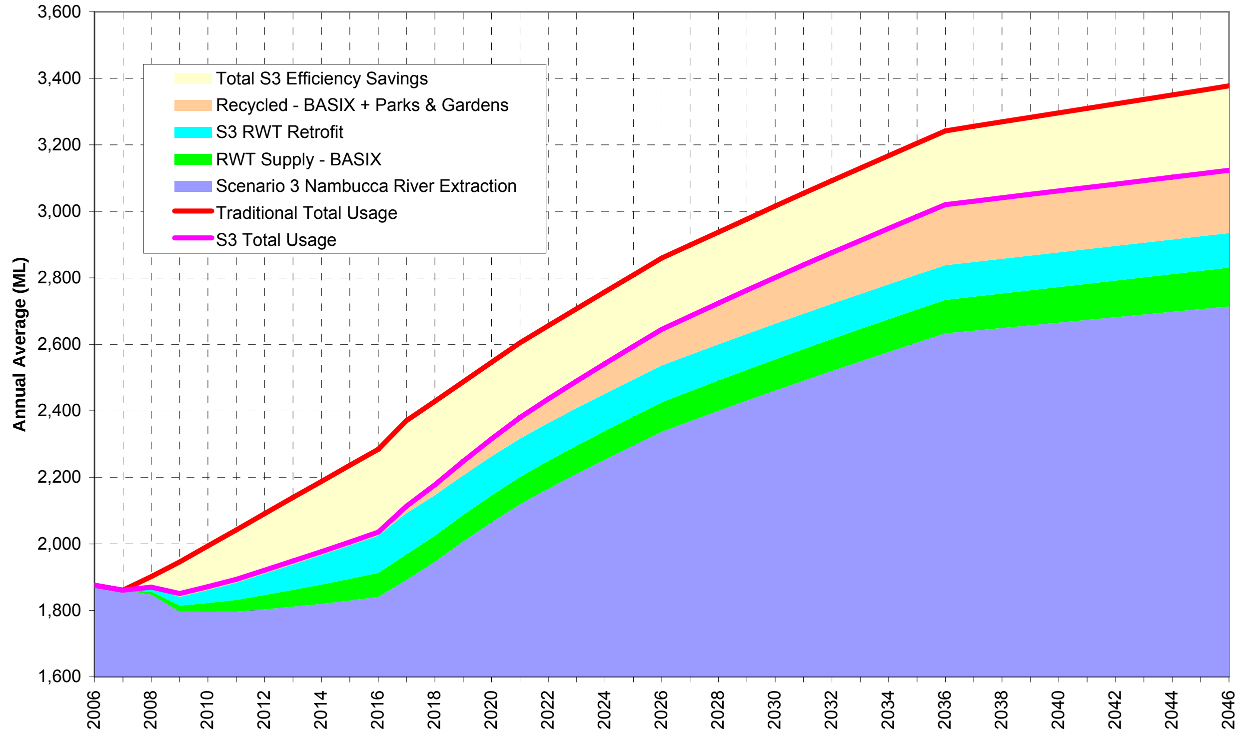

Figure 9.7 Integrated Scenario 3 Water Supply and Demand

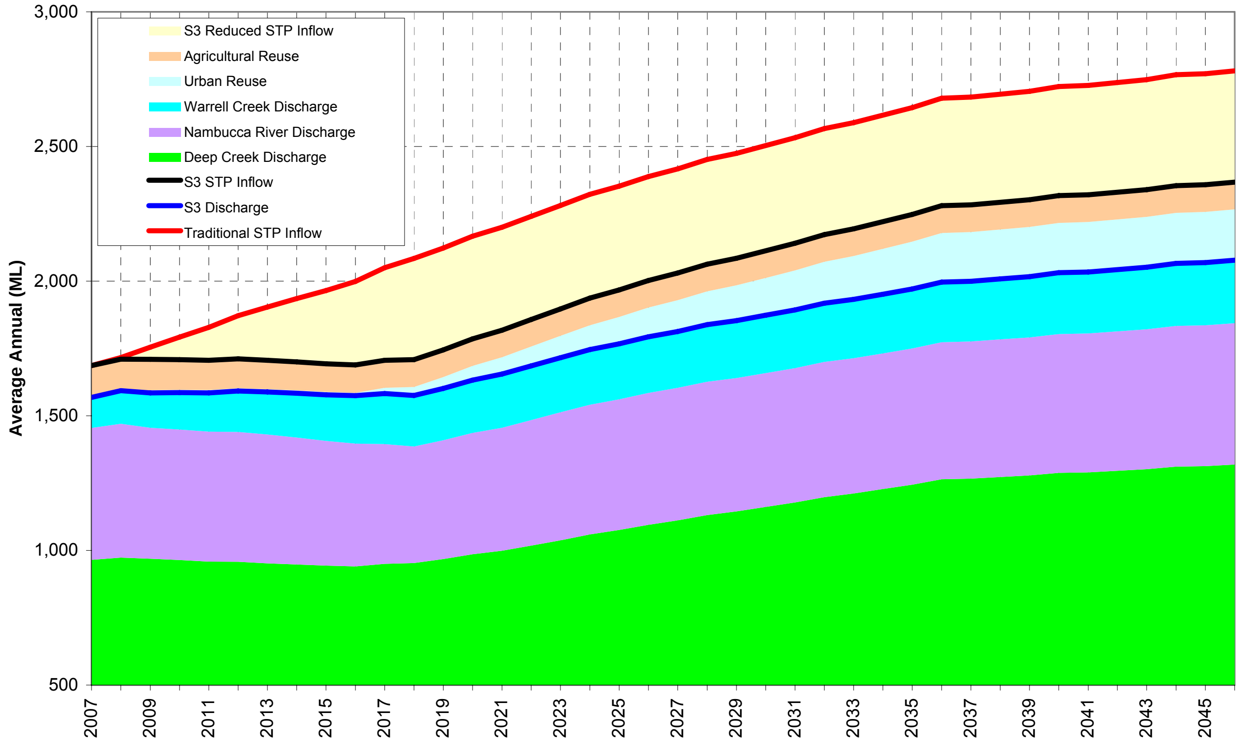

Figure 9.8 Integrated Scenario 3 Wastewater Inflow, Discharge and Reuse

The above Shire wide IWCM scenarios are suggested recommendations by the PRG. They may be modified to reflect the priorities and preferences of individual communities and as a result of additional information and knowledge becoming available from ongoing investigations into the individual components of the scenarios.

9.5 Present Value Analysis of Shire Wide IWCM Scenarios

9.5.1 Water Supply Service

Table 9.7 presents the summary of the estimated total cost of capital outlay and the present value of the capital and the operating, maintenance and administration (OMA) cost estimates over the 40 years for the water supply service in each IWCM scenario based on 2009 dollars. The costing details are presented in Task 7 Paper and Appendix D.

Table 9.7 Summary of Capital and Present Value Costs for the IWCM Scenarios – Water Supply Service Component

Scenario	Total Capital Cost (over the 40 years)	Present Value of Capital Cost @ 7%	Total Present Value @ 7%
Traditional	109.1M	86.5M	97.3M
Scenario 1	105.9M	76.2M	85.8M
Scenario 2	104.1M	74.9M	84.6M
Scenario 3	105.4M	72.8M	81.8M

9.5.2 Sewerage Service

Table 9.8 presents the summary of the estimated total cost of capital outlay and the present value of the capital and OMA cost estimates over the 40 years for the sewerage service in each scenario based on 2009 dollars. The costing details are presented in Task 7 Paper and Appendix D.

Table 9.8 Summary of Capital and Present Value Costs for the IWCM Scenarios – Sewerage Service Component

Scenario	Total Capital Cost (over the 40 years)	Present Value of Capital Cost @ 7%	Total Present Value @ 7%
Traditional	79.8M	61.6M	78.2M
Scenario 1	78.4M	60.5M	77.9M
Scenario 2	78.4M	61.3M	81.6M
Scenario 3	90.0M	64.6M	84.6M

Table 9.7 and Table 9.8 do not include the cost and savings attributed to BASIX compliance measures and some NSC-subsidised site-specific measures within the IWCM scenarios (e.g. rainwater tank retrofit program and water efficiency retrofit program). The site-specific measures require a contribution (above the amount subsidised by NSC) from participating customers. Table 9.9 presents these costs and savings over the planning horizon for the IWCM scenarios for information purposes only. Detailed information including an itemised list of the relevant measures impacting on participating customer costs and savings can be seen in Appendix D.

Table 9.9 Net Present Analysis of Unaccounted Cost and Savings of Participating Customers

Service	Scenario		Present Value - Cost	Present Value - Saving	Net Present Value
Water Supply	Traditional		10.8	1.8	9.0
	Scenario 1		10.9	3.4	7.5
	Scenario 2		13.6	4.1	9.4
	Scenario 3		14.7	4.5	10.2
Wastewater	Traditional		0.4	0.0	0.4
	Scenario 1		0.4	0.0	0.4
	Scenario 2		0.4	0.0	0.4
	Scenario 3		0.4	0.0	0.4
Total	Traditional	BASIX Compliance	11.1	1.8	9.4
		Other Measures	0.0	0.0	0.0
	Scenario 1	BASIX Compliance	11.1	1.8	9.4
		Other Measures	0.1	1.6	-1.5
	Scenario 2	BASIX Compliance	11.1	1.8	9.4
		Other Measures	2.8	2.4	0.4
	Scenario 3	BASIX Compliance	11.2	1.8	9.4
		Other Measures	3.8	2.7	1.2

1. Present Value costs and savings are in $M
2. Planning horizon is 40 years (2009 – 2048 inclusive)
3. Discount Rate = 7%
4. TRB is for 2008/09 financial year in $ and includes a subsidy as part of the Country Towns Water, Sewerage and Drainage Program.
5. Savings include water and energy bill cost reductions for participating customers

9.6 Typical Residential Bill (TRB) Analysis of Scenarios

9.6.1 General

In line with current DWE guidelines, the lowest required revenue from both the residential and non-residential customers and the stable typical residential bill (TRB) with maximum utilisation of existing cash reserves has been established using the financial planning model (FINMOD).

In establishing the TRB the renewal works not related to the capital augmentation under different scenarios have been fully internally funded from Council's cash reserves. Further to facilitate comparability between the scenarios the internal funding for new capital works and the level of cash and investment towards the end of the planning horizon has been maintained at similar level for all scenarios.

The developer charge revenue, up-front charges levied on development to reflect the cost of providing services for new developments, for the four IWCM scenarios were calculated in Task 7 Paper using the direct NPV method in DWE guidelines and are presented in Sections 9.6.2 and 9.6.3 in 2009 dollars. In accordance with Council's current policy of full cost recovery on developer charges, the developer charges used in the financial model beyond 2009 for the four IWCM scenarios were the calculated full amount (i.e., no cross subsidy).

9.6.2 Water Supply Service

Table 9.10 presents the annual typical residential water supply services bills with expected level of state government subsidy and the developer charges for the four IWCM Scenarios.

Table 9.10 Annual TRB and Developer Charges of IWCM Scenarios - Water

Scenario	Developer Charge from 2009/10 onwards	40 Year Capital & Renewal Cost ($Million)	Typical Residential Bill (2009/10$)	Internal Funding for New Capex during next 5 Years ($ Million)	External Borrowing for New Capex during next 5 years ($ Million)
Traditional	9,328	126.3	549	8.17	58.00
Scenario - 1	9,069	122.0	512	13.87	30.00
Scenario - 2	8,997	120.1	535	13.15	30.00
Scenario - 3	9,120	122.1	542	9.62	30.00

Note: All values in current (2008/09) dollars.

Figure 9.9 presents the typical residential water supply services bills for the four IWCM scenarios.

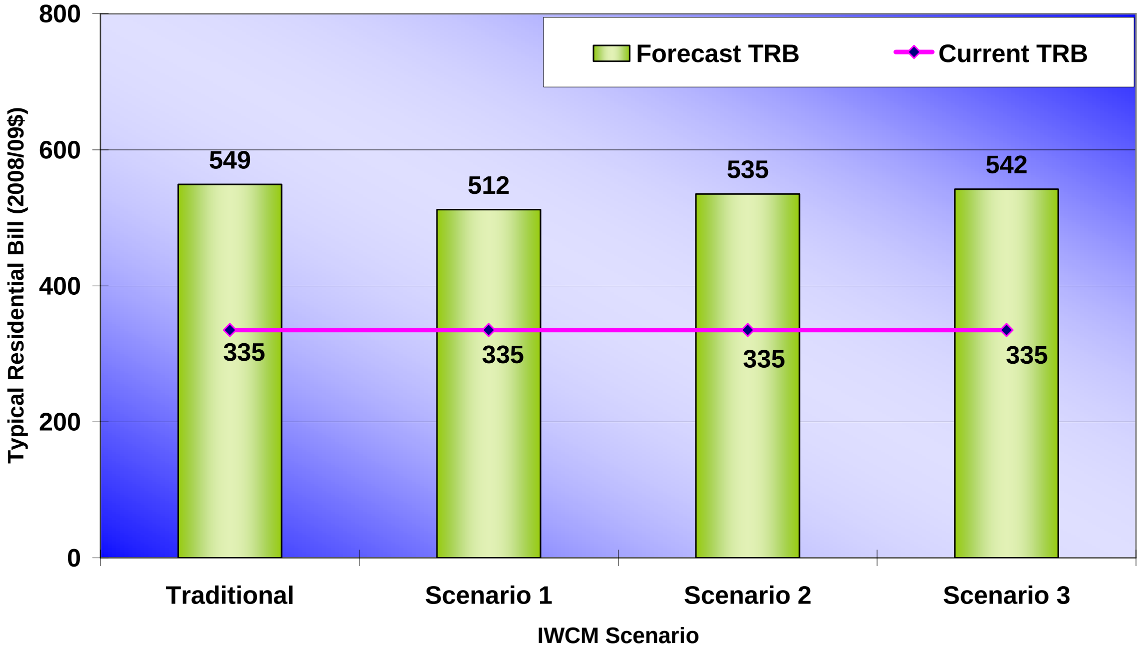

Figure 9.9 - Summary of Typical Residential Bill for IWCM Scenarios - Water

As shown in Figure 9.9 and Table 9.10, the TRB for water supply has to increase from the current level for all the four IWCM scenarios. The minimum and maximum increase is about 55% and 65% respectively with expected level of subsidy.

9.6.3 Sewerage Services

Table 9.11 summarise the typical residential sewerage services bills with expected level of state government subsidy and the developer charges for the four IWCM Scenarios.

Table 9.11 Annual TRB and Developer Charges of IWCM Scenarios - Sewer

Scenario	Developer Charge from 2009/10 onwards	40 Year Capital & Renewal Cost ($Million)	Typical Residential Bill (2009/10$)	Internal Funding for New Capex during next 5 Years ($ Million)	External Borrowing for New Capex during next 5 years ($ Million)
Traditional	9,039	102.7	637	4.41	30.00
Scenario - 1	8,919	101.4	639	3.97	30.00
Scenario - 2	9,037	101.6	683	7.11	30.00
Scenario - 3	9,300	116.6	685	14.31	20.00

Note: All values in current (2008/09) dollars.

Figure 9.10 presents the typical residential sewerage services bills for the four IWCM scenarios.

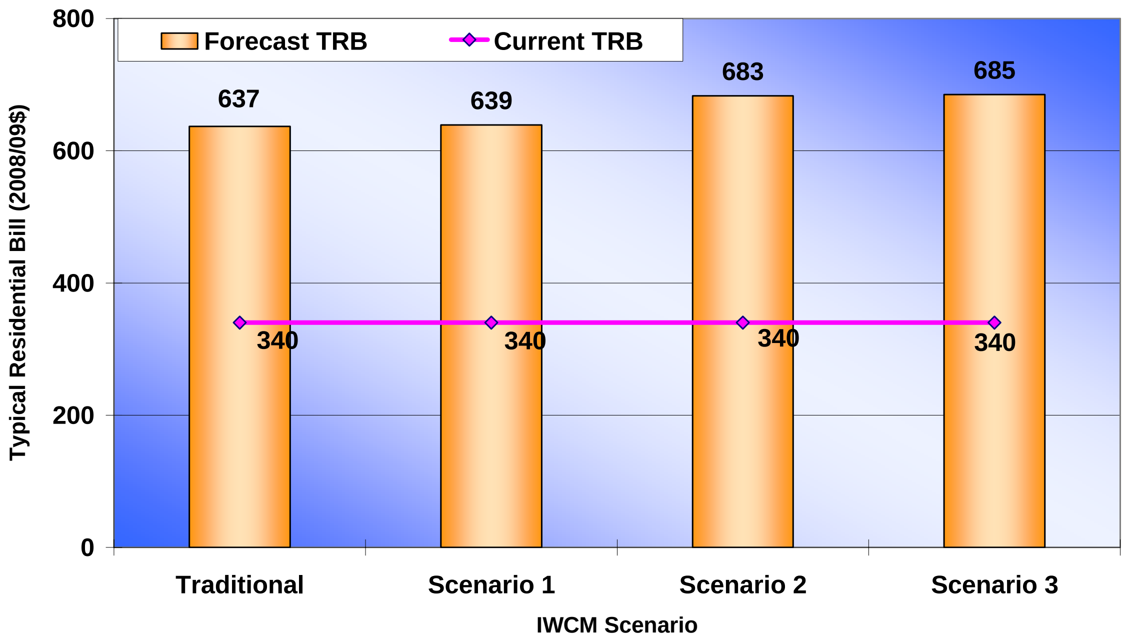

Figure 9.10 - Summary of Typical Residential Bill for IWCM Scenarios - Sewer

As shown in Figure 9.10 and Table 9.11, the TRB for sewerage services has to increase from the current level for all the four IWCM scenarios. The minimum and maximum increase is about 70% and 110% respectively with expected level of subsidy.

9.7 Triple Bottom Line (TBL) Assessment of Scenarios

A total of 33 environmental and social targets have been used to score the IWCM scenarios as to how they address the IWCM issues. Targets and issues were separated into compliance, best practice and aspirational categories (see Section 4), however best practice and aspirational targets only have been used for scoring. A weighting of 2 has been applied to best-practice targets and a weighting of 1 has been applied to aspirational targets. Table 9.12 shows how a score is attributed to each target.

Table 9.12 TBL Scoring Protocol

% of Target Met	Score
<25%	1
25-49%	2
50-74%	3
75-99%	4
>99%	5

Table 9.13 shows the outcome of the environmental and social scoring for each IWCM Scenario across the 33 targets. Detailed scoring information can be seen in Appendix C. Note that the stormwater component of the IWCM scenarios has not been used in scoring.

Table 9.13 Summary of TBL Score for the IWCM Scenarios

Scenario	Environmental Score	Social Score	Environmental and Social Score (ESS)
Traditional	2.96	4.72	7.68
Scenario 1	3.23	4.44	7.68
Scenario 2	3.62	4.44	8.07
Scenario 3	4.08	4.56	8.63

Table 9.14 presents the ranking of the IWCM Scenarios following the DWE ranking methodology.

Table 9.14 IWCM Scenario Ranking

Scenario	Total PV ($M) – Water and Sewer	ESS	ESS / NPV	Rank
Traditional	$176.2	7.68	0.0436	4
Scenario 1	$163.6	7.68	0.0469	3
Scenario 2	$166.2	8.07	0.0485	2
Scenario 3	$166.3	8.63	0.0519	1

According to the assessment and ranking criteria used above, the preferred Shire Wide IWCM Scenario is Integrated Scenario 3.

9.8 *Analysis of Risks and Recommendation*

9.8.1 Overview

Integrated Scenarios 3 has some risks associated with its adoption. These include:

- Rate of population growth is less or greater than the adopted annual growth of 2.1%;
- Impact of climate change;
- Future water demands and uptake rate of water efficiency and local water sources; and
- Cost escalations.

9.8.2 Rate of Population Growth

Sensitivity analysis was undertaken to assess the impact a 1% per annum population growth rate would have on the typical residential bill (TRB) and developer charges reported in Table 9.10 and Table 9.11 for the adopted growth rate. The sensitivity analysis for the 1% growth rate was undertaken by retaining the same planned capital and OMA works and costs as for the adopted growth rate. The analysis for Integrated Scenario 3 indicated the following:

- The water supply services fund will have a negative balance of about $1M by 2012/13 and even if NSC borrows about $2M to cover this deficit the balance will again be negative the following year as cost is greater than revenue. NSC has two alternatives;
  - Raise the TRB to $650 per assessment from 2012/13 and again to about $775 in 2016/17 as well as borrowing about $6M; or
  - Double the developer charges to $18,240 per ET from 2012/13 and then increase TRB to about $655 in 2015/16 as well as borrowing about $6M.
- The sewerage services fund will have a negative balance of about $2M by 2012/13 and even if NSC borrows about $3M to cover this deficit the balance will again be negative the following year as cost is greater than revenue. NSC has two alternatives;
  - Raise the TRB to about $800 per assessment from 2012/13 and again increase the TRB in 2015/16 as well as borrowing about $3M for capital and renewal works in 2014/15; or
  - Double the developer charges to $18,600 per ET from 2012/13 and then increase TRB to about $800 in 2015/16 as well as borrowing about $3M in 2013/14.
- Preliminary analysis indicated that additional loan and increases in TRB and/or developer charges will be required in both funds beyond 2015/16

Analysis undertaken on the other IWCM Scenarios indicated that they will also experience the above issues with a 1% population growth rate.

Since there is significant water supply and sewerage capital expenditure in the next few years independent of the adopted IWCM Scenario, with combined borrowings of about $50M to fund these works, it is strongly recommended that NSC review and implement as soon as possible new pricing policies, control cost crepe with the planned new works and review and update existing asset capacities and population growth on a regular basis.

9.8.3 Impact of Climate Change

The CSIRO has developed a range of global warming scenarios (Ref. 9) and their impact on climatic variables in Australia. To illustrate the possible effects of climate change on the catchment and urban water cycle, the change in rainfall, maximum day temperature and evaporation were estimated for the study area based on the 50th percentile case for medium emission's (A1B) case. Table 9.15 outlines the range of climatic changes for the year 2050.

Table 9.15: Changes in Climatic Variables for the Medium Emission's (A1B) Case

Season	Range in Year 2050		
	Rainfall	Temperature	Evaporation
Summer	-2% to +2%	+1.5 to +2.0 °C	+4% to +8%
Autumn	-5% to -2%	+1.0 to +1.5 °C	+4% to +8%
Winter	-10% to -5%	+1.0 to +1.5 °C	+4% to +8%
Spring	-10% to -5%	+1.5 to +2.0 °C	+4% to +8%

The midpoint of each climatic variable range in the above table was used to quantify the impact of climate change on the urban water cycle, while the worst case extreme of the range was used for quantifying impacts on the catchment water cycle. As part of this study, the projected impacts of climate change have been quantified on the following elements of the catchment and urban water cycles for all the IWCM Scenarios:

- Availability of stream flow (see Task Paper 5);
- Average and dry year water demands (see Appendix D);
- Peak day water demands (see Appendix D);
- Frequency of overflow events from sewerage networks (see Task 3 Paper); and
- Average and dry year stormwater runoff (see Task Paper 3).

The impact of climate change on the water supply headwork was assessed in Task 5 Paper. Table 9.16 presents from Task 5 Paper, the off-river storage requirements for the four IWCM Scenarios for the adopted extraction rule and for an extraction rule with higher low flow protection.

Table 9.16: Sensitivity Analysis for Climate Change Scenario - Storage Size Requirements for the IWCM Scenarios

Scenario	Annual Demand (ML)	Storage Size (ML)	
		Adopted Extraction Rule	Higher Low Flow Protection
Traditional	3,312/3,937	9,400	13,100
1[1]	3,238/3,855	9,200	12,500
2	3,130/3,755	8,600	11,500
3[1]	2,823/3,256	6,900	7,500

Note 1 – Estimate using inter & extrapolation techniques

Table 9.16 suggests that Integrated Scenario 3 with the least sensitivity to annual demand, due to increased water use efficiency and reclaimed water reuse measures, consequently has the lowest impact on storage size requirement. Note if NSC were to proceed with the planned storage size of 5,500ML any further climate change induced upgrade to the headwork would only be needed after 2030 in Integrated Scenario 3 compared to the other scenarios, which require upgrade in early 2020.

Analysis of climate change impact on the frequency of overflow events from the sewerage networks' was presented in Task 4 Paper. Based on this analysis it could be concluded that Integrated Scenario 3, due to higher level of water use efficiency and inflow/infiltration management measures, would have the least impact as a result of climate change. The Traditional Scenario had the highest impact followed by Integrated Scenarios 1 and 2.

Projections of greenhouse gas emissions have been estimated for the IWCM Scenarios. These projections have been based on current unit greenhouse gas emissions (CO2 tonnes / ML) for the water supply and wastewater schemes, and projecting forward on this basis. Figure 9-11 shows the projected greenhouse gas emissions from the operation of the water and sewer schemes for each of the IWCM Scenarios. The 2000 baseline emissions and 60% of the baseline, NSC adopted aspirational target, are also shown in Figure 9-11.

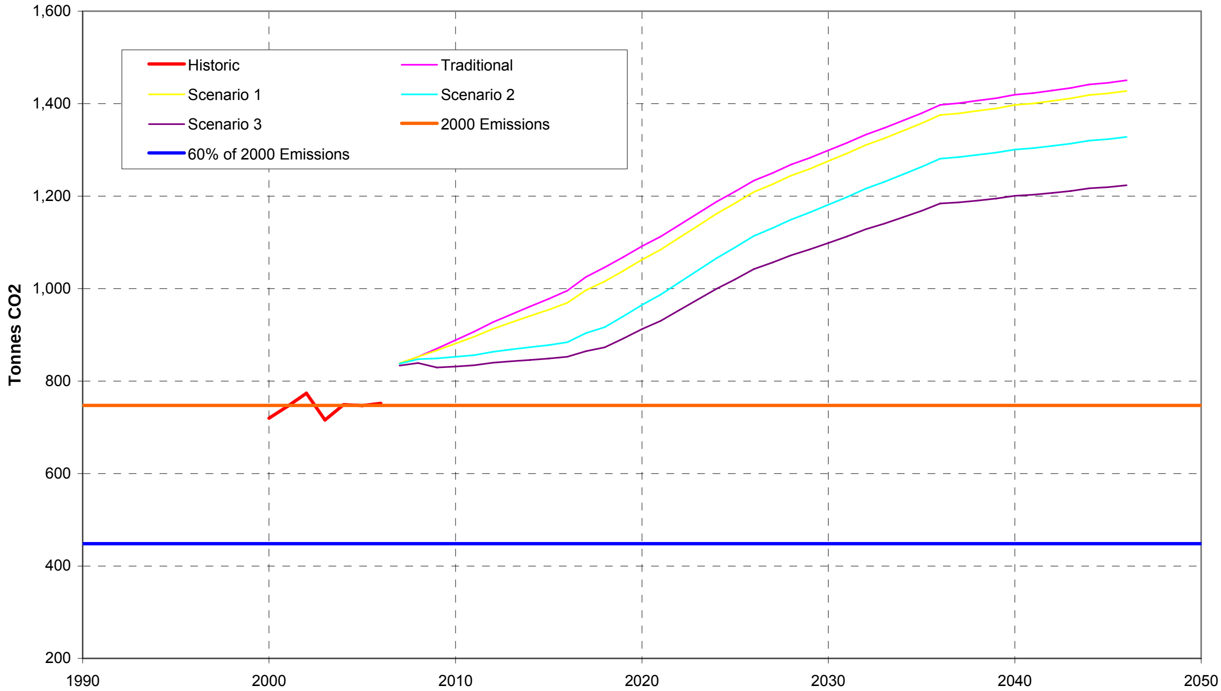

Figure 9-11 Projected Greenhouse Gas Emissions for Water and Sewer Operation

The above figure suggests that the greenhouse gas emission from all the IWCM Scenarios would continue to increase and is significantly above the aspirational target. Irrespective of the IWCM Scenario adopted, NSC should evaluate the cost and benefit of using renewable energy sources and/or revise the aspirational target.

9.8.4 Future Water Demands and Uptake Rate of Water Efficiency and Local Water Sources

Figure 9.1, Figure 9.3, Figure 9.5 and Figure 9.7 illustrated how the demands will be met by different elements for each integrated scenario. The cost implications for Integrated Scenario 3 not meeting the demands predicted by each component and the demand reduction program are greater than for the other IWCM Scenarios. This may arise for example though customer choices uptake of water efficiency measures, reclaimed water and rainwater tanks. If there is a gap between what can be supplied from each component and what the community requires, an upgrade to the headwork would be needed within the planning horizon, making Integrated Scenario 3 more expensive.

9.8.5 Cost Escalations

Any cost escalations through cost crepe and market forces would have a significant impact on the community's ability to pay for the water services considering the socio-economic and age profile of the local community. Further a high TRB and developer charges relative to other regional utilities would also keep future population from migrating to the Shire, compounding the issue.

This risk is common to all the IWCM Scenarios and it is recommended that NSC put in place robust project governance structure to control cost crepe.

9.8.6 Recommendation

Having considered the risks, Commerce recommends that NSC consider the adoption of Integrated Scenario 3. As recommended elsewhere in this report, the IWCM strategy should be reviewed in 6 years with population and planned works reviewed every year.

9.9 Other IWCM Initiatives

In the above sections, the catchment, water sharing and urban stormwater issues and opportunities that have a direct interaction with the provision of water supply and sewerage services were considered and, where appropriate, incorporated into the Shire Wide IWCM Scenarios. Such issues and opportunities can have their benefits to the water supply and sewerage services relatively easily quantified.

Solutions to the remaining catchment, water sharing and urban stormwater issues, although providing a significant benefit to the local environment, economy and community, require a holistic catchment management approach. Funding for these solutions must be obtained from sources such as NSC's general fund, stormwater and catchment levies, the Catchment Management Authority (CMA) and other State and Federal Government departments.

The PRG, using the bundling process, allocated the solutions for the remaining catchment, water sharing and urban stormwater quantity and quality issues into four Shire Wide Scenarios as shown in Table 9.17.

Table 9.17 Shire Wide Scenarios for Stormwater Management

Relevant IWCM Issue			Location	Opportunity Type	Opportunity	Scenario			
Issue	Type	Priority				T	1	2	3
• Nutrients from land use, septic, stormwater & effluent discharge have resulted in deterioration of water quality in some waterways and groundwater systems.	C	H	Bowraville	Improved Stormwater Monitoring	Short-term monitoring program of urban stormwater outlet points to identify/confirm hotspot catchment		x	x	x
• Some stormwater quality issues relating to litter, contaminated material, turbidity, dissolved pollutants and lack of treatment.	SW	M			Systematic monitoring of the local waterways (specifically South Creek) and the urban stormwater quality and quantity		x	x	x
					Remedial program (eg GPT) to fix issues in catchment that drains into South Creek			x	x
				Stormwater quantity and quality control measures for **low priority** sub-catchments	Alberta St (non-built measures)				
					William St (non-built measures)				
					William St (built and non-built measures)				
• Nutrients from land use, septic, stormwater & effluent discharge have resulted in deterioration of water quality in some waterways and groundwater systems.	C	H	Macksville	Improvice Stormwater Monitoring	Short-term monitoring program of urban stormwater outlet points to identify/confirm hotspot catchments		x	x	x
• Some stormwater quality issues relating to litter, contaminated material, turbidity, dissolved pollutants and lack of treatment.	SW	M		Stormwater quantity and quality control measures for **high priority** sub-catchments	Hughes Creek (non-built measures)		x		
• The low level of use of stormwater and rainwater.	SW	M			Hughes Creek (built and non-built measures)			x	x
				Stormwater quantity and quality control measures for **medium priority** sub-catchments	Macksville High School (non-built measures)			x	
					Macksville High School (built and non-built measures)				x
• Localised flooding and erosion due to capacity of existing stormwater infrastructure being exceeded during rainfall events.	SW	M			Macksville Train Station (non-built measures)			x	
					Macksville Train Station (built and non-built measures)				x
					Dawkins Park Lake (non-built measures)			x	
					Dawkins Park Lake (built and non-built measures)				x
				Stormwater quantity and quality control measures for **low priority** sub-catchments	Industrial Estate (non-built measures)				
• Nutrients from land use, septic, stormwater & effluent discharge have resulted in deterioration of water quality in some waterways and groundwater systems.	C	H	Scotts Head	Improvice Stormwater Monitoring	Short-term monitoring program of urban stormwater outlet points to identify/confirm hotspot catchments		x	x	x
• Some stormwater quality issues relating to litter, contaminated material, turbidity, dissolved pollutants and lack of treatment.	SW	M		Stormwater quantity and quality control measures for **high priority** sub-catchments	Forsters Beach (1c) - Education & street sweeping only (non-built measures)		x		
• The low level of use of stormwater and rainwater.	SW	M			Forsters Beach (1c) - Education & street sweeping only (built and non-built measures)			x	x
				Stormwater quantity and quality control measures for **medium priority** sub-catchments	South Scotts Head Sporting Fields (1d) (non-built measures)			x	
					South Scotts Head Sporting Fields (1d) (built and non-built measures)				x
• Nutrients from land use, septic, stormwater & effluent discharge have resulted in deterioration of water quality in some waterways and groundwater systems.	C	H	Nambucca Heads	Improvice Stormwater Monitoring	Short-term monitoring program of urban stormwater outlet points to identify/confirm hotspot catchments		x	x	x
• Some stormwater quality issues relating to litter, contaminated material, turbidity, dissolved pollutants and lack of treatment.	SW	M		Stormwater quantity and quality control measures for **high priority** sub-catchments	Merry Park (non-built measures)		x		
• The low level of use of stormwater and rainwater.	SW	M			Merry Park (built and non-built measures)			x	x
					Seaview St (non-built measures)		x		
					Seaview St (built and non-built measures)			x	x
					Beer Creek (non-built measures)		x		
					Beer Creek (built and non-built measures)			x	x
					Coronation Park (non-built measures)		x		
					Coronation Park (built and non-built measures)			x	x
				Stormwater quantity and quality control measures for **medium priority** sub-catchments	Gordon Park (non-built measures)			x	
					Gordon Park (built and non-built measures)				x
					Bellwood Park (non-built measures)			x	
					Bellwood Park (built and non-built measures)				x
					Industrial Estate (non-built measures)			x	
					Industrial Estate (built and non-built measures)				x
• Nutrients from land use, septic, stormwater & effluent discharge have resulted in deterioration of water quality in some waterways and groundwater systems.	C	H	Valla Beach	Improvice Stormwater Monitoring	Short-term monitoring program of urban stormwater outlet points to identify/confirm hotspot catchments		x	x	x
• Some stormwater quality issues relating to litter, contaminated material, turbidity, dissolved pollutants and lack of treatment.	SW	M		Stormwater quantity and quality control measures for **high priority** sub-catchments	Kuta Road (non-built measures)		x		
• The low level of use of stormwater and rainwater.	SW	M			Kuta Road (built and non-built measures)			x	x

Table 9.18 presents for information the estimated total cost and the present value of the capital and OMA cost over the 40 years for the urban stormwater measures in each scenario based on 2009 dollars.

Table 9.18 Summary of Capital and Present Value Costs for the Urban Stormwater Quantity and Quality Management Scenarios

Scenario	Total Capital Cost (over the 40 years)	Present Value of Capital Cost @ 7%	Total Present Value @ 7%
Traditional	Nil	Nil	Nil
Scenario 1	Nil	Nil	6.4M
Scenario 2	15.2M	6.9M	18.1M
Scenario 3	18.9M	8.5M	20.2M

Part F
How to Deliver the Scenarios?

Part F provides an overview of the delivery time frame and the delivery mechanisms available to Council.

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10 Timeframe for Scenario Implementation

Table 10.1 to Table 10.4 provides the time frame associated with each of the Shire wide scenarios. These time frames were used to project the cash flow in the financial modelling. However, the actual time frame would depend on funding availability and extent of work involved in the subsequent investigation, community consultation and environmental impact assessment stages.

Table 10.1 Traditional Scenario Timeframe for Implementation of Major Works

Scenario	System	Infrastructure	Year Required	Total Capital Cost ($M)
Traditional	Water Supply	HW1 - Build a storage and Borefield to meet projected future demands Build a new 15 ML/d Water Filtration Plant (WFP)	2010	$79.1
		Construct new 1.3 ML reservoir south of Scotts Head to service Urban Release area Construct 200mm main to supply new reservoir from replacement Scotts Head Trunk main near the existing Scotts Head reservoir Construct a new 3.3 ML reservoir on the Western side of the Valla Urban Growth Area Construct 250mm main from the Nambucca trunk main at the Pacific Highway to the new Valla Urban Growth Area Reservoir Construct a booster pumping station in the new main (servicing the Valla Urban Growth Area Reservoir) with a capacity of approximately 40 L/s @ 16m head	2016	$9.1
		Upgrade clear water pumping machinery to supply 300 L/s at 88m Replace 375mm AC main from Wirimbi Junction to Pacific Highway with 450mm main Replace 300mm AC from Wirrimbi Junction to PRV North of Nambucca river at Macksville with 375mm main Replace 200mm AC main to Scotts Head with 200mm m-PVC main	2025	$14.1
		Upgrade WFP to 18.8 ML/d	2030	$6.2
	Wastewater	Option B3 – Optimise Bowraville STP operation and dose with coagulant chemicals Upgrade Bowraville SPS1 Upgrade Macksville SPS (2, 3, 4, 8, 9 and 13) New Macksville SPS (DCP17 and Nursing Home) Increased emergency storage at Macksville SPS2 and SPS3 Opportunity NH3 – Upgrade Nambucca Heads STP to 15,000 EP (10,000 EP Reactor) Upgrade Nambucca Heads SPS (1, 5, 6 and 8) Upgrade Valla Beach SPS (1, 5, 6 and 7)	2010	$31.2
		Opportunity M1 – Optimise current Macksville STP operation Opportunity SH3 – Stage 1 Scotts Head 1,500 EP Reactor and Upgrade Inlet Works Upgrade Scotts Head SPS1	2011	$8.6
		Option B3 – New 1,500 EP Bowraville STP with a new wet-weather storage and appropriate buffer zones from residents Increased emergency storage at Bowraville SPS1	2015	$5.9
		Opportunity SH3 – Stage 2 Scotts Head 1,000 EP Reactor New South Scotts Head Urban Growth Area SPS Opportunity NH3 – Upgrade Nambucca Heads STP to 22,000 EP (Additional 7,000 EP Reactor) Upgrade Nambucca Heads SPS4 New Valla Beach SPS (7b and Valla Urban Growth Area)	2016	$23.0
		Opportunity M1 – New 3,000 EP Macksville Reactor and tertiary filters	2017	$9.0

Years have been chosen when the sum of the infrastructure capital cost is greater than $1M.

Table 10.2 Integrated Scenario 1 Timeframe for Implementation of Major Works

Scenario	System	Infrastructure	Year Required	Total Capital Cost ($M)
Integrated 1	Water Supply	HW1 - Build a storage and Borefield to meet projected future demands	2010	$56.5
		Construct new 1.3 ML reservoir south of Scotts Head to service Urban Release area Construct 200mm main to supply new reservoir from replacement Scotts Head Trunk main near the existing Scotts Head reservoir Construct a new 3.3 ML reservoir on the Western side of the Valla Urban Growth Area Construct 250mm main from the Nambucca trunk main at the Pacific Highway to the new Valla Urban Growth Area Reservoir Construct a booster pumping station in the new main (servicing the Valla Urban Growth Area Reservoir) with a capacity of approximately 40 L/s @ 16m head	2016	$9.1
		Build a new 18.6 ML/d Water Filtration Plant (WFP)	2020	$25.3
		Upgrade clear water pumping machinery to supply 300 L/s at 88m Replace 375mm AC main from Wirimbi Junction to Pacific Highway with 450mm main Replace 300mm AC from Wirrimbi Junction to PRV North of Nambucca river at Macksville with 375mm main Replace 200mm AC main to Scotts Head with 200mm m-PVC main	2025	$14.1
	Wastewater	Option B3 – Optimise Bowraville STP operation and dose with coagulant chemicals Upgrade Bowraville SPS1 Upgrade Macksville SPS (2, 3, 4, 8, 9 and 13) New Macksville SPS (DCP17 and Nursing Home) Increased emergency storage at Macksville SPS2 and SPS3 Opportunity NH3 – Upgrade Nambucca Heads STP to 15,000 EP (10,000 EP Reactor) Upgrade Nambucca Heads SPS (1, 5, 6 and 8) Upgrade Valla Beach SPS (1, 5, 6 and 7)	2010	$31.2
		Opportunity M1 – Optimise current Macksville STP operation Opportunity SH3 – Stage 1 Scotts Head 1,500 EP Reactor and Upgrade Inlet Works Upgrade Scotts Head SPS1	2011	$8.2
		Option B3 – New 1,500 EP Bowraville STP with a new wet-weather storage and appropriate buffer zones from residents Increased emergency storage at Bowraville SPS1	2015	$5.9
		Opportunity SH3 – Stage 2 Scotts Head 1,000 EP Reactor New South Scotts Head Urban Growth Area SPS Opportunity NH3 – Upgrade Nambucca Heads STP to 22,000 EP (Additional 7,000 EP Reactor) Upgrade Nambucca Heads SPS4 New Valla Beach SPS (7b and Valla Urban Growth Area)	2016	$22.0
		Opportunity M1 – New 3,000 EP Macksville Reactor and tertiary filters	2017	$9.0

Table 10.3 Integrated Scenario 2 Timeframe for Implementation of Major Works

Scenario	System	Infrastructure	Year Required	Total Capital Cost ($M)
Integrated 2	Water Supply	HW1 - Build a storage and Borefield to meet projected future demands	2010	$55.7
		Construct new 1.2 ML reservoir south of Scotts Head to service Urban Release area Construct 200mm main to supply new reservoir from replacement Scotts Head Trunk main near the existing Scotts Head reservoir Construct a new 3.3 ML reservoir on the Western side of the Valla Urban Growth Area Construct 250mm main from the Nambucca trunk main at the Pacific Highway to the new Valla Urban Growth Area Reservoir Construct a booster pumping station in the new main (servicing the Valla Urban Growth Area Reservoir) with a capacity of approximately 40 L/s @ 16m head	2016	$9.0
		Build a new 17.7 ML/d Water Filtration Plant (WFP)	2020	$24.2
		Upgrade clear water pumping machinery to supply 290 L/s at 88m Replace 375mm AC main from Wirimbi Junction to Pacific Highway with 450mm main Replace 300mm AC from Wirrimbi Junction to PRV North of Nambucca river at Macksville with 375mm main Replace 200mm AC main to Scotts Head with 200mm m-PVC main	2025	$14.1
	Wastewater	Option B3 – Optimise Bowraville STP operation and dose with coagulant chemicals Upgrade Macksville SPS (2, 3, 4, 8, 9 and 13) New Macksville SPS (DCP17 and Nursing Home) Increased emergency storage at Macksville SPS2 and SPS3 Opportunity NH3 – Upgrade Nambucca Heads STP to 15,000 EP (10,000 EP Reactor) Upgrade Nambucca Heads SPS (1, 5, 6 and 8) Upgrade Valla Beach SPS (1, 5, 6 and 7)	2010	$30.9
		Opportunity M1 – Optimise current Macksville STP operation Reuse to regenerate Gumma Wetland Opportunity SH3 – Stage 1 Scotts Head 1,500 EP Reactor and Upgrade Inlet Works Upgrade Scotts Head SPS1	2011	$11.6
		Option B3 – New 1,500 EP Bowraville STP with a new wet-weather storage and appropriate buffer zones from residents Increased emergency storage at Bowraville SPS1	2015	$5.8
		Opportunity SH3 – Stage 2 Scotts Head 1,000 EP Reactor New South Scotts Head Urban Growth Area SPS Opportunity NH3 – Upgrade Nambucca Heads STP to 22,000 EP (Additional 7,000 EP Reactor) Upgrade Nambucca Heads SPS4 New Valla Beach SPS (7b and Valla Urban Growth Area)	2016	$22.4
		Opportunity M1 – New 3,000 EP Macksville Reactor	2017	$6.6

Table 10.4 Integrated Scenario 3 Timeframe for Implementation of Major Works

Scenario	System	Infrastructure	Year Required	Total Capital Cost ($M)
Integrated 3	Water Supply	WTP1 – Implement a comprehensive and effective catchment management plan including fencing and river bank stabilisation (up to 4 km). Implement a well-head protection plan and storage aerators and storage management plan.	2009	$2.2
		HW1 - Build a storage and Borefield to meet projected future demands	2010	$51.0
		Construct new 0.9 ML reservoir south of Scotts Head to service Urban Release area Construct 200mm main to supply new reservoir from replacement Scotts Head Trunk main near the existing Scotts Head reservoir Construct a new 3.1 ML reservoir on the Western side of the Valla Urban Growth Area Construct 250mm main from the Nambucca trunk main at the Pacific Highway to the new Valla Urban Growth Area Reservoir Construct a booster pumping station in the new main (servicing the Valla Urban Growth Area Reservoir) with a capacity of approximately 40 L/s @ 16m head South Scotts Head Recycled Water Scheme (Pump station, rising main and storage) Valla Urban Growth Area Recycled Water Scheme (Pump station, rising main and storage)	2016	$13.4
		Reticulated Reuse Scheme from Macksville STP (parks and gardens)	2017	$1.3
		Build a new 16.8 ML/d Water Filtration Plant (WFP)	2023	$23.4
		Upgrade clear water pumping machinery to supply 285 L/s at 88m Replace 375mm AC main from Wirimbi Junction to Pacific Highway with 450mm main Replace 300mm AC from Wirrimbi Junction to PRV North of Nambucca river at Macksville with 375mm main Replace 200mm AC main to Scotts Head with 200mm m-PVC main	2025	$14.1
	Wastewater	Option B3 – Optimise Bowraville STP operation and dose with coagulant chemicals Upgrade Macksville SPS (2, 3, 4, 8, 9 and 13) New Macksville SPS (DCP17 and Nursing Home) Increased emergency storage at Macksville SPS2 and SPS3 Opportunity NH1 – Upgrade Nambucca Heads STP to 15,000 EP (10,000 EP Reactor) Upgrade Nambucca Heads SPS (1, 5, 6 and 8) Upgrade Valla Beach SPS (1, 5, 6 and 7)	2010	$30.9
		Opportunity M1 – Optimise current Macksville STP operation Upgrade Scotts Head SPS1	2011	$1.9
		Upgrade Macksville SPS 10 Opportunity SH1 – Upgrade Scotts Head with an 1,500 EP Reactor Upgrade Nambucca Heads SPS13	2012	$7.5
		Option B3 – New 1,500 EP Bowraville STP with a new wet-weather storage and appropriate buffer zones from residents Increased emergency storage at Bowraville SPS1	2015	$5.8
		Opportunity SH1 – New Sewer Mining Plant for South Scotts Head New South Scotts Head Urban Growth Area SPS Opportunity NH1 – New Sewer Mining Plant for Valla Urban Growth Area Opportunity NH1 – Upgrade inlet works at Nambucca Heads STP Upgrade Nambucca Heads SPS2 New Valla Beach SPS (7b and Valla Urban Growth Area)	2016	$26.0
		Opportunity M1 – New 3,000 EP Macksville Reactor with tertiary filters Upgrade Nambucca Heads SPS4	2017	$9.4
		Opportunity NH1 – Upgrade Nambucca Heads STP to 18,000 EP (Additional 3,000 EP Reactor) Upgrade Nambucca Heads SPS15	2028	$8.0

11 Management and Procurement Methods

11.1 Management Methods

Council has three basic options for managing the water services in the future. These options are discussed below. The three figures below provide the various tasks Council or the service provider would have to undertake for each management option.

Management Option 1 – This is the traditional approach and is similar to the current practice. In this option, Council continues to own, fund and operate the water services using its internal resources as appropriate.

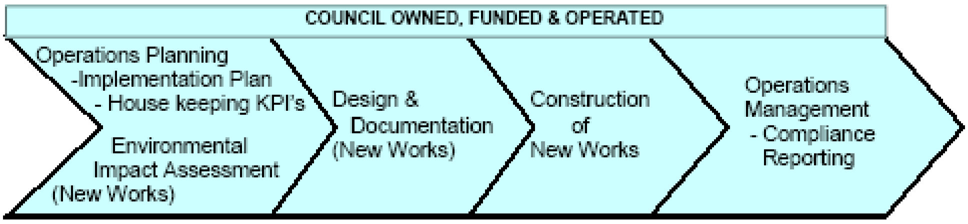

Figure 11.1 Management Option 1

Management Option 2 – In this option Council owns and funds the water services, but the day to day operation and maintenance is managed by a private Contractor or service provider over a set period for a pre-determined annual payment. At the end of the set period the contract is either renewed or terminated and the business transferred to Council on pre-determined terms and conditions.

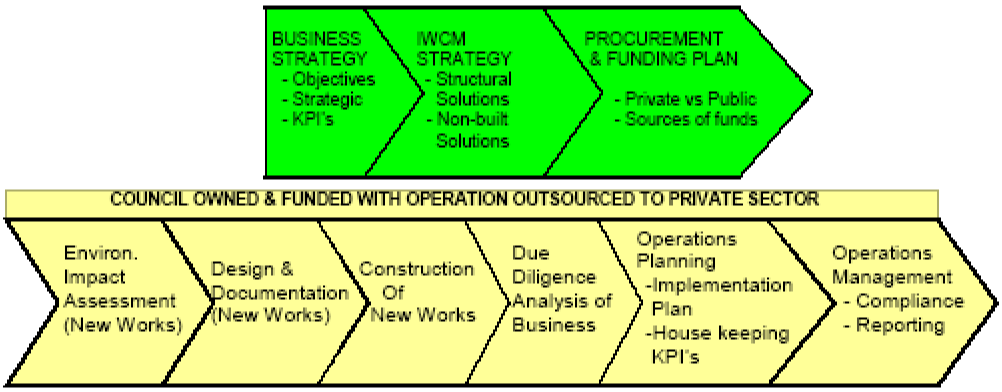

Figure 11.2 Management Option 2

Management Option 3 – In this option the water service business along with the existing and new water services assets and resources is transferred to a private Contractor or service provider. The Contractor owns, operates and funds the services over a set period for a pre-determined annual payment. Similar to option 2, at the end of the set period the contract is either renewed or terminated.

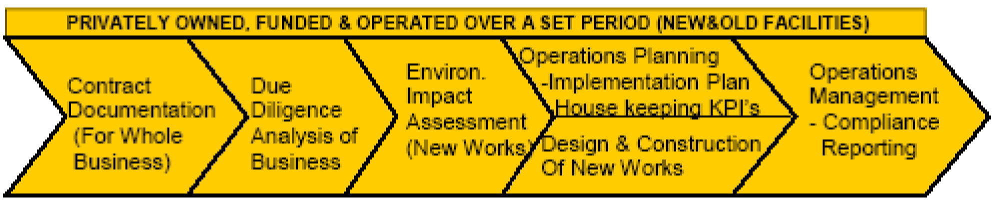

Figure 11.3 Management Option 3

Assessing the costs benefits and risks associated with each of these management options is outside the scope of this report.

11.2 Procurement Methods

In both management options 2 and 3, the new assets and required funds could be procured in a number of ways other than the present method of procurement. Identifying these alternative procurement options and assessing their associated costs, benefits and risks are beyond the scope of this study.

Part G
How Do We Know the Issues Are Fixed?

Part G provides an overview of the benefits achieved by the IWCM process and how Council could sustain and realise these benefits.

12 Overview

This section is concerned with answering the final of the three fundamental questions in the IWCM process, 'how do we know the issue is fixed?'

An answer to this question is time frame dependent. This strategy provides integrated solutions for addressing the issues in Nambucca at the regional, local and Shire wide level. In order to evaluate whether the issues specific to Nambucca have been addressed and whether the resource use is optimised based on social, economic and environmental objectives, it is important to appreciate the study outcomes. This we believe would give the water utilities a baseline to benchmark future reviews and to assist in the journey towards achieving sustainable IWCM. It is envisaged that follow-up assessment and review of this strategy will be undertaken at regular intervals of around 6 years.

12.1 Study Outcomes

The Nambucca IWCM strategy has looked at all water resources in the Shire. The IWCM approach has delivered significant benefits to the community, NSC, the State government and the environmental as demonstrated in the recommended solutions developed in this strategy. These benefits are discussed with respect to the triple bottom line outcomes.

12.1.1 Economic Outcomes

The IWCM planning process for Nambucca has revealed potential savings to the Shire community of about $10M in present value terms. This has been achieved by 'right' sizing and optimising through integration the infrastructure capacity, with the use of:

- Linked climate corrected demand tracking,
- Demand and wastewater forecasting and water services system models,
- Innovative tenement and water use category data capture systems, and
- Improved process designs.

Table 12.1 presents the present value of the savings of the shire-wide integrated scenarios when compared to the Traditional Scenario, which has the least level of integration.

Table 12.1 Present Value of NSC Savings for Integrated Scenarios

	Shire Wide IWCM Scenarios			
	Traditional Scenario	Integrated Scenario 1	Integrated Scenario 2	Integrated Scenario 3
Present Value of savings from Traditional Scenario @ 7%	0	11.8	9.3	9.1

Note – Saving values are in $M

12.1.2 Environmental Outcomes

The integrated water cycle management planning process for Nambucca has delivered the following benefit to the local environment. Further the integrated scenarios contained in this study will also achieve a number of catchment management objectives over the long term.

- Reduction in the amount of water drawn for urban supply from the Nambucca River through demand management measures and use of rainwater tanks;
- Better protection of low flows and preservation of natural flow patterns in Nambucca River leading to improved environmental water quality and improved aquatic habitat conditions;
- Reduced pollution of the waterways and coastal lakes through improved wastewater and stormwater management, sewage pump station and treatment plant upgrades;
- Reduced effluent discharges to waterways through the reductions in urban water use, stormwater inflow and groundwater infiltration, and the development of water reuse systems;
- Improved recreational water quality in the Shire's waterways, particularly during holiday season and dry weather periods;
- Reduced stormwater quantity and quality discharges due to source control measure rather than end-of-pipe control measures;
- Reduces greenhouse gas emissions and energy consumption; and
- Streamlined service specific environmental impact assessments, reducing study times and costs.

12.1.3 Social Outcomes

The IWCM process and the water cycle management options contained in this strategy will deliver the following social outcomes:

- Improved water supply drought security and reliability of supply through the provision of off-river storage;
- Improved water quality and public health protection for regional water supply consumers through the planned construction of water filtration plant;
- Promotion of local supply sources provides customer with supply source choice and an appreciation of their water use pattern resulting in lower water use in the long term;
- The comprehensive demand management program in addition to delivering savings in water bills will also result in electricity savings; and
- Integrated scenarios that closely match community wants and expectations.

12.1.4 How to Realise and Sustain the Outcomes

Sustaining the outcomes of this study requires both structural and non-structural solutions. The structural solutions refer to physical assets and the non-structural solutions encompass the internal processes that support and monitor the performance of the water utility business and its assets. This study has identified that many of Council's internal process are either absent or are lacking in clarity and detail. One important outcome from the development of this study has been the implementation of simple frameworks and systems to capture data and information. For example linking meter readings to the GIS has allowed easy evaluation of the quantity of water used within the Shire.

It is important that these frameworks and systems be further developed, adequately resourced and kept up to date, such that future assessment and review of this strategy can be undertaken at minimal cost and time frame. Capturing data and information in a systematic way is also essential in determining how effective the adopted scenario is performing, and an important step in assessing whether the identified issues in Nambucca are fixed.

Reducing water usage can be achieved through applying structural solutions such as the installation of more water efficient fixtures and appliances. While these may decrease the flow rate of water, they may not necessarily result in reduced water use. Behavioural and cultural aspects also form an important component of water consumption. These are primarily addressed through the provision of education and information to the community. Therefore, a successful program to reduce water usage needs to incorporate both structural and non-structural solutions.

Ongoing monitoring systems need to be developed to ensure that initiatives such as demand management are achieving their intended goals and should form a fundamental component in assessing whether those issues identified for the Nambucca Shire have been addressed. Data and information gathered through appropriate on-going monitoring systems can then be feed back into the education campaign to form a continued refinement of this process.

Another important factor in ensuring that the outcomes from this IWCM strategy are sustained is to monitor the volume of bulk water production lost through the distribution network. This IWCM strategy has devised a two stage approach to reducing the amount of water lost. The accurate determination of unaccounted for water through additional metering has been identified as the first important step, prior to the implementation of the loss reduction program.

An additional aspect to consider in managing the urban water cycle of Nambucca in a sustainable manner is to establish a common water cycle fund. This would allow Council to offer choices of price paths for its customers to achieve differing levels of integration. Although, the current legislative arrangements do not allow this to occur, it is recommended that Council and DWE pursue this further, as a common water cycle fund provides Council the flexibility and opportunity to signal its customers the expected outcomes.

12.1.5 Strategy Review Cycle

Although, this strategy has been developed for a planning period of 40 years, it is strongly recommended that the strategy be regularly reviewed. The recommended review interval is six years but not greater than 10 years.

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28.

Appendix A Water Demand Projection

A.1 Average Year Water Cycle Balance for Study Area

The urban water cycled was quantified at the three following scales:

- The Study Area Scale

  This level of analysis quantifies all aspects of the water cycle from the catchment to receiving waters for stormwater and wastewater. Figure below shows the current average year water cycle at the Study Area Scale.

- Urban Centre Scale

  Individual urban centre water cycles have been quantified at this level of analysis, allowing for an appreciation of the relative contribution of urban centres to water usage, stormwater and wastewater production. The Task 3 Paper (Ref. 4) shows the current urban centre water cycle balances for dry, average and wet years.

- Lot Scale

  The lot scale water balance for an occupied residential dwelling at each of the urban centres was also quantified. This scale of analysis allows for the examination of opportunities at the lot-level, before aggregating back to the urban centre and study-area levels. The Task 3 Paper (Ref. 4) contains the lot-scale water balances for the urban centers of the study area.

Quantifying the current urban water cycle allows for the identification of issues and opportunities with regards to integrated water cycle management.

Average Year Water Cycle Balance for Study Area

Average Year 2006

Note: All flows are in ML/a

Irrigation upstream of Borefield 2,290 ML

Rain 1,332 mm

Nambucca River @ Lanes Bridge Bowraville 192,363 ML

Catchment

Borefield — 1,820 Production — 1,491 Consumption → **Urban Service Area**

NRW 329

Rain (mm)		
1	NH	1,405
2	VB	1,405
3	SH	1,405
4	M	1,273
5	B	1,332

Key		
	AL	Agricultural Land
	B	Bowraville
	BB	Beilbys Beach
	BC	Bellwood Creek
	CC	Cedar Creek
	DC	Deep Creek
	HC	Hugh's Creek
	HP	Hyland Park
	M	Macksville
	NC	Newee Creek
	NH	Nambucca Heads
	NR	Nambucca River
	OC	Oyster Creek
	PO	Pacific Ocean
	SC	South Creek
	SH	Scotts Head
	SwaC	Swampy Creek
	SwC	Swimming Creek
	TwC	Tilly Willy Creek
	VB	Valla Beach
	WC	Warrell Creek

Wastewater (ML)		
1	NH	825
2	SH	83
3	M	361
4	B	104
		1,373

Receiving Water (ML)		
1	DC	?
2	WC	?
3	NR	353
4	NR	10
		363

Reuse (ML)		
1	NH	0
2	SH	0
3	M	0
4	B	94
		94

I/I (ML)		
1	NH	46
2	VB	
3	SH	9
4	M	73
5	B	19
		146

Groundwater

?

Stormwater (ML)		
1	NH	4,314
2	VB	905
3	SH	563
4	M	2,741
5	B	513
		9,036

Receiving Water (ML)				
1	NH	NR	1,350	**4,314**
		BB	147	
		BC	1,033	
		CC	159	
		SwaC	519	
		SwC	1,106	
2	VB / HP	OC	314	**905**
		DC	507	
		PO	84	
3	SH	PO	206	**563**
		WC	356	
4	M	HC	1,262	**2,741**
		NR	394	
		NC	59	
		TwC	989	
		TA	37	
5	B	AL	339	**513**
		SC	174	

A.2 Accounts Affected by Water Saving Measures

Traditional Scenario

Year	2006	2011	2016	2021	2026	2031	2036	2041	2046
ACCOUNTS									
Residential	4,402	4,943	5,618	6,568	7,303	7,891	8,449	8,644	8,838
Commercial	208	231	262	280	292	297	302	307	312
Industrial	113	129	149	162	168	169	169	170	170
Holiday/Hotels/Motels/Carvans	32	34	36	37	37	38	39	39	40
Parks and Open Space	18	20	22	26	28	31	33	33	33
Rural	371	411	467	518	547	550	552	552	552
Institutional	64	77	98	117	125	126	127	128	129
TOTAL	5,208	5,844	6,652	7,708	8,501	9,101	9,671	9,872	10,074
Rainwater Tanks									
New Residential (BASIX)	0	550	1,238	2,157	2,900	3,490	4,059	4,264	4,469
Existing Residential RWT	68	68	68	68	68	68	68	68	68
Infill Residential (NSW Government Rebate)	0	4	8	12	17	21	25	29	33
Total Residential	68	623	1,315	2,238	2,985	3,579	4,152	4,361	4,570

Scenario 1

Year	2006	2011	2016	2021	2026	2031	2036	2041	2046
ACCOUNTS									
Residential	4,402	4,943	5,618	6,568	7,303	7,891	8,449	8,644	8,838
Commercial	208	231	262	280	292	297	302	307	312
Industrial	113	129	149	162	168	169	169	170	170
Holiday/Hotels/Motels/Carvans	32	34	36	37	37	38	39	39	40
Parks and Open Space	18	20	22	26	28	31	33	33	33
Rural	371	411	467	518	547	550	552	552	552
Institutional	64	77	98	117	125	126	127	128	129
TOTAL	5,208	5,844	6,652	7,708	8,501	9,101	9,671	9,872	10,074
Rainwater Tanks									
New Residential (BASIX)	0	550	1,238	2,157	2,900	3,490	4,059	4,264	4,469
Existing Residential RWT	68	68	68	68	68	68	68	68	68
Infill Residential (NSW Government Rebate)	0	4	8	12	17	21	25	29	33
Total Residential	68	623	1,315	2,238	2,985	3,579	4,152	4,361	4,570
Basic Residential Tuneup Program									
New Residential (BASIX)	0	0	0	0	0	0	0	0	0
Infill Residential (NSC Refit Program - 75% rebate)	0	660	1,761	2,201	2,201	2,201	2,201	2,201	2,201
Total Residential	0	660	1,761	2,201	2,201	2,201	2,201	2,201	2,201
Non-Residential Water Efficiency Program (Council Premises)									
Commercial	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0
Holiday/Hotels/Motels/Carvans	0	0	0	0	0	0	0	0	0
Parks and Open Space	0	2	3	3	3	3	3	3	3
Rural	0	0	0	0	0	0	0	0	0
Institutional	0	7	9	9	9	9	9	9	9
Total Non-Residential	0	9	12	12	12	12	12	12	12

Scenario 2

Year	2006	2011	2016	2021	2026	2031	2036	2041	2046
ACCOUNTS									
Residential	4,402	4,943	5,618	6,568	7,303	7,891	8,449	8,644	8,838
Commercial	208	231	262	280	292	297	302	307	312
Industrial	113	129	149	162	168	169	169	170	170
Holiday/Hotels/Motels/Carvans	32	34	36	37	37	38	39	39	40
Parks and Open Space	18	20	22	26	28	31	33	33	33
Rural	371	411	467	518	547	550	552	552	552
Institutional	64	77	98	117	125	126	127	128	129
TOTAL	5,208	5,844	6,652	7,708	8,501	9,101	9,671	9,872	10,074
Rainwater Tanks									
New Residential (BASIX)	0	550	1,238	2,157	2,900	3,490	4,059	4,264	4,469
Existing Residential RWT	68	68	68	68	68	68	68	68	68
Infill Residential (NSC Refit Program - 75% rebate)	0	330	880	1,101	1,101	1,101	1,101	1,101	1,101
Infill Residential (NSW Government Rebate)	0	2	2	2	2	2	2	2	2
Total Residential	68	950	2,188	3,327	4,070	4,660	5,229	5,434	5,639
Basic Residential Tuneup Program									
New Residential (BASIX)	0	0	0	0	0	0	0	0	0
Infill Residential (NSC Refit Program - 75% rebate)	0	660	1,761	2,201	2,201	2,201	2,201	2,201	2,201
Total Residential	0	660	1,761	2,201	2,201	2,201	2,201	2,201	2,201
Enhanced Residential Tuneup Program									
New Residential (BASIX)	0	0	0	0	0	0	0	0	0
Infill Residential (NSC Refit Program - 75% rebate)	0	660	1,761	2,201	2,201	2,201	2,201	2,201	2,201
Total Residential	0	660	1,761	2,201	2,201	2,201	2,201	2,201	2,201
Non-Residential Water Efficiency Program (All Non-Residential Sector)									
Commercial	0	22	29	29	29	29	29	29	29
Industrial	0	12	16	16	16	16	16	16	16
Holiday/Hotels/Motels/Carvans	0	3	4	4	4	4	4	4	4
Parks and Open Space	0	2	3	3	3	3	3	3	3
Rural	0	0	0	0	0	0	0	0	0
Institutional	0	7	9	9	9	9	9	9	9
Total Non-Residential	0	45	62	62	62	62	62	62	62

Scenario 3

Year	2006	2011	2016	2021	2026	2031	2036	2041	2046
ACCOUNTS									
Residential	4,402	4,943	5,618	6,568	7,303	7,891	8,449	8,644	8,838
Commercial	208	231	262	280	292	297	302	307	312
Industrial	113	129	149	162	168	169	169	170	170
Holiday/Hotels/Motels/Carvans	32	34	36	37	37	38	39	39	40
Parks and Open Space	18	20	22	26	28	31	33	33	33
Rural	371	411	467	518	547	550	552	552	552
Institutional	64	77	98	117	125	126	127	128	129
TOTAL	5,208	5,844	6,652	7,708	8,501	9,101	9,671	9,872	10,074
Rainwater Tanks									
New Residential (BASIX)	0	550	1,238	1,551	1,779	1,945	2,111	2,277	2,443
Existing Residential RWT	68	68	68	68	68	68	68	68	68
Infill Residential (NSC Refit Program - 90% rebate)	0	660	1,761	2,201	2,201	2,201	2,201	2,201	2,201
Infill Residential (NSW Government Rebate)	0	2	2	2	2	2	2	2	2
Total Residential	68	1,280	3,069	3,822	4,050	4,216	4,382	4,548	4,714
Dual Reticulation									
Valla Urban Growth Area (BASIX)	0	0	0	455	910	1,274	1,638	1,638	1,638
South Scotts Head (BASIX)	0	0	0	151	211	271	310	349	388
Total Dual Reticulation	0	0	0	606	1,121	1,545	1,948	1,987	2,026
Basic Residential Tuneup Program									
New Residential (BASIX)	0	0	0	0	0	0	0	0	0
Infill Residential (NSC Refit Program - 75% rebate)	0	660	1,761	2,201	2,201	2,201	2,201	2,201	2,201
Total Residential	0	660	1,761	2,201	2,201	2,201	2,201	2,201	2,201
Enhanced Residential Tuneup Program									
New Residential (BASIX)	0	0	0	0	0	0	0	0	0
Infill Residential (NSC Refit Program - 75% rebate)	0	660	1,761	2,201	2,201	2,201	2,201	2,201	2,201
Total Residential	0	660	1,761	2,201	2,201	2,201	2,201	2,201	2,201
Greywater Reuse									
New Residential (BASIX)	0	0	0	0	0	0	0	0	0
Infill Residential (NSC Refit Program - 50% rebate)	0	66	176	220	220	220	220	220	220
Total Residential	0	66	176	220	220	220	220	220	220
Non-Residential Water Efficiency Program (All Non-Residential Sector)									
Commercial	0	22	29	29	29	29	29	29	29
Industrial	0	12	16	16	16	16	16	16	16
Holiday/Hotels/Motels/Carvans	0	3	4	4	4	4	4	4	4
Parks and Open Space	0	2	3	3	3	3	3	3	3
Rural	0	0	0	0	0	0	0	0	0
Institutional	0	7	9	9	9	9	9	9	9
Total Non-Residential	0	45	62	62	62	62	62	62	62

A.3 Projected Annual Demands

Traditional Scenario

Projected Demand (ML)		2006	2011	2016	2021	2026	2031	2036	2041	2046
Traditional - Av Year	Connected	1,527	1,627	1,793	2,017	2,198	2,336	2,469	2,516	2,562
	Unconnected	57	57	58	59	59	60	61	62	63
	Losses	292	323	363	415	456	488	518	529	540
	Total	1,875	2,007	2,214	2,490	2,714	2,885	3,049	3,107	3,166
Traditional - Dry Year	Connected	1,738	1,857	2,057	2,324	2,540	2,704	2,863	2,918	2,973
	Unconnected	94	95	96	97	99	100	102	104	105
	Losses	292	323	363	415	456	488	518	529	540
	Total	2,124	2,275	2,516	2,836	3,094	3,292	3,483	3,551	3,618
Traditional - CC 2050 (Av Year)	Connected	1,604	1,707	1,886	2,124	2,317	2,465	2,606	2,655	2,704
	Unconnected	60	60	61	62	63	64	65	66	67
	Losses	291	322	361	413	454	486	516	529	540
	Total	1,955	2,089	2,308	2,599	2,834	3,014	3,187	3,251	3,312
Traditional - CC 2050 (Dry Year)	Connected	1,905	2,040	2,262	2,558	2,796	2,978	3,153	3,215	3,276
	Unconnected	108	109	110	112	114	115	117	119	121
	Losses	291	322	361	413	454	486	516	529	540
	Total	2,304	2,471	2,734	3,083	3,364	3,579	3,787	3,863	3,937
Headworks Strategy	Total	2,013	2,164	2,315	2,465	2,611	2,753	2,887	3,013	3,136

Scenario 1

Projected Demand (ML)		2006	2011	2016	2021	2026	2031	2036	2041	2046
Scenario 1 - Av Year	Connected	1,527	1,601	1,736	1,963	2,158	2,304	2,443	2,488	2,533
	Unconnected	57	57	58	59	59	60	61	62	63
	Losses	292	291	326	373	410	439	466	476	486
	Total	1,875	1,949	2,120	2,395	2,627	2,804	2,971	3,027	3,083
Scenario 1 - Dry Year	Connected	1,738	1,836	2,003	2,273	2,501	2,673	2,837	2,891	2,945
	Unconnected	94	95	96	97	99	100	102	104	105
	Losses	292	291	326	373	410	439	466	476	486
	Total	2,124	2,222	2,425	2,743	3,010	3,213	3,405	3,471	3,536
Scenario 1 - CC 2050 (Av Year)	Connected	1,604	1,701	1,863	2,101	2,297	2,446	2,588	2,637	2,685
	Unconnected	60	60	61	62	63	64	65	66	67
	Losses	292	291	326	373	410	439	466	476	486
	Total	1,956	2,052	2,251	2,536	2,770	2,948	3,120	3,179	3,238
Scenario 1 - CC 2050 (Dry Year)	Connected	1,905	2,019	2,208	2,507	2,757	2,947	3,128	3,188	3,248
	Unconnected	108	109	110	112	114	115	117	119	121
	Losses	292	291	326	373	410	439	466	476	486
	Total	2,305	2,419	2,645	2,991	3,281	3,502	3,711	3,783	3,855

Scenario 2

Projected Demand (ML)		2006	2011	2016	2021	2026	2031	2036	2041	2046
Scenario 2 - Av Year	Connected	1,527	1,582	1,714	1,873	2,070	2,217	2,356	2,396	2,437
	Unconnected	57	57	58	59	59	60	61	62	63
	Losses	292	291	326	373	410	439	466	476	486
	Total	1,875	1,930	2,098	2,305	2,539	2,717	2,883	2,935	2,986
Scenario 2 - Dry Year	Connected	1,738	1,775	1,913	2,184	2,414	2,588	2,751	2,800	2,850
	Unconnected	94	95	96	97	99	100	102	104	105
	Losses	292	291	326	373	410	439	466	476	486
	Total	2,124	2,161	2,335	2,654	2,923	3,127	3,319	3,380	3,442
Scenario 2 - CC 2050 (Av Year)	Connected	1,604	1,624	1,738	1,980	2,187	2,343	2,489	2,533	2,576
	Unconnected	60	60	61	62	63	64	65	66	67
	Losses	292	291	326	373	410	439	466	476	486
	Total	1,956	1,975	2,126	2,415	2,661	2,846	3,021	3,075	3,130
Scenario 2 - CC 2050 (Dry Year)	Connected	1,905	1,956	2,115	2,413	2,666	2,857	3,037	3,092	3,147
	Unconnected	108	109	110	112	114	115	117	119	121
	Losses	292	291	326	373	410	439	466	476	486
	Total	2,305	2,356	2,551	2,898	3,190	3,411	3,620	3,687	3,755

Scenario 3

Projected Demand (ML)		2006	2011	2016	2021	2026	2031	2036	2041	2046
Scenario 3 - Av Year	Connected	1,527	1,468	1,487	1,726	1,909	2,038	2,153	2,184	2,215
	Unconnected	57	57	58	59	59	60	61	62	63
	Losses	292	271	296	334	368	393	418	427	436
	Total	1,875	1,796	1,840	2,119	2,337	2,491	2,633	2,673	2,714
Scenario 3 - Dry Year	Connected	1,738	1,739	1,840	2,007	2,167	2,287	2,400	2,432	2,464
	Unconnected	94	95	96	97	99	100	102	104	105
	Losses	292	271	296	334	368	393	418	427	436
	Total	2,124	2,106	2,232	2,438	2,634	2,781	2,920	2,963	3,006
Scenario 3 - CC 2050 (Av Year)	Connected	1,603	1,587	1,663	1,843	2,012	2,138	2,256	2,288	2,320
	Unconnected	60	60	61	62	63	64	65	66	67
	Losses	292	271	296	334	368	393	418	427	436
	Total	1,955	1,919	2,020	2,240	2,443	2,595	2,739	2,781	2,823
Scenario 3 - CC 2050 (Dry Year)	Connected	1,904	1,919	2,040	2,215	2,384	2,510	2,629	2,664	2,700
	Unconnected	108	109	110	112	114	115	117	119	121
	Losses	292	271	296	334	368	393	418	427	436
	Total	2,304	2,300	2,446	2,661	2,865	3,018	3,164	3,210	3,256

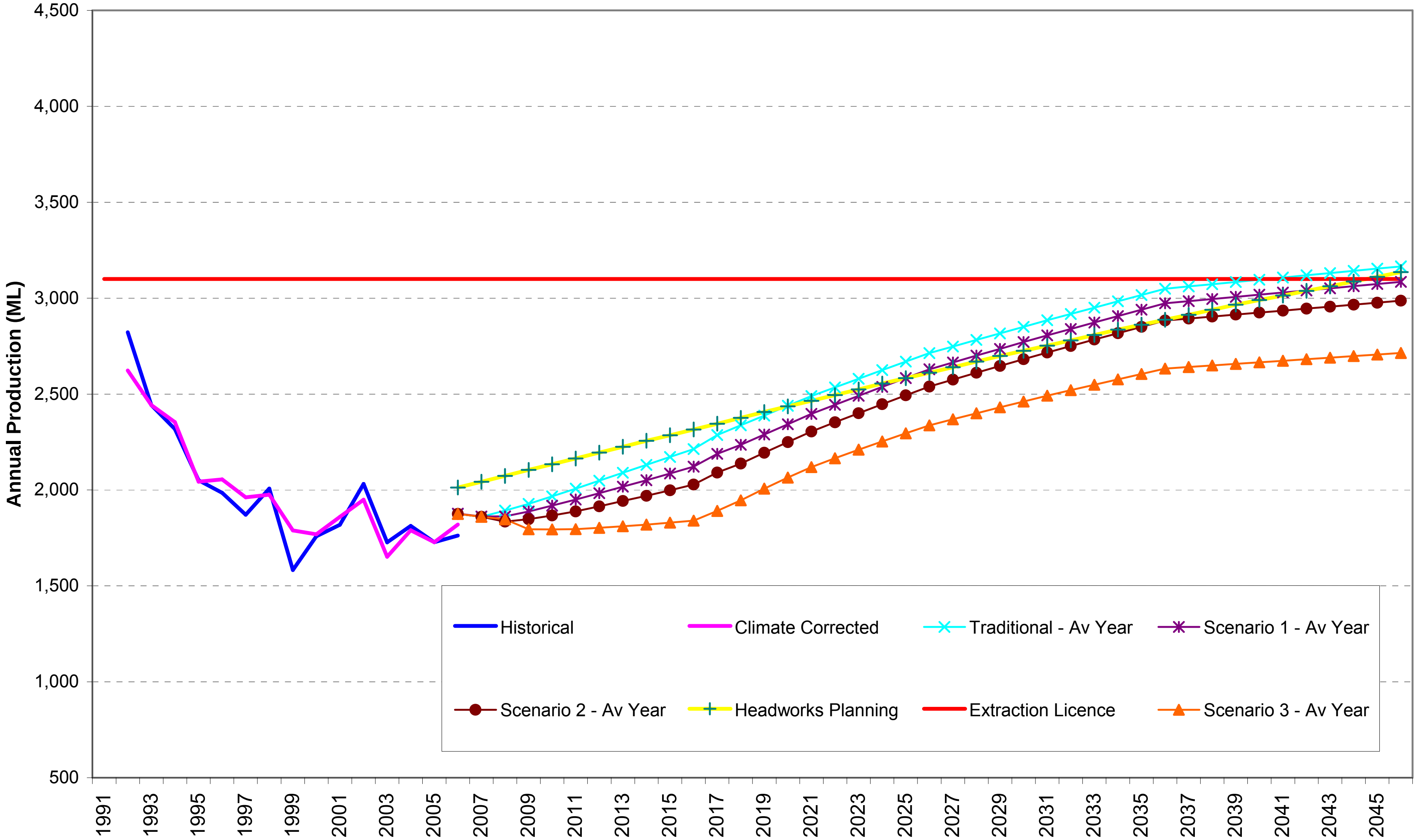

Figure A1 – Average Year Annual Headworks Projection

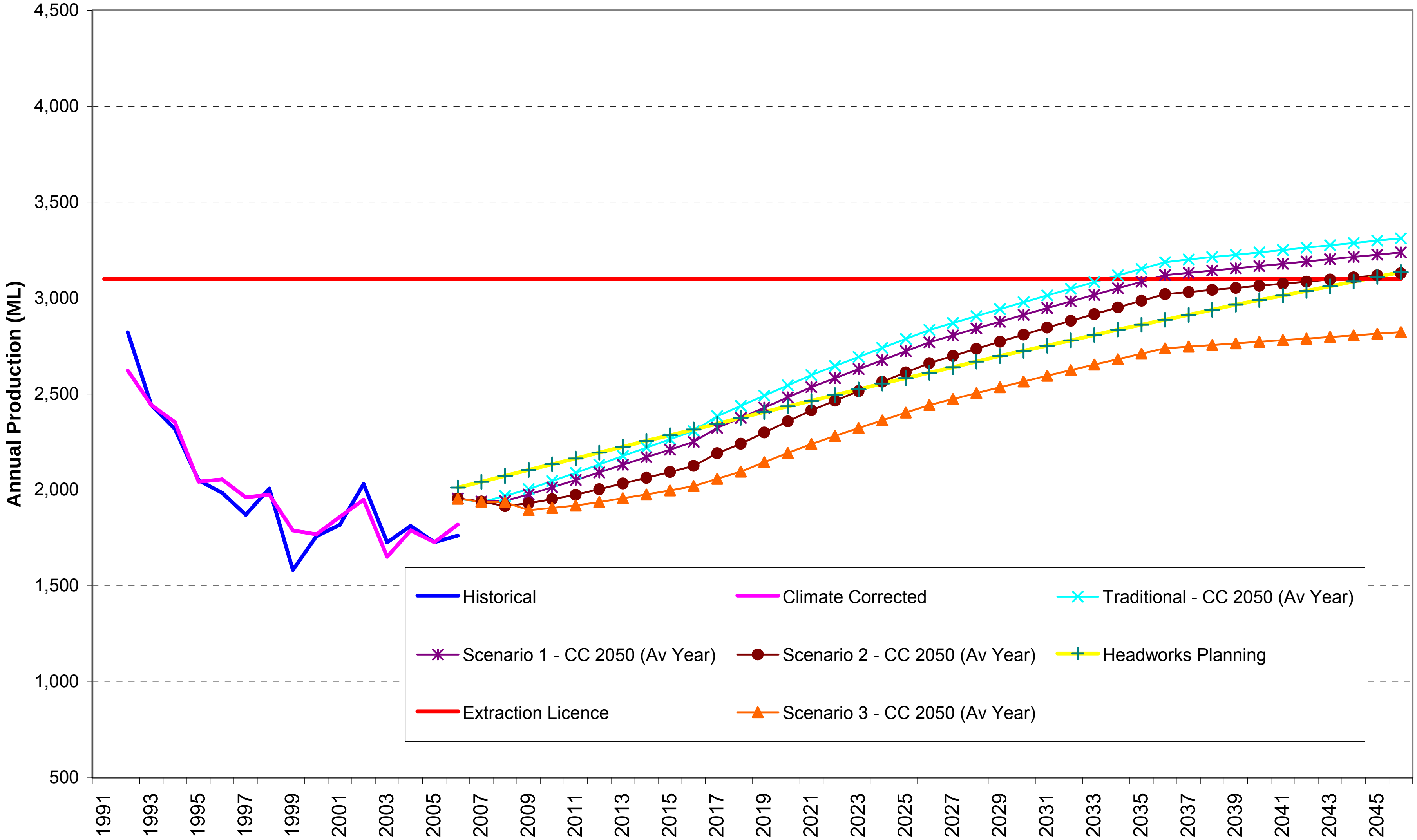

Figure A2 – Average Year With Climate Change Annual Headworks Projection

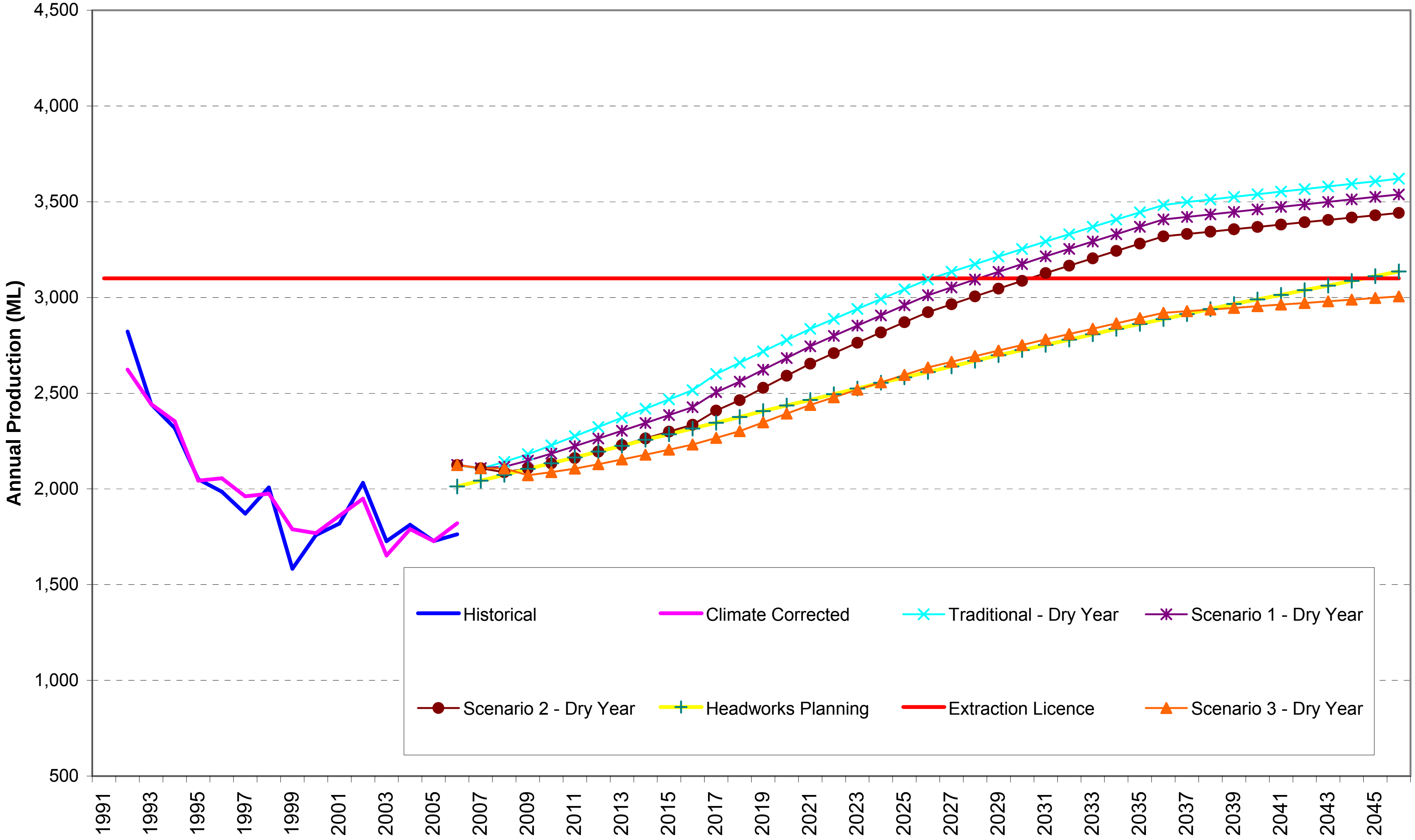

Figure A3 – Dry Year Annual Headworks Projection

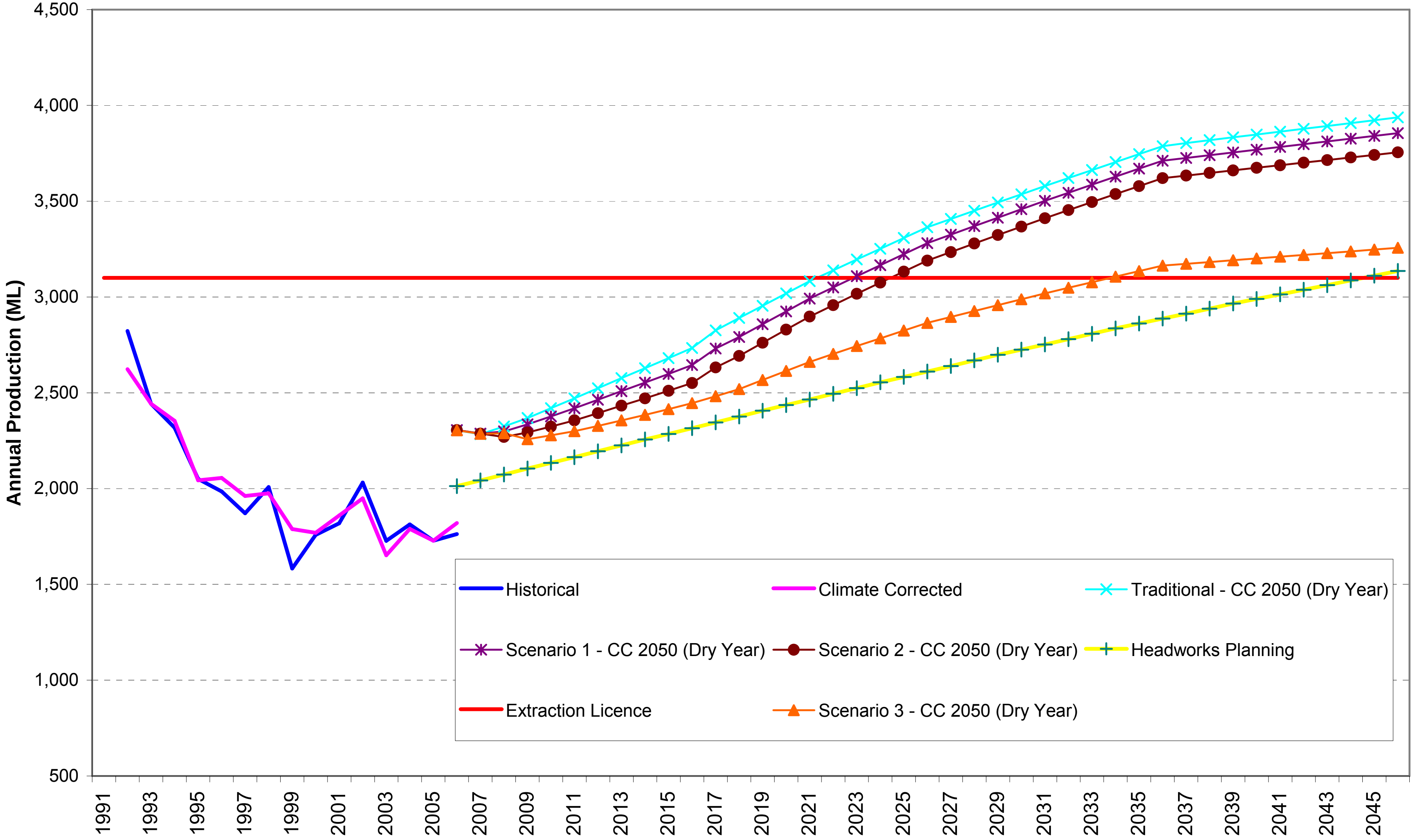

Figure A4 – Dry Year with Climate Change Annual Headworks Projection

A.4 Projected Peak Day Demands

See Task Paper 6.

Appendix B Wastewater Projections

B.1 Traditional Scenario

Bowraville Sewerage Scheme

Updated Corrected ADWF	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
	1		242	238	235	230	229	229	229	229	229

PWWF (L/s)	Pump Station	SA (L/s/ET)									
	1	0.058	33.0	33.3	33.7	33.6	33.6	33.6	33.6	33.6	33.6

Annual Pumped (ML)	Pump Station	WWF	98								
			2007	2011	2016	2021	2026	2031	2036	2041	2046
	1	1.36	118.1	115.9	114.8	112.2	111.9	111.8	112.0	111.7	111.7

Macksville Sewerage Scheme

Updated Corrected ADWF (kL)	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
	1		62	63	66	66	66	66	66	67	67
	2		181	199	224	242	261	281	300	320	340
	3		114	144	195	244	264	265	265	265	265
	4		172	275	367	404	449	457	464	472	480
	5		71	70	68	67	67	67	67	67	67
	6		238	267	317	365	385	386	386	386	387
	7		318	316	315	314	314	315	315	316	317
	8		**333**	**437**	**529**	**565**	**610**	**619**	**627**	**635**	**644**
	9		**782**	**826**	**898**	**962**	**1,002**	**1,022**	**1,043**	**1,064**	**1,085**
	10		18	83	160	206	251	258	266	273	281
	11		37	35	34	33	33	33	33	33	33
	12		37	40	44	44	44	44	44	44	44
	13		46	153	248	288	333	341	348	356	364
	14		0	15	16	13	13	13	13	13	13
	DCP17		0	54	121	166	211	219	226	234	241
	Nursing Home		0	32	84	135	155	155	155	155	155
	Total		**1,116**	**1,263**	**1,428**	**1,527**	**1,612**	**1,641**	**1,670**	**1,699**	**1,729**

PWWF (L/s)	Pump Station	Capacity (L/s)	2007	2011	2016	2021	2026	2031	2036	2041	2046
	1	8.0	7.8	8.3	9.0	9.2	9.2	9.2	9.2	9.2	9.2
	2	25.4	31.2	31.2	26.8	24.6	25.9	27.2	28.5	29.8	31.0
	3	11.0	17.0	17.9	18.6	21.7	23.7	23.7	23.7	23.8	23.8
	4	38.4	55.1	71.1	62.5	51.0	56.5	57.5	58.4	59.4	60.3
	5	24.0	15.0	12.5	8.4	6.7	6.7	6.7	6.7	6.7	6.7
	6	50.6	37.8	36.3	32.9	34.4	36.4	36.4	36.4	36.5	36.5
	7	33.8	32.7	28.9	22.6	20.0	20.0	20.0	20.1	20.1	20.1
	8	82.5	**71.6**	**87.7**	**79.2**	**67.7**	**73.2**	**74.2**	**75.2**	**76.2**	**77.1**
	9	92.0	**116.8**	**108.5**	**89.1**	**83.6**	**86.9**	**88.3**	**89.7**	**91.0**	**92.4**
	10	16.0	3.2	12.5	22.7	28.4	33.9	34.8	35.8	36.7	37.6
	11	11.0	5.5	5.5	5.4	5.4	5.4	5.4	5.4	5.4	5.4
	12	17.8	4.8	5.3	5.8	5.9	5.9	6.0	6.0	6.0	6.0
	13	12.1	19.2	41.4	43.4	36.4	41.9	42.8	43.8	44.7	45.6
	14	4.0	0.0	2.1	2.0	1.4	1.4	1.4	1.4	1.4	1.4
	DCP17	-	0.0	7.2	15.7	21.2	26.8	27.7	28.6	29.5	30.5
	Nursing Home	-	0.0	3.6	8.9	13.9	15.9	15.9	15.9	15.9	15.9
	Total		**188.4**	**196.2**	**168.3**	**151.3**	**160.2**	**162.5**	**164.9**	**167.2**	**169.5**

	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
Annual Pumped (ML)	1		15	16	17	17	17	17	17	17	17
	2		70	79	91	100	110	120	131	141	151
	3		61	74	95	116	125	125	125	125	125
	4		82	131	174	188	207	211	214	217	220
	5		35	34	33	32	32	32	32	32	32
	6		119	131	152	172	181	181	181	181	181
	7		137	136	135	134	134	134	134	134	134
	8		**143**	**192**	**234**	**248**	**267**	**271**	**275**	**277**	**281**
	9		**347**	**366**	**398**	**426**	**444**	**454**	**466**	**475**	**485**
	10		8	37	71	91	110	113	117	120	123
	11		15	14	14	13	13	13	13	13	13
	12		15	16	17	17	17	17	17	17	17
	13		23	74	118	134	153	156	160	163	166
	14		0	8	9	7	7	7	7	7	7
	DCP17		0	23	52	71	91	94	98	101	104
	Nursing Home		0	14	36	58	67	67	67	67	67
	Total		**490**	**558**	**633**	**674**	**711**	**725**	**740**	**752**	**766**

Scotts Head Sewerage Scheme

	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
Updated Corrected ADWF (kL)	**1**		**410**	**512**	**654**	**759**	**791**	**823**	**845**	**868**	**890**
	2		206	215	232	237	237	237	237	238	238
	3		140	165	203	212	214	216	217	219	221
	4		28	31	36	37	37	37	37	37	37
	5		22	26	32	34	35	35	36	36	37
	6		7	8	9	9	9	9	9	9	9
	7		33	45	61	65	66	68	69	70	72
	8		10	27	47	125	155	185	204	224	244
	Release		0	0	0	72	101	130	149	167	186
	Total		**410**	**512**	**654**	**759**	**791**	**823**	**845**	**868**	**890**

	Pump Station	Capacity (L/s)	2007	2011	2016	2021	2026	2031	2036	2041	2046
PWWF (L/s)	**1**	**52.3**	**39.7**	**53.4**	**65.3**	**77.2**	**81.8**	**86.3**	**89.4**	**92.4**	**95.5**
	2	15.7	14.2	14.5	15.0	15.2	15.2	15.2	15.2	15.2	15.2
	3	24.0	16.7	18.9	20.9	21.1	21.2	21.4	21.5	21.7	21.8
	4	6.0	3.7	3.8	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	5	5.7	3.1	3.7	4.5	4.7	4.8	4.9	5.0	5.1	5.2
	6	2.0	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9
	7	11.0	5.1	6.4	7.1	6.9	7.0	7.2	7.3	7.5	7.6
	8	30.5	2.4	6.4	6.7	16.6	21.0	25.4	28.2	31.1	34.0
	Release	-	0.0	0.0	0.0	11.3	15.6	19.9	22.7	25.4	28.2
	Total		**39.7**	**53.4**	**65.3**	**77.2**	**81.8**	**86.3**	**89.4**	**92.4**	**95.5**

	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
Annual Pumped (ML)	**1**		**113**	**148**	**194**	**234**	**247**	**260**	**270**	**278**	**288**
	2		49	49	51	51	51	51	52	52	52
	3		44	50	58	60	61	61	62	63	63
	4		9	9	9	9	9	9	9	9	10
	5		7	7	9	10	10	10	10	10	10
	6		2	2	3	3	3	3	3	3	3
	7		11	15	19	21	21	22	22	23	23
	8		5	15	26	59	71	84	93	101	110
	Release		0	0	0	30	42	54	62	70	78
	Total		**113**	**148**	**194**	**234**	**247**	**260**	**270**	**278**	**288**

Nambucca Sewerage Scheme (Nambucca)

	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
Updated Corrected ADWF (kL)	1		106	112	122	125	129	134	138	142	147
	2		597	629	651	668	700	732	765	798	830
	3		319	309	300	292	291	292	292	292	293
	4		**794**	**835**	**873**	**893**	**926**	**959**	**992**	**1,026**	**1,060**
	5		64	63	62	61	61	61	61	62	62
	6		282	276	272	266	267	268	270	271	273
	7		440	437	439	432	432	432	433	435	436
	8		**1,344**	**1,344**	**1,360**	**1,360**	**1,383**	**1,408**	**1,434**	**1,460**	**1,487**
	9		20	19	18	17	17	17	17	17	17
	10		33	33	32	32	32	32	32	32	32
	11		0	0	0	0	0	0	0	0	0
	12		20	25	32	35	35	35	35	35	35
	13		46	69	81	95	119	143	167	192	216
	14		13	18	25	31	38	45	52	58	65
	15		1	4	7	10	14	17	21	24	28
	Total		**2,137**	**2,179**	**2,233**	**2,254**	**2,308**	**2,367**	**2,426**	**2,487**	**2,547**

	Pump Station	**Capacity (L/s)**	2007	2011	2016	2021	2026	2031	2036	2041	2046
PWWF (L/s)	1	4.8	13.4	14.4	15.8	16.4	16.8	17.3	17.7	18.2	18.7
	2	62.0	53.1	58.1	63.4	67.9	72.8	77.6	82.4	87.2	92.0
	3	64.3	48.5	48.5	48.7	48.5	48.5	48.5	48.5	48.5	48.5
	4	**96.0**	**80.2**	**87.6**	**96.2**	**101.8**	**106.7**	**111.7**	**116.6**	**121.5**	**126.4**
	5	3.9	9.9	9.9	9.8	9.8	9.8	9.8	9.8	9.8	9.8
	6	16.5	37.2	37.5	38.1	38.1	38.2	38.3	38.4	38.5	38.7
	7	92.7	65.5	66.8	68.6	68.7	68.7	68.7	68.8	68.8	68.8
	8	**85.0**	**174.1**	**178.8**	**185.0**	**188.1**	**191.1**	**194.3**	**197.4**	**200.5**	**203.7**
	9	10.9	3.8	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
	10	9.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
	11	?	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	12	7.2	5.0	6.1	7.8	8.5	8.5	8.5	8.5	8.5	8.5
	13	10.1	5.6	9.3	13.2	17.1	21.4	25.6	29.9	34.1	38.3
	14	3.0	1.9	2.6	3.6	4.5	5.4	6.3	7.2	8.1	9.0
	15	3.0	0.2	0.7	1.4	2.1	2.7	3.4	4.0	4.7	5.3
	Total		**254.3**	**266.3**	**281.3**	**289.9**	**297.9**	**305.9**	**314.0**	**322.0**	**330.1**

	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
Annual Pumped (ML)	1		39	41	45	46	48	49	51	53	54
	2		165	181	191	199	214	229	244	259	274
	3		150	145	141	137	136	136	136	136	136
	4		**243**	**264**	**282**	**291**	**306**	**321**	**338**	**353**	**368**
	5		23	22	22	21	21	21	21	21	21
	6		85	83	82	81	81	81	81	81	82
	7		197	195	195	191	191	190	191	191	191
	8		**510**	**511**	**519**	**518**	**526**	**536**	**547**	**556**	**566**
	9		8	7	7	7	6	6	7	7	7
	10		15	15	15	14	14	14	14	14	14
	11		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
	12		11	14	18	19	19	19	19	19	19
	13		23	36	42	50	63	76	89	102	115
	14		6	8	11	14	16	19	22	25	28
	15		1	2	5	7	10	12	15	17	19
	Total		**754**	**775**	**800**	**808**	**832**	**857**	**885**	**908**	**934**

Nambucca Sewerage Scheme (Valla Beach)

	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
Updated Corrected ADWF (kL)	1		253	268	290	294	295	297	299	302	304
	2		129	130	133	132	132	132	133	133	134
	3		37	36	36	35	35	35	35	35	36
	4		3	3	3	3	3	3	3	3	3
	5		590	655	710	725	735	746	758	769	781
	6		109	114	122	123	124	125	126	128	129
	7		**748**	**820**	**886**	**1,155**	**1,421**	**1,637**	**1,853**	**1,868**	**1,882**
	8		4	5	6	6	6	6	6	6	6
	9		14	25	39	43	44	45	46	47	48
	10		20	21	23	23	23	24	24	24	25
	11		0	0	0	0	0	0	0	0	0
	12		6	6	7	7	7	7	7	7	7
	13		1	2	2	2	2	2	2	2	2
	14		9	32	61	74	82	91	100	108	117
	SV Release		0	0	0	0	0	0	0	0	0
	BC Release		0	0	0	253	506	708	910	910	910
	Total		**748**	**820**	**886**	**1,155**	**1,421**	**1,637**	**1,853**	**1,868**	**1,882**

	Pump Station	Capacity (L/s)	2007	2011	2016	2021	2026	2031	2036	2041	2046
PWWF (L/s)	1	20.0	31.3	34.5	38.8	39.9	40.2	40.5	40.8	41.1	41.4
	2	13.8	14.4	14.7	15.0	15.0	15.0	15.0	15.0	15.0	15.0
	3	9.7	5.8	5.8	5.7	5.7	5.7	5.8	5.8	5.8	5.8
	4	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0
	5	18.1	45.9	53.4	62.2	65.1	66.5	68.0	69.4	70.9	72.3
	6	8.4	13.4	14.2	15.2	15.5	15.6	15.7	15.8	15.9	16.1
	7	**42.0**	**65.3**	**73.1**	**81.8**	**118.4**	**152.5**	**179.8**	**207.0**	**208.7**	**210.4**
	8	2.4	0.6	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8
	9	14.0	3.0	5.5	8.9	9.9	10.1	10.3	10.6	10.8	11.0
	10	2.0	2.6	2.8	2.9	3.0	3.0	3.1	3.1	3.1	3.2
	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	12	?	0.8	0.9	1.0	1.1	1.1	1.1	1.1	1.1	1.1
	13	2.0	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
	14	24.0	1.2	4.4	8.3	9.9	11.0	12.1	13.2	14.3	15.4
	SV Release	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BC Release	-	0.0	0.0	0.0	33.9	66.4	92.1	117.7	117.7	117.7
	Total		**65.3**	**73.1**	**81.8**	**118.4**	**152.5**	**179.8**	**207.0**	**208.7**	**210.4**

	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
Annual Pumped (ML)	1		93	97	105	105	106	106	107	107	108
	2		45	45	46	45	45	45	45	45	45
	3		15	14	14	13	13	13	14	14	14
	4		2	1	1	1	1	1	1	2	2
	5		146	165	188	194	198	202	207	211	216
	6		42	43	46	46	46	47	47	48	48
	7		**211**	**232**	**257**	**372**	**486**	**578**	**673**	**677**	**682**
	8		2	2	3	3	3	3	3	3	3
	9		5	9	15	16	16	17	17	18	18
	10		8	8	9	9	9	9	9	10	10
	11		0	0	0	0	0	0	0	0	0
	12		2	3	3	3	3	3	3	3	3
	13		1	1	1	1	1	1	1	1	1
	14		4	14	26	31	35	39	43	46	50
	SV Release		0	0	0	0	0	0	0	0	0
	BC Release		0	0	0	109	218	305	393	392	392
	Total		**211**	**232**	**257**	**372**	**486**	**578**	**673**	**677**	**682**

B.2 Scenario 1

Bowraville Sewerage Scheme

Updated Corrected ADWF (kL)	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
	1		242	235	231	226	226	226	226	226	226

PWWF (L/s)	Pump Station	SA (L/s/ET)	2007	2011	2016	2021	2026	2031	2036	2041	2046
	1	0.058	33.0	33.2	33.5	33.5	33.5	33.5	33.5	33.5	33.5

Annual Pumped (ML)	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
	1	1.36	118.1	114.5	112.8	110.5	110.5	110.5	110.8	110.5	110.5

Macksville Sewerage Scheme

Updated Corrected ADWF (kL)	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
	1		62	63	65	65	65	66	66	66	66
	2		181	198	222	240	260	279	299	319	338
	3		114	143	193	243	264	264	264	264	265
	4		172	273	365	402	447	455	463	470	478
	5		71	69	67	66	66	66	66	66	66
	6		238	266	314	363	384	384	385	385	385
	7		318	315	313	312	313	314	314	315	316
	8		**333**	**435**	**526**	**562**	**608**	**616**	**625**	**633**	**641**
	9		**782**	**822**	**891**	**956**	**997**	**1,018**	**1,039**	**1,060**	**1,081**
	10		18	83	160	205	250	258	266	273	281
	11		37	35	33	32	32	33	33	33	33
	12		37	40	43	43	44	44	44	44	44
	13		46	153	248	288	333	340	348	356	363
	14		0	15	16	13	13	13	13	13	13
	DCP17		0	54	121	166	211	219	226	234	241
	Nursing Home		0	32	84	135	155	155	155	155	155
	Total		**1,116**	**1,256**	**1,417**	**1,518**	**1,605**	**1,634**	**1,664**	**1,693**	**1,722**

PWWF (L/s)	Pump Station	Capacity (L/s)	2007	2011	2016	2021	2026	2031	2036	2041	2046
	1	8.0	7.8	8.3	9.0	9.1	9.1	9.2	9.2	9.2	9.2
	2	25.4	31.2	31.2	26.7	24.5	25.8	27.1	28.4	29.7	31.0
	3	11.0	17.0	17.9	18.5	21.7	23.7	23.7	23.7	23.7	23.8
	4	38.4	55.1	71.0	62.4	50.9	56.5	57.4	58.4	59.3	60.3
	5	24.0	15.0	12.5	8.4	6.7	6.7	6.7	6.7	6.7	6.7
	6	50.6	37.8	36.2	32.9	34.3	36.3	36.4	36.4	36.4	36.5
	7	33.8	32.7	28.9	22.5	19.9	20.0	20.0	20.0	20.1	20.1
	8	**82.5**	**71.6**	**87.6**	**79.1**	**67.6**	**73.1**	**74.1**	**75.1**	**76.1**	**77.1**
	9	**92.0**	**116.8**	**108.3**	**88.9**	**83.4**	**86.8**	**88.2**	**89.5**	**90.9**	**92.3**
	10	16.0	3.2	12.5	22.7	28.4	33.9	34.8	35.7	36.7	37.6
	11	11.0	5.5	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4
	12	17.8	4.8	5.3	5.8	5.9	5.9	5.9	6.0	6.0	6.0
	13	12.1	19.2	41.4	43.4	36.4	41.9	42.8	43.7	44.7	45.6
	14	4.0	0.0	2.1	2.0	1.4	1.4	1.4	1.4	1.4	1.4
	DCP17	-	0.0	7.2	15.7	21.2	26.8	27.7	28.6	29.5	30.5
	Nursing Home	-	0.0	3.6	8.9	13.9	15.9	15.9	15.9	15.9	15.9
	Total		**188.4**	**195.9**	**167.9**	**151.0**	**159.9**	**162.3**	**164.6**	**167.0**	**169.3**

	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
Annual Pumped (ML)	1		15	16	17	17	17	17	17	17	17
	2		70	77	86	93	102	111	120	129	138
	3		61	71	90	110	119	119	119	119	119
	4		82	128	165	178	198	201	205	208	211
	5		35	32	30	28	28	28	28	28	28
	6		119	127	144	162	171	171	172	171	171
	7		137	131	122	118	118	118	118	118	118
	8		**143**	**189**	**225**	**238**	**257**	**261**	**265**	**268**	**271**
	9		**347**	**355**	**369**	**390**	**408**	**417**	**427**	**435**	**445**
	10		8	37	71	90	110	113	117	120	123
	11		15	14	14	13	13	13	13	13	13
	12		15	16	17	17	17	17	17	17	17
	13		23	72	114	129	148	152	155	158	161
	14		0	8	8	6	6	6	6	6	6
	DCP17		0	23	52	71	91	94	98	101	104
	Nursing Home		0	14	36	58	67	67	67	67	67
	Total		**490**	**543**	**595**	**628**	**665**	**678**	**692**	**703**	**715**

Scotts Head Sewerage Scheme

	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
Updated Corrected ADWF (kL)	**1**		**410**	**518**	**655**	**751**	**784**	**816**	**839**	**861**	**884**
	2		206	217	233	233	234	234	235	235	236
	3		140	167	203	209	211	213	214	216	218
	4		28	31	36	36	36	36	36	37	37
	5		22	26	32	34	34	35	35	36	36
	6		7	8	9	9	9	9	9	9	9
	7		33	45	61	64	66	67	68	70	71
	8		10	27	47	125	155	184	204	224	244
	Release		0	0	0	72	101	130	149	167	186
	Total		**410**	**518**	**655**	**751**	**784**	**816**	**839**	**861**	**884**

	Pump Station	**Capacity (L/s)**	2007	2011	2016	2021	2026	2031	2036	2041	2046
PWWF (L/s)	**1**	**52.3**	**39.7**	**53.6**	**65.3**	**76.9**	**81.5**	**86.1**	**89.2**	**92.2**	**95.3**
	2	15.7	14.2	14.6	15.0	15.1	15.1	15.1	15.1	15.1	15.1
	3	24.0	16.7	19.0	21.0	21.0	21.1	21.3	21.4	21.6	21.7
	4	6.0	3.7	3.8	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	5	5.7	3.1	3.7	4.5	4.7	4.8	4.9	5.0	5.1	5.2
	6	2.0	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9
	7	11.0	5.1	6.4	7.1	6.9	7.0	7.2	7.3	7.4	7.6
	8	30.5	2.4	6.4	6.7	16.5	21.0	25.4	28.2	31.1	34.0
	Release	-	0.0	0.0	0.0	11.3	15.6	19.9	22.7	25.4	28.2
	Total		**39.7**	**53.6**	**65.3**	**76.9**	**81.5**	**86.1**	**89.2**	**92.2**	**95.3**

	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
Annual Pumped (ML)	**1**		**113**	**149**	**194**	**232**	**245**	**259**	**268**	**277**	**286**
	2		49	49	51	51	51	51	51	51	51
	3		44	50	58	59	60	61	61	62	62
	4		9	9	9	9	9	9	9	9	9
	5		7	8	9	9	10	10	10	10	10
	6		2	2	3	2	3	3	3	3	3
	7		11	15	19	20	21	21	22	23	23
	8		5	15	26	59	71	84	93	101	110
	Release		0	0	0	30	42	54	62	70	78
	Total		**113**	**149**	**194**	**232**	**245**	**259**	**268**	**277**	**286**

Nambucca Sewerage Scheme (Nambucca)

Updated Corrected ADWF (kL)	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
	1		106	111	120	124	128	133	137	141	146
	2		597	625	646	663	696	729	762	794	827
	3		319	305	294	287	287	288	288	289	289
	4		**794**	**830**	**866**	**887**	**920**	**954**	**988**	**1,022**	**1,056**
	5		64	62	61	60	60	61	61	61	62
	6		282	272	266	262	263	265	267	268	270
	7		440	433	431	425	427	428	429	430	432
	8		**1,344**	**1,330**	**1,338**	**1,341**	**1,368**	**1,395**	**1,422**	**1,449**	**1,475**
	9		20	18	17	17	17	17	17	17	17
	10		33	32	32	31	31	31	31	31	32
	11		0	0	0	0	0	0	0	0	0
	12		20	25	32	35	35	35	35	35	35
	13		46	69	80	94	119	143	167	192	216
	14		13	18	25	31	38	45	51	58	65
	15		1	4	7	10	14	17	21	24	28
	Total		**2,137**	**2,160**	**2,203**	**2,228**	**2,288**	**2,349**	**2,410**	**2,470**	**2,531**

PWWF (L/s)	Pump Station	**Capacity (L/s)**	2007	2011	2016	2021	2026	2031	2036	2041	2046
	1	4.8	13.4	14.4	15.7	16.3	16.8	17.2	17.7	18.2	18.6
	2	62.0	53.1	58.0	63.3	67.8	72.6	77.5	82.3	87.1	91.9
	3	64.3	48.5	48.4	48.5	48.3	48.4	48.4	48.4	48.4	48.4
	4	**96.0**	**80.2**	**87.4**	**96.0**	**101.6**	**106.6**	**111.5**	**116.5**	**121.4**	**126.3**
	5	3.9	9.9	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8
	6	16.5	37.2	37.4	37.9	38.0	38.1	38.2	38.3	38.4	38.6
	7	92.7	65.5	66.6	68.4	68.5	68.6	68.6	68.6	68.7	68.7
	8	**85.0**	**174.1**	**178.4**	**184.4**	**187.6**	**190.7**	**193.9**	**197.0**	**200.2**	**203.3**
	9	10.9	3.8	3.7	3.7	3.6	3.6	3.6	3.7	3.7	3.7
	10	9.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
	11	?	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	12	7.2	5.0	6.1	7.8	8.5	8.5	8.5	8.5	8.5	8.5
	13	10.1	5.6	9.3	13.2	17.1	21.4	25.6	29.9	34.1	38.3
	14	3.0	1.9	2.6	3.6	4.5	5.4	6.3	7.2	8.1	9.0
	15	3.0	0.2	0.7	1.4	2.1	2.7	3.4	4.0	4.7	5.3
	Total		**254.3**	**265.8**	**280.4**	**289.1**	**297.3**	**305.4**	**313.5**	**321.6**	**329.6**

Annual Pumped (ML)	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
	1		39	41	44	46	47	49	51	52	54
	2		165	180	189	197	212	228	243	258	273
	3		150	143	138	134	134	134	135	135	135
	4		**243**	**262**	**279**	**289**	**304**	**320**	**336**	**351**	**367**
	5		23	22	21	21	21	21	21	21	21
	6		85	82	81	79	79	80	80	80	81
	7		197	193	192	188	188	188	189	189	189
	8		**510**	**506**	**510**	**510**	**520**	**531**	**542**	**551**	**561**
	9		8	7	7	6	6	6	6	6	6
	10		15	15	14	14	14	14	14	14	14
	11		0	0	0	0	0	0	0	0	0
	12		11	14	18	19	19	19	19	19	19
	13		23	36	42	49	62	76	89	102	115
	14		6	8	11	13	16	19	22	25	28
	15		1	2	5	7	10	12	15	17	19
	Total		**754**	**768**	**789**	**799**	**825**	**851**	**879**	**902**	**928**

Nambucca Sewerage Scheme (Valla Beach)

	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
Updated Corrected ADWF (kL)	1		253	266	286	290	293	295	297	300	302
	2		129	129	131	130	131	131	132	132	133
	3		37	36	35	34	34	35	35	35	35
	4		3	3	3	3	3	3	3	3	3
	5		590	650	703	719	731	742	754	766	777
	6		109	113	121	121	123	124	125	127	128
	7		**748**	**814**	**877**	**1,147**	**1,415**	**1,631**	**1,848**	**1,863**	**1,877**
	8		4	5	6	6	6	6	6	6	6
	9		14	24	38	43	44	45	46	47	48
	10		20	21	22	23	23	23	24	24	24
	11		0	0	0	0	0	0	0	0	0
	12		6	6	7	7	7	7	7	7	7
	13		1	2	2	2	2	2	2	2	2
	14		9	32	61	74	82	91	99	108	117
	SV Release		0	0	0	0	0	0	0	0	0
	BC Release		0	0	0	253	506	708	910	910	910
	Total		**748**	**814**	**877**	**1,147**	**1,415**	**1,631**	**1,848**	**1,863**	**1,877**

	Pump Station	Capacity (L/s)	2007	2011	2016	2021	2026	2031	2036	2041	2046
PWWF (L/s)	1	20.0	31.3	34.4	38.6	39.8	40.1	40.4	40.7	41.0	41.3
	2	13.8	14.4	14.6	14.9	14.9	14.9	15.0	15.0	15.0	15.0
	3	9.7	5.8	5.7	5.7	5.7	5.7	5.7	5.8	5.8	5.8
	4	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0
	5	18.1	45.9	53.3	62.0	64.9	66.4	67.8	69.3	70.7	72.2
	6	8.4	13.4	14.1	15.2	15.4	15.5	15.7	15.8	15.9	16.0
	7	**42.0**	**65.3**	**72.9**	**81.5**	**118.1**	**152.2**	**179.6**	**206.9**	**208.5**	**210.2**
	8	2.4	0.6	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8
	9	14.0	3.0	5.5	8.9	9.9	10.1	10.3	10.6	10.8	11.0
	10	2.0	2.6	2.7	2.9	3.0	3.0	3.1	3.1	3.1	3.2
	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	12	?	0.8	0.9	1.0	1.1	1.1	1.1	1.1	1.1	1.1
	13	2.0	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
	14	24.0	1.2	4.4	8.3	9.9	11.0	12.1	13.2	14.3	15.4
	SV Release	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BC Release	-	0.0	0.0	0.0	33.9	66.4	92.1	117.7	117.7	117.7
	Total		**65.3**	**72.9**	**81.5**	**118.1**	**152.2**	**179.6**	**206.9**	**208.5**	**210.2**

	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
Annual Pumped (ML)	1		93	96	103	104	105	105	106	106	107
	2		45	45	45	44	44	45	45	45	45
	3		15	14	14	13	13	13	13	13	13
	4		2	1	1	1	1	1	1	1	2
	5		146	164	186	192	197	201	206	210	215
	6		42	43	45	46	46	46	47	47	48
	7		**211**	**230**	**254**	**370**	**484**	**577**	**671**	**675**	**681**
	8		2	2	3	3	3	3	3	3	3
	9		5	9	14	16	16	17	17	18	18
	10		8	8	9	9	9	9	9	9	10
	11		0	0	0	0	0	0	0	0	0
	12		2	3	3	3	3	3	3	3	3
	13		1	1	1	1	1	1	1	1	1
	14		4	14	26	31	35	39	43	46	50
	SV Release		0	0	0	0	0	0	0	0	0
	BC Release		0	0	0	109	218	305	393	392	392
	Total		**211**	**230**	**254**	**370**	**484**	**577**	**671**	**675**	**681**

B.3 Scenario 2

Bowraville Sewerage Scheme

Updated Corrected ADWF	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
	1		242	232	225	220	220	220	220	220	220

PWWF (L/s)	Pump Station	Capacity (L/s)	2007	2011	2016	2021	2026	2031	2036	2041	2046
	1	30.0	33.0	29.4	23.3	20.6	20.6	20.6	20.6	20.6	20.6

Annual Pumped (ML)	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
	1	M	118.1	110.5	103.8	99.6	99.6	99.6	99.9	99.6	99.6

Macksville Sewerage Scheme

Updated Corrected ADWF (kL)	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
	1		62	62	64	64	64	64	64	65	65
	2		181	183	178	178	189	201	212	223	235
	3		114	127	151	190	210	211	211	211	211
	4		172	271	362	398	443	451	459	467	474
	5		71	68	66	64	64	64	65	65	65
	6		238	242	251	283	304	304	304	305	305
	7		318	265	180	145	145	145	146	146	146
	8		**333**	**432**	**521**	**557**	**603**	**611**	**619**	**628**	**636**
	9		**782**	**733**	**650**	**645**	**678**	**690**	**702**	**714**	**726**
	10		18	83	159	205	250	258	265	273	280
	11		37	34	32	31	31	32	32	32	32
	12		37	39	42	43	43	43	43	43	43
	13		46	152	248	287	332	340	348	355	363
	14		0	15	16	13	13	13	13	13	13
	DCP17		0	54	121	166	211	219	226	234	241
	Nursing Home		0	32	84	135	155	155	155	155	155
	Total		**1,116**	**1,165**	**1,171**	**1,202**	**1,280**	**1,301**	**1,321**	**1,342**	**1,362**

PWWF (L/s)	Pump Station	**Capacity (L/s)**	**2007**	**2011**	**2016**	**2021**	**2026**	**2031**	**2036**	**2041**	**2046**
	1	8.0	7.8	7.9	7.8	7.6	7.6	7.6	7.6	7.6	7.7
	2	25.4	31.2	30.3	24.0	20.9	22.0	23.0	24.1	25.1	26.2
	3	11.0	17.0	17.3	17.0	19.8	21.8	21.8	21.8	21.8	21.8
	4	38.4	55.1	70.5	60.8	48.9	54.5	55.4	56.4	57.3	58.3
	5	24.0	15.0	12.5	8.3	6.6	6.6	6.6	6.6	6.6	6.7
	6	50.6	37.8	34.8	29.1	29.6	31.6	31.6	31.6	31.6	31.7
	7	33.8	32.7	27.4	18.4	14.7	14.8	14.8	14.8	14.8	14.9
	8	82.5	**71.6**	**87.1**	**77.4**	**65.5**	**71.1**	**72.1**	**73.0**	**74.0**	**75.0**
	9	92.0	**116.8**	**104.4**	**78.2**	**69.8**	**72.9**	**74.0**	**75.1**	**76.3**	**77.4**
	10	16.0	3.2	12.1	21.2	26.5	32.0	32.9	33.9	34.8	35.7
	11	11.0	5.5	5.4	5.4	5.3	5.3	5.3	5.3	5.4	5.4
	12	17.8	4.8	5.3	5.8	5.9	5.9	5.9	5.9	5.9	5.9
	13	12.1	19.2	41.0	42.0	34.5	40.0	40.9	41.9	42.8	43.7
	14	4.0	0.0	2.1	2.0	1.4	1.4	1.4	1.4	1.4	1.4
	DCP17	-	0.0	7.2	15.7	21.2	26.8	27.7	28.6	29.5	30.5
	Nursing Home	-	0.0	3.6	8.9	13.9	15.9	15.9	15.9	15.9	15.9
	Total		**188.4**	**191.5**	**155.6**	**135.3**	**144.0**	**146.1**	**148.2**	**150.3**	**152.4**

	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
Annual Pumped (ML)	1		15	15	16	15	15	15	15	15	15
	2		70	70	65	64	69	74	80	85	90
	3		61	63	69	84	93	93	93	93	93
	4		82	127	162	175	195	198	202	204	208
	5		35	32	29	28	28	28	28	28	28
	6		119	115	112	124	133	133	133	133	133
	7		137	110	70	55	55	55	55	55	55
	8		**143**	**187**	**222**	**234**	**254**	**257**	**261**	**264**	**267**
	9		**347**	**314**	**265**	**259**	**273**	**278**	**284**	**289**	**294**
	10		8	37	70	89	108	111	115	118	121
	11		15	14	13	13	13	13	13	13	13
	12		15	15	17	17	17	17	17	17	17
	13		23	72	112	127	147	150	154	157	160
	14		0	8	8	6	6	6	6	6	6
	DCP17		0	23	52	71	91	94	98	101	104
	Nursing Home		0	14	36	58	67	67	67	67	67
	Total		**490**	**501**	**487**	**493**	**527**	**536**	**546**	**553**	**561**

Scotts Head Sewerage Scheme

	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
Updated Corrected ADWF (kL)	**1**		**410**	**511**	**636**	**727**	**759**	**791**	**813**	**835**	**857**
	2		206	216	229	229	230	230	231	231	232
	3		140	162	188	189	191	192	194	195	197
	4		28	31	35	35	35	36	36	36	36
	5		22	26	32	33	33	34	34	35	35
	6		7	8	9	9	9	9	9	9	9
	7		33	42	49	48	49	50	51	52	53
	8		10	27	47	124	154	184	204	224	244
	Release		0	0	0	72	101	130	149	167	186
	Total		**410**	**511**	**636**	**727**	**759**	**791**	**813**	**835**	**857**

	Pump Station	**Capacity (L/s)**	2007	2011	2016	2021	2026	2031	2036	2041	2046
PWWF (L/s)	**1**	**52.3**	**39.7**	**53.3**	**64.5**	**75.9**	**80.5**	**85.1**	**88.1**	**91.2**	**94.2**
	2	15.7	14.2	14.5	14.9	14.9	14.9	15.0	15.0	15.0	15.0
	3	24.0	16.7	18.8	20.3	20.1	20.3	20.4	20.6	20.7	20.8
	4	6.0	3.7	3.8	3.9	3.9	3.9	3.9	3.9	4.0	4.0
	5	5.7	3.1	3.7	4.5	4.7	4.8	4.9	4.9	5.0	5.1
	6	2.0	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9
	7	11.0	5.1	6.2	6.5	6.1	6.3	6.4	6.5	6.6	6.8
	8	30.5	2.4	6.4	6.7	16.5	21.0	25.4	28.2	31.1	34.0
	Release	-	0.0	0.0	0.0	11.3	15.6	19.9	22.7	25.4	28.2
	Total		**39.7**	**53.3**	**64.5**	**75.9**	**80.5**	**85.1**	**88.1**	**91.2**	**94.2**

	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
Annual Pumped (ML)	**1**		**113**	**147**	**188**	**224**	**237**	**250**	**260**	**268**	**277**
	2		49	49	50	50	50	50	50	50	50
	3		44	49	53	53	53	54	54	54	55
	4		9	9	9	9	9	9	9	9	9
	5		7	7	9	9	9	10	10	10	10
	6		2	2	2	2	2	2	2	2	2
	7		11	14	15	15	15	15	16	16	16
	8		5	15	26	59	71	84	93	101	109
	Release		0	0	0	30	42	54	62	70	78
	Total		**113**	**147**	**188**	**224**	**237**	**250**	**260**	**268**	**277**

Nambucca Sewerage Scheme (Nambucca)

	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
Updated Corrected ADWF (kL)	1		106	110	118	121	126	130	134	139	143
	2		597	621	639	655	688	721	753	786	819
	3		319	301	286	278	278	279	279	280	280
	4		**794**	**825**	**856**	**875**	**909**	**943**	**977**	**1,010**	**1,044**
	5		64	61	59	58	59	59	60	60	60
	6		282	269	260	254	255	257	259	260	262
	7		440	428	422	414	415	417	418	419	420
	8		**1,344**	**1,316**	**1,311**	**1,309**	**1,336**	**1,363**	**1,390**	**1,417**	**1,444**
	9		20	18	17	16	16	16	16	16	16
	10		33	32	31	30	30	31	31	31	31
	11		0	0	0	0	0	0	0	0	0
	12		20	25	32	35	35	35	35	35	35
	13		46	69	80	94	118	142	167	191	215
	14		13	18	24	31	38	44	51	58	65
	15		1	4	7	10	14	17	21	24	28
	Total		**2,137**	**2,141**	**2,167**	**2,185**	**2,245**	**2,306**	**2,367**	**2,427**	**2,488**

	Pump Station	**Capacity (L/s)**	2007	2011	2016	2021	2026	2031	2036	2041	2046
PWWF (L/s)	1	4.8	13.4	14.4	15.7	16.2	16.7	17.2	17.6	18.1	18.6
	2	62.0	53.1	57.5	61.5	64.9	69.1	73.2	77.4	81.5	85.6
	3	64.3	48.5	48.1	47.6	47.3	47.3	47.3	47.3	47.3	47.3
	4	**96.0**	**80.2**	**86.9**	**94.0**	**98.4**	**102.7**	**107.0**	**111.3**	**115.5**	**119.7**
	5	3.9	9.9	9.7	9.4	9.3	9.3	9.3	9.3	9.4	9.4
	6	16.5	37.2	37.2	37.4	37.3	37.4	37.6	37.7	37.8	37.9
	7	92.7	65.5	66.3	67.4	67.4	67.4	67.4	67.5	67.5	67.6
	8	**85.0**	**174.1**	**177.6**	**182.7**	**185.5**	**188.6**	**191.8**	**194.9**	**198.1**	**201.2**
	9	10.9	3.8	3.7	3.6	3.6	3.6	3.6	3.6	3.6	3.6
	10	9.6	4.6	4.5	4.6	4.5	4.5	4.5	4.6	4.6	4.6
	11	?	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	12	7.2	5.0	6.0	7.7	8.3	8.3	8.3	8.3	8.3	8.3
	13	10.1	5.6	8.9	11.6	14.5	18.1	21.6	25.2	28.7	32.2
	14	3.0	1.9	2.6	3.6	4.5	5.4	6.3	7.2	8.1	9.0
	15	3.0	0.2	0.7	1.4	2.1	2.7	3.4	4.0	4.7	5.3
	Total		**254.3**	**264.4**	**276.7**	**283.9**	**291.4**	**298.8**	**306.2**	**313.6**	**321.0**

	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
Annual Pumped (ML)	1		39	40	44	45	46	48	50	51	53
	2		165	178	186	193	208	222	238	252	266
	3		150	139	128	122	122	122	122	122	122
	4		**243**	**260**	**274**	**282**	**297**	**312**	**328**	**342**	**358**
	5		23	21	19	18	19	19	19	19	19
	6		85	81	77	75	75	76	76	76	77
	7		197	188	181	175	175	175	176	175	176
	8		**510**	**497**	**492**	**488**	**498**	**508**	**520**	**529**	**539**
	9		8	7	6	6	6	6	6	6	6
	10		15	14	14	14	14	14	14	14	14
	11		0	0	0	0	0	0	0	0	0
	12		11	13	17	18	18	18	18	18	18
	13		23	35	40	47	60	72	85	98	110
	14		6	8	11	13	16	19	22	25	28
	15		1	2	5	7	10	12	15	17	19
	Total		**754**	**757**	**765**	**770**	**795**	**821**	**848**	**871**	**897**

Nambucca Sewerage Scheme (Valla Beach)

	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
Updated Corrected ADWF (kL)	1		253	263	280	283	285	287	290	292	294
	2		129	128	129	127	128	128	129	129	130
	3		37	35	34	33	33	33	34	34	34
	4		3	3	3	3	3	3	3	3	3
	5		590	591	541	513	522	531	541	550	559
	6		109	111	114	113	114	115	116	118	119
	7		**743**	**742**	**687**	**907**	**1,171**	**1,384**	**1,598**	**1,609**	**1,621**
	8		4	5	5	6	6	6	6	6	6
	9		14	24	38	42	43	44	45	46	47
	10		20	19	17	16	16	17	17	17	17
	11		0	0	0	0	0	0	0	0	0
	12		6	6	6	5	5	5	5	5	5
	13		1	1	1	1	1	1	1	1	1
	14		9	30	49	55	62	68	75	81	88
	SV Release		0	0	0	0	0	0	0	0	0
	BC Release		0	0	0	253	506	708	910	910	910
	Total		**743**	**742**	**687**	**907**	**1,171**	**1,384**	**1,598**	**1,609**	**1,621**

	Pump Station	Capacity (L/s)	2007	2011	2016	2021	2026	2031	2036	2041	2046
PWWF (L/s)	1	20.0	31.3	34.0	37.6	38.6	38.9	39.2	39.5	39.8	40.1
	2	13.8	14.4	14.6	14.8	14.8	14.9	14.9	14.9	14.9	14.9
	3	9.7	5.8	5.5	5.1	5.0	5.0	5.0	5.0	5.0	5.1
	4	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0
	5	18.1	45.9	51.0	55.8	57.1	58.5	59.9	61.2	62.6	64.0
	6	8.4	13.4	13.0	11.9	11.3	11.4	11.5	11.6	11.7	11.8
	7	42.0	**65.3**	**69.2**	**71.3**	**105.2**	**139.2**	**166.5**	**193.6**	**195.2**	**196.7**
	8	2.4	0.6	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8
	9	14.0	3.0	5.5	8.8	9.8	10.1	10.3	10.6	10.8	11.0
	10	2.0	2.6	2.7	2.7	2.7	2.7	2.8	2.8	2.8	2.9
	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	12	?	0.8	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	13	2.0	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3
	14	24.0	1.2	4.3	7.8	9.3	10.3	11.3	12.4	13.4	14.4
	SV Release	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BC Release	-	0.0	0.0	0.0	33.9	66.4	92.1	117.7	117.7	117.7
	Total		**65.3**	**69.2**	**71.3**	**105.2**	**139.2**	**166.5**	**193.6**	**195.2**	**196.7**

	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
Annual Pumped (ML)	1		93	94	99	98	99	99	100	101	101
	2		45	45	44	44	44	44	44	44	44
	3		15	14	12	12	12	12	12	12	12
	4		2	1	1	1	1	1	1	1	1
	5		146	152	152	149	152	156	159	162	166
	6		42	41	40	39	40	40	40	41	41
	7		**211**	**213**	**207**	**310**	**423**	**514**	**607**	**610**	**614**
	8		2	2	3	3	3	3	3	3	3
	9		5	9	14	16	16	17	17	17	18
	10		8	8	7	6	6	7	7	7	7
	11		0	0	0	0	0	0	0	0	0
	12		2	2	2	2	2	2	2	2	2
	13		1	1	1	1	1	1	1	1	1
	14		4	12	21	24	26	29	32	35	38
	SV Release		0	0	0	0	0	0	0	0	0
	BC Release		0	0	0	109	218	305	393	392	392
	Total		**211**	**213**	**207**	**310**	**423**	**514**	**607**	**610**	**614**

B.4 Scenario 3

Bowraville Sewerage Scheme

Updated Corrected ADWF	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
	1		242	232	225	220	220	220	220	220	220

PWWF (L/s)	Pump Station	Capacity (L/s)	2007	2011	2016	2021	2026	2031	2036	2041	2046
	1	30.0	33.0	29.4	23.3	20.6	20.6	20.6	20.6	20.6	20.6

Annual Pumped (ML)	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
	1	M	118.1	110.5	103.8	99.6	99.6	99.6	99.9	99.6	99.6

Macksville Sewerage Scheme

Updated Corrected ADWF (kL)	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
	1		62	62	64	64	64	64	64	65	65
	2		181	180	170	167	178	189	201	212	223
	3		114	127	151	190	210	211	211	211	211
	4		172	271	362	398	443	451	459	467	474
	5		71	68	66	64	64	64	65	65	65
	6		238	242	251	283	304	304	304	305	305
	7		318	265	180	145	145	145	146	146	146
	8		**333**	**417**	**481**	**506**	**552**	**560**	**568**	**576**	**584**
	9		**782**	**730**	**641**	**634**	**666**	**679**	**691**	**703**	**715**
	10		18	83	159	205	250	258	265	273	280
	11		37	34	32	31	31	32	32	32	32
	12		37	36	34	31	31	31	31	32	32
	13		46	152	248	287	332	340	348	355	363
	14		0	15	16	13	13	13	13	13	13
	DCP17		0	54	121	166	211	219	226	234	241
	Nursing Home		0	32	84	135	155	155	155	155	155
	Total		**1,116**	**1,147**	**1,122**	**1,140**	**1,218**	**1,238**	**1,258**	**1,279**	**1,299**

PWWF (L/s)	Pump Station	**Capacity (L/s)**	2007	2011	2016	2021	2026	2031	2036	2041	2046
	1	8.0	7.8	7.9	7.8	7.6	7.6	7.6	7.6	7.6	7.7
	2	25.4	31.2	30.1	23.7	20.4	21.5	22.6	23.6	24.7	25.7
	3	11.0	17.0	17.3	17.0	19.8	21.8	21.8	21.8	21.8	21.8
	4	38.4	55.1	70.5	60.8	48.9	54.5	55.4	56.4	57.3	58.3
	5	24.0	15.0	12.5	8.3	6.6	6.6	6.6	6.6	6.6	6.7
	6	50.6	37.8	34.8	29.1	29.6	31.6	31.6	31.6	31.6	31.7
	7	33.8	32.7	27.4	18.4	14.7	14.8	14.8	14.8	14.8	14.9
	8	82.5	**71.6**	**86.6**	**76.1**	**63.8**	**69.4**	**70.3**	**71.3**	**72.3**	**73.3**
	9	92.0	**116.8**	**104.3**	**77.8**	**69.3**	**72.4**	**73.6**	**74.7**	**75.8**	**76.9**
	10	16.0	3.2	12.1	21.2	26.5	32.0	32.9	33.9	34.8	35.7
	11	11.0	5.5	5.4	5.4	5.3	5.3	5.3	5.3	5.4	5.4
	12	17.8	4.8	5.1	5.4	5.4	5.5	5.5	5.5	5.5	5.5
	13	12.1	19.2	41.0	42.0	34.5	40.0	40.9	41.9	42.8	43.7
	14	4.0	0.0	2.1	2.0	1.4	1.4	1.4	1.4	1.4	1.4
	DCP17	-	0.0	7.2	15.7	21.2	26.8	27.7	28.6	29.5	30.5
	Nursing Home	-	0.0	3.6	8.9	13.9	15.9	15.9	15.9	15.9	15.9
	Total		**188.4**	**190.9**	**153.9**	**133.1**	**141.8**	**143.9**	**146.0**	**148.1**	**150.2**

	Pump Station	2007	2011	2016	2021	2026	2031	2036	2041	2046
Annual Pumped (ML)	1	15	15	16	15	15	15	15	15	15
	2	70	68	61	59	64	69	75	80	85
	3	61	63	69	84	93	93	93	93	93
	4	82	127	162	175	194	197	201	204	207
	5	35	32	29	28	28	28	28	28	28
	6	119	115	112	124	133	133	133	133	133
	7	137	110	70	55	55	55	55	55	55
	8	**143**	**181**	**205**	**213**	**233**	**236**	**240**	**243**	**246**
	9	**347**	**313**	**261**	**254**	**268**	**273**	**279**	**284**	**289**
	10	8	37	70	89	108	111	115	118	121
	11	15	14	13	12	12	12	12	12	12
	12	15	14	13	12	12	12	12	12	12
	13	23	72	112	127	147	150	154	157	160
	14	0	8	8	6	6	6	6	6	6
	DCP17	0	23	52	71	91	94	98	101	104
	Nursing Home	0	14	36	58	67	67	67	67	67
	Total	**490**	**493**	**466**	**467**	**501**	**509**	**519**	**526**	**535**

Scotts Head Sewerage Scheme

	Pump Station	2007	2011	2016	2021	2026	2031	2036	2041	2046
Updated Corrected ADWF (kL)	**1**	**410**	**495**	**590**	**596**	**599**	**602**	**606**	**609**	**612**
	2	206	200	183	171	171	172	172	172	173
	3	140	162	188	189	191	192	194	195	197
	4	28	30	32	32	32	32	32	32	32
	5	22	26	32	33	33	34	34	35	35
	6	7	7	6	5	6	6	6	6	6
	7	33	42	49	48	49	50	51	52	53
	8	10	27	47	52	53	54	55	57	58
	Release	0	0	0	72	101	130	149	167	186
	Total	**410**	**495**	**590**	**596**	**599**	**602**	**606**	**609**	**612**

	Pump Station	Capacity (L/s)	2007	2011	2016	2021	2026	2031	2036	2041	2046
PWWF (L/s)	**1**	**52.3**	**39.7**	**52.8**	**63.0**	**73.9**	**78.5**	**83.1**	**86.1**	**89.1**	**92.2**
	2	15.7	14.2	13.9	13.4	12.9	12.9	12.9	13.0	13.0	13.0
	3	24.0	16.7	18.8	20.3	20.1	20.3	20.4	20.6	20.7	20.8
	4	6.0	3.7	3.7	3.8	3.7	3.8	3.8	3.8	3.8	3.8
	5	5.7	3.1	3.7	4.5	4.7	4.8	4.9	4.9	5.0	5.1
	6	2.0	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	7	11.0	5.1	6.2	6.5	6.1	6.3	6.4	6.5	6.6	6.8
	8	30.5	2.4	6.4	6.7	16.5	21.0	25.4	28.2	31.1	34.0
	Release	0.0	0.0	0.0	0.0	11.3	15.6	19.9	22.7	25.4	28.2
	Total		**39.7**	**52.8**	**63.0**	**73.9**	**78.5**	**83.1**	**86.1**	**89.1**	**92.2**

	Pump Station	2007	2011	2016	2021	2026	2031	2036	2041	2046
Annual Pumped (ML)	**1**	**113**	**144**	**178**	**199**	**208**	**216**	**223**	**228**	**234**
	2	49	46	40	37	37	37	38	37	38
	3	44	49	53	53	53	54	54	54	55
	4	9	9	8	8	8	8	8	8	8
	5	7	7	9	9	9	10	10	10	10
	6	2	2	2	2	2	2	2	2	2
	7	11	14	15	15	15	15	16	16	16
	8	5	15	26	47	55	62	68	73	79
	SHR - MBR	0	0	0	28	39	49	57	64	71
	SHR - SPS8	0	0	0	18	26	33	38	42	47
	Release	0	0	0	30	42	54	62	70	78
	Total	**113**	**144**	**178**	**199**	**208**	**216**	**223**	**228**	**234**

Nambucca Sewerage Scheme (Nambucca)

	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
Updated Corrected ADWF (kL)	1		106	110	118	121	126	130	134	139	143
	2		597	621	639	655	688	721	753	786	819
	3		319	301	286	278	278	279	279	280	280
	4		**794**	**825**	**856**	**875**	**909**	**943**	**977**	**1,010**	**1,044**
	5		64	61	59	58	59	59	60	60	60
	6		282	269	260	254	255	257	259	260	262
	7		440	428	422	414	415	417	418	419	420
	8		**1,344**	**1,316**	**1,311**	**1,309**	**1,336**	**1,363**	**1,390**	**1,417**	**1,444**
	9		20	18	17	16	16	16	16	16	16
	10		33	32	31	30	30	31	31	31	31
	11		0	0	0	0	0	0	0	0	0
	12		20	25	32	35	35	35	35	35	35
	13		46	69	80	94	118	142	167	191	215
	14		13	18	24	31	38	44	51	58	65
	15		1	4	7	10	14	17	21	24	28
	Total		**2,137**	**2,141**	**2,167**	**2,185**	**2,245**	**2,306**	**2,367**	**2,427**	**2,488**

	Pump Station	**Capacity (L/s)**	2007	2011	2016	2021	2026	2031	2036	2041	2046
PWWF (L/s)	1	4.8	13.4	14.4	15.7	16.2	16.7	17.2	17.6	18.1	18.6
	2	62.0	53.1	57.5	61.5	64.9	69.1	73.2	77.4	81.5	85.6
	3	64.3	48.5	48.1	47.6	47.3	47.3	47.3	47.3	47.3	47.3
	4	**96.0**	**80.2**	**86.9**	**94.0**	**98.4**	**102.7**	**107.0**	**111.3**	**115.5**	**119.7**
	5	3.9	9.9	9.7	9.4	9.3	9.3	9.3	9.3	9.4	9.4
	6	16.5	37.2	37.2	37.4	37.3	37.4	37.6	37.7	37.8	37.9
	7	92.7	65.5	66.3	67.4	67.4	67.4	67.4	67.5	67.5	67.6
	8	**85.0**	**174.1**	**177.6**	**182.7**	**185.5**	**188.6**	**191.8**	**194.9**	**198.1**	**201.2**
	9	10.9	3.8	3.7	3.6	3.6	3.6	3.6	3.6	3.6	3.6
	10	9.6	4.6	4.5	4.6	4.5	4.5	4.5	4.6	4.6	4.6
	11	?	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	12	7.2	5.0	6.0	7.7	8.3	8.3	8.3	8.3	8.3	8.3
	13	10.1	5.6	8.9	11.6	14.5	18.1	21.6	25.2	28.7	32.2
	14	3.0	1.9	2.6	3.6	4.5	5.4	6.3	7.2	8.1	9.0
	15	3.0	0.2	0.7	1.4	2.1	2.7	3.4	4.0	4.7	5.3
	Total		**254.3**	**264.4**	**276.7**	**283.9**	**291.4**	**298.8**	**306.2**	**313.6**	**321.0**

	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
Annual Pumped (ML)	1		39	40	44	45	46	48	50	51	53
	2		165	177	182	189	203	218	233	247	262
	3		150	139	128	122	122	122	122	122	122
	4		**243**	**258**	**268**	**275**	**290**	**305**	**321**	**335**	**350**
	5		23	21	19	18	19	19	19	19	19
	6		85	81	77	75	75	76	76	76	77
	7		197	188	181	175	175	175	176	175	176
	8		**510**	**494**	**484**	**478**	**488**	**498**	**509**	**517**	**527**
	9		8	7	6	6	6	6	6	6	6
	10		15	14	14	14	14	14	14	14	14
	11		0	0	0	0	0	0	0	0	0
	12		11	13	17	18	18	18	18	18	18
	13		23	35	40	47	60	72	85	98	110
	14		6	8	11	13	16	19	22	25	28
	15		1	2	5	7	10	12	15	17	19
	Total		**754**	**752**	**752**	**753**	**778**	**803**	**830**	**852**	**877**

Nambucca Sewerage Scheme (Valla Beach)

	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
Updated Corrected ADWF (kL)	1		253	246	234	223	225	227	229	231	233
	2		129	117	98	88	88	89	89	89	90
	3		37	35	34	33	33	33	34	34	34
	4		3	3	3	3	3	3	3	3	3
	5		590	574	493	452	461	470	479	488	497
	6		109	111	114	113	114	115	116	118	119
	7		**748**	**729**	**642**	**596**	**607**	**618**	**630**	**641**	**652**
	8		4	4	4	4	4	4	4	4	4
	9		14	24	38	42	43	44	45	46	47
	10		20	19	17	16	16	17	17	17	17
	11		0	0	0	0	0	0	0	0	0
	12		6	6	6	5	5	5	5	5	5
	13		1	1	1	1	1	1	1	1	1
	14		9	30	49	55	62	68	75	81	88
	Sub-Total		**748**	**729**	**642**	**596**	**607**	**618**	**630**	**641**	**652**
	SV Release		0	0	0	0	0	0	0	0	0
	BC Release		0	0	0	253	506	708	910	910	910
	Sewer Mining		**0**	**0**	**0**	**253**	**506**	**708**	**910**	**910**	**910**

	Pump Station	**Capacity (L/s)**	2007	2011	2016	2021	2026	2031	2036	2041	2046
PWWF (L/s)	1	20.0	31.3	33.4	36.0	36.6	36.8	37.1	37.4	37.7	38.0
	2	13.8	14.4	14.2	13.8	13.5	13.5	13.5	13.6	13.6	13.6
	3	9.7	5.8	5.5	5.1	5.0	5.0	5.0	5.0	5.0	5.1
	4	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0
	5	18.1	45.9	50.4	54.1	55.0	56.3	57.7	59.1	60.5	61.8
	6	8.4	13.4	13.0	11.9	11.3	11.4	11.5	11.6	11.7	11.8
	7	**42.0**	**65.3**	**68.6**	**69.7**	**97.2**	**125.4**	**148.0**	**170.4**	**171.9**	**173.5**
	8	2.4	0.6	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8
	9	14.0	3.0	5.5	8.8	9.8	10.1	10.3	10.6	10.8	11.0
	10	2.0	2.6	2.7	2.7	2.7	2.7	2.8	2.8	2.8	2.9
	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	12	?	0.8	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	13	2.0	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3
	14	24.0	1.2	4.3	7.8	9.3	10.3	11.3	12.4	13.4	14.4
	Sub-Total		**65.3**	**68.6**	**69.7**	**97.2**	**125.4**	**148.0**	**170.4**	**171.9**	**173.5**
	SV Release	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BC Release	-	0.0	0.0	0.0	33.9	66.4	92.1	117.7	117.7	117.7
	Sewer Mining		**0.0**	**0.0**	**0.0**	**5.9**	**11.7**	**16.4**	**21.1**	**21.1**	**21.1**

	Pump Station		2007	2011	2016	2021	2026	2031	2036	2041	2046
Annual Pumped (ML)	1		93	88	81	76	76	77	78	78	78
	2		45	40	32	29	29	29	29	29	29
	3		15	14	12	12	12	12	12	12	12
	4		2	1	1	1	1	1	1	1	1
	5		146	145	133	125	129	132	136	139	143
	6		42	41	40	39	40	40	40	41	41
	7		**211**	**206**	**189**	**245**	**317**	**375**	**435**	**437**	**442**
	8		2	2	2	2	2	2	2	2	2
	9		5	9	14	15	15	16	16	17	17
	10		8	8	7	6	6	7	7	7	7
	11		0	0	0	0	0	0	0	0	0
	12		2	2	2	2	2	2	2	2	2
	13		1	1	1	1	1	1	1	1	1
	14		4	12	21	24	26	29	32	35	38
	SV Release		0	0	0	0	0	0	0	0	0
	BC Release		0	0	0	109	218	305	393	392	392
	Total			**206**	**189**	**245**	**317**	**375**	**435**	**437**	**442**

Appendix C TBL Scoring

C.1 Environmental Scoring

TBL	Objective	KPI	Target	Type	Score					Notes	Weight	Weighted Score				
					T	S1	S2 (NH4)	S2 (NH3)	S3			T	S1	S2 (NH4)	S2 (NH3)	S3
ENVIRONMENTAL	Ensure efficient use of drinking water	Percentage of new development and redevelopment proposals incorporating BASIX concepts	100% (ie, 40% reduction in average annual town water use for new residential dwellings)	C	5	5	5		5		0.000	0.00	0.00	0.00		0.00
		Percentage of existing houses fitted with water saving devices	Greater than 50% over the next 10 years	A	1	5	5		5		0.033	0.03	0.17	0.17	0.17	0.17
		Percentage reduction in peak water use per person	5% reduction in peak day consumption per person (averaged over system) within 5 years	A	4	5	5		5	Measured at 2012	0.033	0.13	0.17	0.17	0.17	0.17
		Percentage of existing houses fitted with RWT	Existing houses to fit water tanks (50% over 10 years)	A	1	1	3		5		0.033	0.03	0.03	0.10	0.10	0.17
	Ensure the sustainability of the water resources	Do not pump between dusk to dawn when flow at the gauging station after extraction by upstream irrigators is between 80ML/d to 120ML/d during January to September and 40ML/d to 120ML/d during October to December.	100%	C	5	5	5		5	Same for all scenarios	0.000	0.00	0.00	0.00		0.00
		Stop pumping to distribution system to meet existing demands when the flow at the gauging station reaches the 95%ile flow corresponding to that month.	100%	C	5	5	5		5	Same for all scenarios	0.000	0.00	0.00	0.00		0.00
		Stop pumping to distribution system to meet future growth demands and to fill the off-river storage (ORS) when the flow at the gauging station reaches the 90%ile flow corresponding to that month.	100%	C	5	5	5		5	Same for all scenarios	0.000	0.00	0.00	0.00		0.00
		The upstream irrigators and town water supply are allowed to extract up to 60% of the total daily flow provided other constraints are satisfied.	100%	C	5	5	5		5	Same for all scenarios	0.000	0.00	0.00	0.00		0.00
		When off-river storage (ORS) is drawn-down to say 60% and the water supply is subject to level 4 and above restrictions, the previous rules are relaxed with pumping to water supply ceasing at 95%ile flow corresponding to that month.	100%	C	5	5	5		5	Same for all scenarios	0.000	0.00	0.00	0.00		0.00
		Upstream irrigators are to cease pumping when the previous day's affected flow at the gauging station reaches the annual 95%ile flow, which is about 10ML/d.	100%	C	5	5	5		5	Same for all scenarios	0.000	0.00	0.00	0.00		0.00
	Reduce greenhouse gas emissions	Cutting of carbon dioxide emission from scheme operation to year 2000 levels by 2025	100% (NSW Greenhouse Plan)	BP	2	2	3		3	Average of 2002-2005 used as 2000 baseline	0.067	0.13	0.13	0.20		0.20
		Cutting of carbon dioxide emission from scheme operation (2000 base year)	60% by 2050 (NSW Greenouse Plan)	BP	1	1	1		1	Reported for 2046	0.067	0.07	0.07	0.07		0.07
	Help protect catchments, estuaries and aquatic ecosystems	Put in place a mutually acceptable MOU with CMA.	NSC and CMA to finalise MOU by 30/6/2008		0	0	0		0	Remove	0.000	0.00	0.00	0.00		0.00
		Dollar value of catchment protection works funded by Council	By 2016, rehabilitate and protect 60% of stream length in the North Arm Nambucca River Sub-catchment (W1 CAP)	BP	2	2	2		5	Note this is 18/60 = 30%	0.067	0.13	0.13	0.13	0.13	0.33
			Active participation in water monitoring / environmental education networks by 2009 (W3 CAP)	BP	4	5	5		5	Existing Monitoring in place.	0.067	0.27	0.33	0.33	0.33	0.33
		Dollar value of estuarine protection works funded by Council	100% implementation of identified priority actions from the Estuary Management Plan by 2016 (C2 CAP)	BP	2.3	3.0	4.3		3.7	Based on activities in EMP	0.067	0.16	0.20	0.29	0.29	0.24
	Protect the health and diversity of the receiving waters	Percentage reduction in bacterial concentration	25% reduction for stormwater within 5 years	A	1	1	1		1	This has been assessed for stormwater hot spots in existing urban areas.	0.000	0.00	0.00	0.00		0.00
		Percentage compliance to DECC licence for bacterial content	§ 100%	C	5	5	5		5	All scenarios compliant	0.000	0.00	0.00	0.00		0.00
		Percentage reduction in total phosphorus and nitrogen concentrations	IEO Targets for Nambucca Catchment: TP = 30mg/L and TN = 300mg/L	BP	1	1.6	2.2		2.4	This has been assessed for stormwater hot spots in existing urban areas.	0.000	0.00	0.00	0.00		0.00
		Percentage compliance to DECC licence for nutrient concentration and annual load	§ 100%	C	5	5	5		5	All scenarios compliant	0.000	0.00	0.00	0.00		0.00
		Percentage reduction in suspended sediment concentrations	IEO Targets for Nambucca Catchment: Turbidity = 10 NTU	BP	1	1.6	2.3		2.3	This has been assessed for stormwater hot spots in existing urban areas with known sediment issues.	0.000	0.00	0.00	0.00		0.00
		Percentage compliance to DECC licence for suspended sediment load	§ 100%	C	5	5	5		5	All scenarios compliant	0.000	0.00	0.00	0.00		0.00
		Percentage reduction in volume discharging	Greater than 80% for effluent	A	1	1	2		2	Measured against Traditional Scenario	0.033	0.03	0.03	0.07	0.07	0.07
			Greater than 5% for stormwater	A	1	1	5		5	Existing Urban Area in 2046 - 2006 base (Measured against traditional scenario)	0.033	0.03	0.03	0.17	0.17	0.17
		Percentage compliance to DECC licence for annual and daily volume of discharge	§ 100%	C	4	4	5		5	Option B1 won't achieve 100% compliance	0.000	0.00	0.00	0.00		0.00
		Percentage reduction in velocity of discharge water	Greater than 25% within 5 years	A	0	0	0		0	Not able to quantify	0.000	0.00	0.00	0.00		0.00
	Ensure the sustainability of reuse areas	Annual percentage of groundwater and soil samples complying to relevant standards	§ 100% (DECC Licence – Bowraville STP)	C	3	3	5		5	This is % of compliant events from Bowraville STP from 2005-2007. It has been assumed that B1 will make no difference to this performance.	0.000	0.00	0.00	0.00		0.00
	Minimise the impact of stormwater run-off from existing land-use	Percentage compliance with DCP sediment control measures	Greater than 90%	A	4	4	4		4	Same for all scenarios	0.033	0.13	0.13	0.13	0.13	0.13
	Maximise beneficial reuse	Percentage of effluent reused, replacing town water supply	Greater than 50% within 5 years for Macksville and NH STP	A	1	1	1		1	Macksville in 5 years	0.033	0.03	0.03	0.03	0.03	0.03
				A	1	1	1		4	NH after development of Boggy / Cow Creek	0.033	0.03	0.03	0.03	0.03	0.13
				A	1	1	1		5	SH after St Scotts Head Development	0.033	0.03	0.03	0.03	0.03	0.17
		Percentage reuse of biosolids	Greater than 75% within 10 years	A	1	1	1		1	No biosolidsreuse opportunities	0.033	0.03	0.03	0.03	0.03	0.03
	Minimise the impact of the stormwater generation potential of future development through sustainable development and design.	Increase in net storm flow volumes between developed and undeveloped lot	Meet Blue Book Guidelines with 100% Target	BP	5	5	5		5	Same for all scenarios	0.067	0.33	0.33	0.33	0.33	0.33
		Increase in net nutrient loads between developed and undeveloped lot	Meet Blue Book Guidelines with 100% Target	BP	5	5	5		5	Same for all scenarios	0.067	0.33	0.33	0.33	0.33	0.33
		Increase in net suspended solids load between developed and undeveloped lot	Meet Blue Book Guidelines with 100% Target	BP	5	5	5		5	Same for all scenarios	0.067	0.33	0.33	0.33	0.33	0.33
		Reduction in stormwater run-off from roads	Meet Blue Book Guidelines with 100% Target	BP	5	5	5		5	Same for all scenarios	0.067	0.33	0.33	0.33	0.33	0.33
		Percentage of development proposals incorporating on-site stormwater management facilities	Meet Blue Book Guidelines with 100% Target	BP	5	5	5		5	Same for all scenarios	0.067	0.33	0.33	0.33	0.33	0.33
	Protect the recreational and economic value of the waterways and beaches	Percentage of wet days when unrestricted swimming is possible	Beachwatch Target 1: Median FC < 100 cfu/100 mL (5 samples with < 1 month frequency)	BP	0	0	0		0	Not able to quantify	0					
		Percentage of dry days unrestricted swimming is possible	Beachwatch Target 2: 2nd highest sample FC < 600 cfu/100 mL (5 samples with < 1 month frequency)	BP	0	0	0		0	Not able to quantify	0					
		Number of wet day samples with bacteria greater than 10cells but less than 100cells/100mL	Beachwatch Target 3: Median enterococci < 35 cfu/100 mL (5 samples with < 1 month frequency)	BP	0	0	0		0	Not able to quantify	0					
			Beachwatch Target 4: 2nd highest sample enterococci < 100 cfu/100 mL (5 samples with < 1 month frequency)	BP	0	0	0		0	Not able to quantify	0					
			ANZECC Target: Median enterococci < 35 cfu/100 mL (over bathing season)	BP	0	0	0		0	Not able to quantify	0					
		Number of dry day samples at outlets exceeding oyster farm bacterial guidelines	IEO Targets for Shellfish	BP	0	0	0		0	Not able to quantify	0					
		Number of samples at discharge points exceeding the oyster farm bacterial guidelines	IEO Targets for Shellfish	BP	0	0	0		0	Not able to quantify	0					
											1.00	2.96	3.23	3.62	3.62	4.08

C.2 *Social Scoring*

TBL	Objective	KPI	Target	Type	Score T	Score S1	Score S2	Score	Score S3	Notes	Weight	Weighted Score T	Weighted Score S1	Weighted Score S2	Weighted Score	Weighted Score S3
SOCIAL	Maintain continuous water supply to towns	Average number of drought related Level 3 restrictions in a 10 year period (SBP)	1	BP	5	5	5		5	From Task 5	0.111	0.56	0.56	0.56		0.56
		Total percentage duration of drought related restrictions (SBP)	5%	A	5	5	5		5	From Task 5	0.056	0.28	0.28	0.28		0.28
	Protect the public safety of the urban community	Number of accidents related to stormwater structures/facilities	?	0	0	0	0		0	No Target - remove	0.000	0.00	0.00	0.00		0.00
		Number of public liability claims	?	0	0	0	0		0	No Target - remove	0.000	0.00	0.00	0.00		0.00
	Protect the urban properties and premises	Average number of localised flooding due to inadequate system design	2 / year	A	4	4	4		4	Current Unknown. This hasn't been quantified	0.056	0.22	0.22	0.22		0.22
		Percentage of urban population provided with stormwater management services	100%	A	5	5	5		5		0.056	0.28	0.28	0.28		0.28
	Enhance the 'nature coast' perception amongst visitors	Number of visitor complaints about unsightly litter sites	3	A	1	2	3		3	Scored against gross pollutant reduction at known litter hot spot sites.	0.000	0.00	0.00	0.00		0.00
		Number of complaints about visual contaminants in waterways	2	A	0	0	0		0	Remove as similar to # 49.	0.000	0.00	0.00	0.00		0.00
	Minimise water supply interruptions	Average number of water interruptions per year due to asset failure affecting < 100 Properties	?	0	0	0	0		0	No Target - remove	0.000	0.00	0.00	0.00		0.00
		Average number of water interruptions per year due to asset failure affecting > 100 Properties and < 50% of all serviced properties	?	0	0	0	0		0	No Target - remove	0.000	0.00	0.00	0.00		0.00
		Average number of water interruptions per year due to asset failure affecting > 100 Properties and > 50% of all serviced properties	?	0	0	0	0		0	No Target - remove	0.000	0.00	0.00	0.00		0.00
		Decrease in number of interruptions due to third party damage	?	0	0	0	0		0	No Target - remove	0.000	0.00	0.00	0.00		0.00
		Average number of annual planned interruptions for maintenance or improvement works with notice issued 24 hours.	?	0	0	0	0		0	No Target - remove	0.000	0.00	0.00	0.00		0.00
	Protect public health	Compliance with Australian Drinking Water Quality Guidelines bacteriological standards	100%	BP	5	4	4		4		0.111	0.56	0.44	0.44		0.44
		Percentage of first bacteriological samples complying with Australian Drinking Water Quality Guidelines	?	0	0	0	0		0	No Target - remove	0.000	0.00	0.00	0.00		0.00
		Number of boil water notices	?	0	0	0	0		0	No Target - remove	0.000	0.00	0.00	0.00		0.00
		Number of notices not to drink water	0	A	5	4	4		4	Due to WFP	0.056	0.28	0.22	0.22		0.22
		Number of reportable water borne diseases	0	A	5	5	5		5		0.056	0.28	0.28	0.28		0.28
		Number of complaints due to nuisance organisms (eg mosquitoes)	0	A	4	4	4		4	Assessed as part of RWT risk - BASIX	0.056	0.22	0.22	0.22		0.22
		Number of odour complaints per site	0	A	4	4	4		4	No septicity opportunities included	0.056	0.22	0.22	0.22		0.22
		Average number of blockages per township	?	0	0	0	0		0	No Target - remove	0.000	0.00	0.00	0.00		0.00
		Number of notifiable sewer surcharges in dry periods due to system failure	2 incidents / year (SBP)	BP	5	5	5		5	None at present	0.111	0.56	0.56	0.56		0.56
		Number of bypasses of sewerage treatment plants in dry periods	§ Nil (DECC Licences)	C	5	5	5		5	None at present	0.000	0.00	0.00	0.00		0.00
		Annual average of reportable surcharges in wet periods	Uncontrolled discharge onto private property < 1 / 200 connections (SBP)	BP	4	4	4		5	Increase with infiltration and inflow programs.	0.111	0.44	0.44	0.44		0.56
		Annual number of sewerage treatment plant bypasses in wet weather	0	A	5	5	5		5		0.056	0.28	0.28	0.28		0.28
		Percentage of on-site systems failing during wet weather resulting in run off onto public place	0	A	0	0	0		0	No data available	0.000	0.00	0.00	0.00		0.00
	Provide good quality drinking water	Compliance with Australian Drinking Water Quality Guidelines physical and chemical standards	100% (SBP)	BP	5	4	4		4		0.111	0.56	0.44	0.44		0.44
		Average number of dirty water incidents causing complaints	?	BP		0	0		0	No Target - remove	0.000					
		Average number of taste and odour incidents causing complaints	?	BP		0	0		0	No Target - remove	0.000					
		Average number of complaints due to change in water colour	?	BP		0	0		0	No Target - remove	0.000					
		Kilometres of pipeline cleaned annually	5	A		0	0		0	No data available	0.000					
	Maintain adequate pressure at the household	Serviced areas with water pressure between 12 and 90 metres to a residential meter under normal conditions. (SBP)	99% (SBP)	BP		0	0		0	No data available	0.000					
		Number of incidents causing complaints about pressure	99% compliance (SBP)	BP		0	0		0	No data available	0.000					
	Maintain adequate fire fighting services	Percentage of urban area with fire fighting facilities	?	0		0	0		0	No Target - remove	0.000					
		Percentage of system capable of meeting fire engine requirements	?	0		0	0		0	No Target - remove	0.000					
	Increase public awareness of urban water issues	Percentage of community participation in events (eg Clean Up Australia, Water Week etc)	50%	A		0	0		0	No data available	0.000					
		Cost of community education programs as a percentage of total operating costs	?	0		0	0		0	No Target - remove	0.000					
	Increase customer satisfaction	Percentage of customers satisfied with action taken on complaint	?	0		0	0		0	No Target - remove	0.000					
		Percentage of customers satisfied with time taken to deal with complaint or work request	?	0		0	0		0	No Target - remove	0.000					
		Percentage of times unplanned supply interruptions restored within 2 hours during business hours	99% (SBP)	BP		0	0		0	No data available	0.000					
		Percentage of times blockages cleaned within 2 hours (business hours)	99% (SBP)	BP		0	0		0	No data available	0.000					
											1.00	4.72	4.44	4.44	4.44	4.56

Appendix D Supporting Cost Information

D.1 Water Supply NPV

Traditional Scenario

- Headworks
- Water Conservation
- Water Distribution Netowrk

ITEM	DESCRIPTION	June '08 rates		Rate ($/Unit)		COST	PRESENT WORTH		
						$K	4%	7%	10%
1.0	Direct Costs	Quantity	Unit						
1.1	**Headworks Opportunities**								
1.1.1	Build upfront a storage (xx ML) and Borefield to meet projected future demands (HW1)					58,195	55,957	54,388	52,905
1.1.2	Undertake no catchment protection works (i.e. no fencing but river bank stabilisation in the vicinity of the Borefield). Implement a well-head protection plan and storage aerators and storage management plan (WTP3)					621	613	607	602
1.1.3	Build a WFP (assume membrane filtration or DAFF)	15	ML/d			14,294	13,745	13,359	12,995
1.1.4	Upgrade WFP	3.82	ML/d			4,312	1,892	1,041	583
1.2	**Water Distribution Network (To supply 2046 Demands)**								
1.2.1	Upgrade clear water pumping machinery to supply 300 L/s at 88m	363	kW						
	Civil - Housing	1	LS	36%		182	97	62	40
	Pump, Motor and Valves	2	LS	64%		324	173	110	70
	Switchboard	0	LS			0	0	0	0
1.2.2	Replace 375mm AC main from Wirimbi Junction to Pacific Highway with 450mm main	6.7	km	$700		4,815	2,571	1,631	1,048
1.2.3	Replace 300mm AC from Wirrimbi Junction to PRV North of Nambucca river at Macksville with 375mm main	4.8	km	$462		2,343	1,251	794	510
1.2.4	Replace 200mm AC main to Scotts Head with 200mm m-PVC main	8.2	km	$190		2,150	1,148	728	468
1.2.5	Construct new reservoir south of Scotts Head to service Urban Release area	1.3	ML			1,347	1,023	839	691
1.2.6	Construct 200mm main to supply new reservoir from replacement Scotts Head Trunk main near the existing Scotts Head reservoir	2.6	km	$190		767	583	478	394
1.2.7	Construct a new reservoir on the Western side of the Valla Urban Growth Area	3.3	ML			2,240	1,702	1,395	1,149
1.2.8	Construct 250mm main from the Nambucca trunk main at the Pacific Highway to the new Valla Urban Growth Area Reservoir	5.5	km	$245		1,877	1,426	1,169	963
1.2.9	Construct a booster pumping station in the new main (servicing the Valla Urban Growth Area Reservoir) with a capacity of approximately 40 L/s at 16m head	9	kW						
	Civil - Housing	1	LS	31%		41	31	25	21
	Pump, Motor and Valves	2	LS	69%		30	23	19	16
	Switchboard	1	LS			20	15	12	10
2.0	Direct Cost					35,362	26,293	22,269	19,560
2.1	Contingency				20%	7,072	5,259	4,454	3,912
3.0	Construction Cost					42,434	31,552	26,723	23,471
3.1	Project Management and Engineering				20%	8,487	6,310	5,345	4,694
TOTAL CAPITAL COST						**109,117**	**93,819**	**86,456**	**81,071**
						109.1		86.5	
4.0	Operations & Maintenance Costs								
4.1	Energy Costs	see below	c per kWh			3,361	1,595	988	675
4.2	Chemicals (Water Filtration)	see below	$/ML			4,893	2,407	1,530	1,060
4.4	Labour Costs	see below	Operator			4,015	2,101	1,408	1,023
4.5	Maintenance Costs	see below	of Capex			21,247	10,653	6,903	4,883
TOTAL O&M ANNUAL COST						33,515	16,757	10,829	7,642
								10.8	
TOTAL PRESENT WORTH						**142,632**	**110,576**	**97,285**	**88,712**

Integrated Scenario 1

- Headworks
- Water Conservation
- Water Distribution Netowrk

ITEM		DESCRIPTION	June '08 rates				COST	PRESENT WORTH		
							$K	4%	7%	10%
1.0	Direct Costs		Quantity	Unit	Rate ($/Unit)					
	1.1	Headworks Opportunities								
	1.1.1	Build upfront a storage (xx ML) and Borefield to meet projected future demands (HW1)					56,187	54,026	52,512	51,080
	1.1.2	Undertake catchment protection works in the vicinity of the Borefield (about 1 km of fencing and river bank stabilisation). Implement a well-head protection plan and storage aerators and storage management plan. (WTP2)					823	815	810	804
	1.1.3	Build a WFP (assume membrane filtration or DAFF) in 2020	18.6	ML/d			17,564	11,409	8,344	6,156
	1.2	Water Distribution Network (To supply 2046 Demands)								
	1.2.1	Upgrade clear water pumping machinery to supply 300 L/s at 88m	363	kW						
		Civil - Housing	1	LS	36%		182	97	62	40
		Pump, Motor and Valves	2	LS	64%		324	173	110	70
		Switchboard	0	LS			0	0	0	0
	1.2.2	Replace 375mm AC main from Wirimbi Junction to Pacific Highway with 450mm main	6.7	km	$700		4,815	2,571	1,631	1,048
	1.2.3	Replace 300mm AC from Wirrimbi Junction to PRV North of Nambucca river at Macksville with 375mm main	4.8	km	$462		2,343	1,251	794	510
	1.2.4	Replace 200mm AC main to Scotts Head with 200mm m-PVC main	8.2	km	$190		2,150	1,148	728	468
	1.2.5	Construct new reservoir south of Scotts Head to service Urban Release area	1.3	ML			1,347	1,023	839	691
	1.2.6	Construct 200mm main to supply new reservoir from replacement Scotts Head Trunk main near the existing Scotts Head reservoir	2.6	km	$190		767	583	478	394
	1.2.7	Construct a new reservoir on the Western side of the Valla Urban Growth Area	3.3	ML			2,240	1,702	1,395	1,149
	1.2.8	Construct 250mm main from the Nambucca trunk main at the Pacific Highway to the new Valla Urban Growth Area Reservoir	5.5	km	$245		1,877	1,426	1,169	963
	1.2.9	Construct a booster pumping station in the new main (servicing the Valla Urban Growth Area Reservoir) with a capacity of approximately 40 L/s at 16m head	9	kW						
		Civil - Housing	1	LS	31%		41	31	25	21
		Pump, Motor and Valves	2	LS	69%		30	23	19	16
		Switchboard	1	LS			20	15	12	10
2.0	Direct Cost						34,521	22,267	16,415	12,340
	2.1	Contingency				20%	6,904	4,453	3,283	2,468
3.0	Construction Cost						41,426	26,721	19,698	14,808
	3.1	Project Management and Engineering				20%	8,285	5,344	3,940	2,962
TOTAL CAPITAL COST							**105,898**	**86,091**	**76,149**	**68,849**
							105.9		76.1	
4.0	Operations & Maintenance Costs									
	4.1	Power Consumption	see below	c per kWh			3,591	1,659	1,065	752
	4.2	Chemicals (Water Filtration)	see below	$/ML			3,990	1,506	789	439
	4.4	Labour Costs	see below	Operator			3,685	1,672	1,047	716
	4.5	Maintenance Costs	see below	of Capex			26,433	11,312	6,726	4,362
TOTAL O&M ANNUAL COST							37,699	16,150	9,627	6,270
									9.6	
TOTAL PRESENT WORTH							**143,598**	**102,241**	**85,776**	**75,119**

Integrated Scenario 2

- Headworks
- Water Conservation
- Water Distribution Netowrk

ITEM	DESCRIPTION	June '08 rates Quantity	Unit	Rate ($/Unit)		COST $K	PRESENT WORTH 4%	7%	10%
1.0	Direct Costs								
1.1	Headworks Opportunities								
1.1.1	Build upfront a storage (xx ML) and Borefield to meet projected future demands (HW1)					55,460	53,327	51,832	50,418
1.1.2	Undertake catchment protection works in the vicinity of the Borefield (about 1 km of fencing and river bank stabilisation). Implement a well-head protection plan and storage aerators and storage management plan. (WTP2)					823	815	810	804
1.1.3	Build a WFP (assume membrane filtration or DAFF) in 2020	17.7	ML/d			16,832	10,934	7,997	5,900
1.2	Water Distribution Network (To supply 2046 Demands)								
1.2.1	Upgrade clear water pumping machinery to supply 290 L/s at 88m	351	kW						
	Civil - Housing	1	LS	36%		177	95	60	39
	Pump, Motor and Valves	2	LS	64%		315	168	107	69
	Switchboard	0	LS			0	0	0	0
1.2.2	Replace 375mm AC main from Wirimbi Junction to Pacific Highway with 450mm main	6.7	km	$700		4,815	2,571	1,631	1,048
1.2.3	Replace 300mm AC from Wirrimbi Junction to PRV North of Nambucca river at Macksville with 375mm main	4.8	km	$462		2,343	1,251	794	510
1.2.4	Replace 200mm AC main to Scotts Head with 200mm m-PVC main	8.2	km	$190		2,150	1,148	728	468
1.2.5	Construct new reservoir south of Scotts Head to service Urban Release area	1.2	ML			1,304	991	812	669
1.2.6	Construct 200mm main to supply new reservoir from replacement Scotts Head Trunk main near the existing Scotts Head reservoir	2.6	km	$190		767	583	478	394
1.2.7	Construct a new reservoir on the Western side of the Valla Urban Growth Area	3.3	ML			2,240	1,702	1,395	1,149
1.2.8	Construct 250mm main from the Nambucca trunk main at the Pacific Highway to the new Valla Urban Growth Area Reservoir	5.5	km	$245		1,877	1,426	1,169	963
1.2.9	Construct a booster pumping station in the new main (servicing the Valla Urban Growth Area Reservoir) with a capacity of approximately 40 L/s at 16m head	9	kW						
	Civil - Housing	1	LS	31%		41	31	25	21
	Pump, Motor and Valves	2	LS	69%		30	23	19	16
	Switchboard	1	LS			20	15	12	10
2.0	Direct Cost					33,734	21,753	16,036	12,059
2.1	Contingency				20%	6,747	4,351	3,207	2,412
3.0	Construction Cost					40,481	26,103	19,243	14,471
3.1	Project Management and Engineering				20%	8,096	5,221	3,849	2,894
TOTAL CAPITAL COST						**104,037**	**84,651**	**74,924**	**67,783**
						104.0		74.9	
4.0	Operations & Maintenance Costs								
4.1	Power Consumption	see below	c per kWh			3,321	1,523	974	686
4.2	Chemicals (Water Filtration)	see below	$/ML			3,861	1,457	763	425
4.4	Labour Costs	see below	Operator			3,685	1,672	1,047	716
4.5	Maintenance Costs	see below	of Capex			26,417	11,463	6,923	4,579
TOTAL O&M ANNUAL COST						37,284	16,116	9,707	6,406
								9.7	
TOTAL PRESENT WORTH						**141,321**	**100,767**	**84,630**	**74,189**

Integrated Scenario 3

- Headworks
- Water Conservation
- Water Distribution Netowrk

ITEM		DESCRIPTION	June '08 rates Quantity	Unit	Rate ($/Unit)		COST $K	PRESENT WORTH 4%	7%	10%
1.0		Direct Costs								
	1.1	**Headworks Opportunities**								
	1.1.1	Build upfront a storage (xx ML) and Borefield to meet projected future demands (HW1)					50,669	48,720	47,354	46,063
	1.1.2	Implement a comprehensive and effective catchment management plan including fencing and river bank stabilisation (up to 4 km). Implement a well-head protection plan and storage aerators and storage management plan. (WTP1)					1,701	1,693	1,688	1,683
	1.1.3	Build a WFP (assume membrane filtration or DAFF) in 2023	16.75	ML/d			16,284	9,404	6,315	4,288
	1.2	**Water Distribution Network (To supply 2046 Demands)**								
	1.2.1	Upgrade clear water pumping machinery to supply 285 L/s at 88m	345	kW						
		Civil - Housing	1	LS	36%		175	93	59	38
		Pump, Motor and Valves	2	LS	64%		311	166	105	68
		Switchboard	0	LS			0	0	0	0
	1.2.2	Replace 375mm AC main from Wirimbi Junction to Pacific Highway with 450mm main	6.7	km	$700		4,815	2,571	1,631	1,048
	1.2.3	Replace 300mm AC from Wirrimbi Junction to PRV North of Nambucca river at Macksville with 375mm main	4.8	km	$462		2,343	1,251	794	510
	1.2.4	Replace 200mm AC main to Scotts Head with 200mm m-PVC main	8.2	km	$190		2,150	1,148	728	468
	1.2.5	Construct new reservoir south of Scotts Head to service Urban Release area	0.9	ML			1,084	824	675	557
	1.2.6	Construct 200mm main to supply new reservoir from replacement Scotts Head Trunk main near the existing Scotts Head reservoir	2.6	km	$190		767	583	478	394
	1.2.7	Construct a new reservoir on the Western side of the Valla Urban Growth Area	3.1	ML			2,162	1,643	1,346	1,109
	1.2.8	Construct 250mm main from the Nambucca trunk main at the Pacific Highway to the new Valla Urban Growth Area Reservoir	5.5	km	$245		1,877	1,426	1,169	963
	1.2.9	Construct a booster pumping station in the new main (servicing the Valla Urban Growth Area Reservoir) with a capacity of approximately 40 L/s at 16m head	7	kW						
		Civil - Housing	1	LS	31%		41	31	25	21
		Pump, Motor and Valves	2	LS	69%		30	23	19	16
		Switchboard	1	LS			20	15	12	10
	1.3	**Reuse to Reduce Potable Demand**								
	1.3.1	Reticulated Reuse Scheme from Macksville STP (parks and gardens)								
		Recycled Water Pump Station 1 x 14L/s x 37m in 2010	7.1	kW						
		Civil - Housing	1	LS	31%		41	31	25	21
		Pump, Motor and Valves	2	LS	69%		30	23	19	16
		Switchboard	1	LS	$10		10	8	6	5
		Pressure Sandfilters	1.0	ML/d	$300,000		300	228	187	154
		Medium Pressure UV Unit	1.0	ML/d	$58,500		59	44	36	30
		150mm oPVC Ring Main	3,396	m	$109		370	281	230	190
		30kL Storage Tanks	2	LS	$50,000		100	76	62	51
	1.3.2	Non-Potable Dual Reticulation for South Scotts Head								
		150mm mPVC Reticulation Pipeline	1,554	m	$109		0	0	0	0
		Recycled Water Pump Station 1 x 4.5L/s x 75m	5	kW						
		Civil - Pump Well	1	LS	31%		46	35	29	24
		Pump, Motor and Valves	2	LS	69%		39	29	24	20
		Power supply and switchboard	1	LS	$10		10	8	6	5
		Non-Potable Concrete Storage Reservoir	0.8	ML			973	739	606	499
		100mm oPVC Non-Potable Rising Main	513	m	$73		38	29	23	19
	1.3.3	Non-Potable Dual Reticulation for Valla Urban Growth Area								
		150mm uPVC Reticulation Pipeline	3,671	m	$109		0	0	0	0
		Recycled Water Pump Station 1 x 21L/s x 82m in 2016	24	kW						
		Civil - Housing	1	LS	31%		46	35	29	24
		Pump, Motor and Valves	2	LS	69%		52	39	32	26
		Switchboard	1	LS	$20		20	15	12	10
		Non-Potable Concrete Storage Reservoir	2.3	ML			1,851	1,407	1,153	950
		150mm DICL Rising Main to Non-Potable Reservoir	2,307	m	$109		251	191	157	129
2.0		Direct Cost					37,996	24,064	17,646	13,303
	2.1	Contingency				20%	7,599	4,813	3,529	2,661
3.0		Construction Cost					45,596	28,876	21,176	15,963
	3.1	Project Management and Engineering				20%	9,119	5,775	4,235	3,193
TOTAL CAPITAL COST							**105,384**	**83,372**	**72,765**	**65,219**
							105.4		72.8	
4.0		Operations & Maintenance Costs								
	4.1	Power Consumption	see below	c per kWh			2,877	1,295	815	565
	4.2	Chemicals (Water Filtration)	see below	$/ML			3,206	1,139	564	295
	4.4	Labour Costs	see below	Operator			3,905	1,824	1,163	806
	4.5	Maintenance Costs	see below	of Capex			25,444	10,832	6,469	4,250
TOTAL O&M ANNUAL COST							35,432	15,090	9,011	5,916
									9.0	
TOTAL PRESENT WORTH							**140,815**	**98,462**	**81,776**	**71,135**

D.2 Wastewater NPV

Traditional Scenario

• Wastewater Management

ITEM	DESCRIPTION	June '08 rates Quantity	Unit	Rate ($/Unit)		COST $K	PRESENT WORTH 4%	7%	10%
1.0	Direct Costs								
1.1	**Bowraville Sewerage Scheme**								
1.1.1	Option B3 - Optimise Bowraville STP operation until 2015, new 1,500 plant in 2015								
	Optimise Bowraville STP operation and dose with coagulant chemicals			$ 190,310		190	183	178	173
	Renew existing plant by constructing a new 1,500 EP STP in 2015 with a new wet-weather storage and appropriate buffer zones from residents	1,500	EP	$ 3,988,525		3,989	3,152	2,658	2,251
1.1.2	Bowraville SPS1	5	kW						
	Civil - (New well)	0	LS			50	40	33	28
	Pump, Motor and Valves	1	LS			205	189	178	169
	Switchboard	0	LS			0	0	0	0
1.2	**Macksville Sewerage Scheme**								
1.2.1	Opportunity M1 – Optimise Current STP operation and add a new reactor in parallel to the existing reactor in 2017								
	Initial Optimisation in 2011			$ 936,837		937	866	818	774
	New Reactor & Tertiary Filters in 2017	3,000	EP	$ 6,249,589		6,250	4,567	3,637	2,915
1.2.2	Macksville SPS2 in 2010	5	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			155	149	145	141
	Switchboard	0	LS			0	0	0	0
1.2.3	Macksville SPS3 in 2010	6	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			147	141	137	134
	Switchboard	0	LS			0	0	0	0
	Replace Rising main with 150mm PVC to SPS6	670	m	$113		76	73	71	69
1.2.4	Macksville SPS4 in 2010	15	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			200	192	187	182
	Switchboard	0	LS			0	0	0	0
	Replace Rising main with 200mm PVC to SPS8	440	m	$190		84	80	78	76
1.2.5	Macksville SPS8 in 2010	18	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			200	192	187	182
	Switchboard	0	LS			0	0	0	0
1.2.6	Macksville SPS9 in 2010	29	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			225	216	210	205
	Switchboard	0	LS			0	0	0	0
1.2.7	Macksville SPS10 in 2012	21	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			175	156	143	131
	Switchboard	0	LS			0	0	0	0
	Replace Rising main with 150mm PVC to SPS13	400	m	$113		45	40	37	34
1.2.8	Macksville SPS13 in 2010	18	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			160	154	150	145
	Switchboard	0	LS			0	0	0	0
	Replace Rising main with 200mm PVC to SPS4	290	m	$190		55	53	51	50
1.2.9	Macksville DCP 17 SPS in 2010	10	kW						
	Civil - (New Well)	1	LS			55	53	51	50
	Pump, Motor and Valves	1	LS			152	146	142	138
	Switchboard	1	LS			30	29	28	27
1.2.10	Macksville Nursing Home SPS in 2010	5	kW						
	Civil - (New Well)	1	LS			50	48	47	45
	Pump, Motor and Valves	1	LS			135	130	126	123
	Switchboard	1	LS			30	29	28	27
	100mm PVC Rising Main to SPS3	650	m	$86		56	54	52	51
1.2.11	Increased Emergency Storage at SPS 2	1	LS	$50,000		50	48	47	45
1.2.12	Increased Emergency Storage at SPS 3	1	LS	$50,000		50	48	47	45
1.3	**Scotts Head Sewerage Scheme**								
1.3.1	Opportunity SH3 – Upgrade existing STP capacity by 2,500 EP to 4,500 EP	4,500	EP						
	New Chemical Dosing Facility in 2010		LS	$ 308,542		309	309	309	309
	Stage 1 Reactor in 2011 & Upgrade Inlet Works	1,500	EP	$ 4,709,274		4,709	4,354	4,113	3,892
	Stage 2 Reactor in 2016	1,000	EP	$ 2,669,122		2,669	2,028	1,662	1,370
1.3.2	SH SPS1 in 2011	31	kW						
	Civil - (New Well)	0	LS			150	139	131	124
	Pump, Motor and Valves	1	LS			210	194	183	174
	Switchboard	0	LS			0	0	0	0
1.3.3	SH SPS8 in 2038	16	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			180	58	25	11
	Switchboard	0	LS			0	0	0	0
1.3.4	South SH Release SPS in 2016	8	kW						
	Civil - (New Well)	1	LS			175	133	109	90
	Pump, Motor and Valves	2	LS			147	112	92	75
	Switchboard	1	LS			30	23	19	15
	150mm PVC Rising Main to SPS8	713	m	$113		81	61	50	41
1.4	**Nambucca Heads Sewerage Scheme (Nambucca Heads)**								
1.4.1	Opportunity NH3 – Upgrade Nambucca Heads STP to 22,000 EP capacity	22,000	EP						
	New IDEA Reactor	10,000	EP	##########		17,181	16,520	16,057	15,619
	Additional IDEA Reactor in 2016	7,000	EP	$ 7,696,060		7,696	5,848	4,793	3,949
1.4.2	NH SPS1 in 2010	6	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			142	137	133	129
	Switchboard	0	LS			0	0	0	0
1.4.3	NH SPS2 in 2014	40	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			210	173	150	130
	Switchboard	0	LS			0	0	0	0
	250mm PVC Rising Main to SPS8	1,610	m	$245		394	324	281	245
1.4.4	NH SPS4 in 2016	88	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			310	236	193	159
	Switchboard	0	LS			0	0	0	0
1.4.5	NH SPS5 in 2010	2	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			119	114	111	108
	Switchboard	0	LS			0	0	0	0
1.4.6	NH SPS6 in 2010	17	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			175	168	164	159
	Switchboard	0	LS			0	0	0	0
1.4.7	NH SPS8 in 2010	87	kW						
	Civil - (New Well)	0	LS			102	98	95	93
	Pump, Motor and Valves	1	LS			350	337	327	318
	Switchboard	0	LS			0	0	0	0
1.4.8	NH SPS13 in 2012	11	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			152	135	124	114
	Switchboard	0	LS			0	0	0	0
	150mm PVC Rising Main to SPS2	380	m	$113		43	38	35	32
1.4.9	NH SPS14 in 2013	1	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			119	102	91	81
	Switchboard	0	LS			0	0	0	0
1.4.10	NH SPS15 in 2028	1	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			119	56	33	19
	Switchboard	0	LS			0	0	0	0
1.5	**Nambucca Heads Sewerage Scheme (Valla Beach)**								
1.5.1	VB SPS1 in 2010	16	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			180	173	168	164
	Switchboard	0	LS			0	0	0	0
	200mm PVC Rising Main to SPS2	990	m	$190		188	181	176	171
1.5.2	VB SPS5 in 2010	31	kW						
	Civil - (New Well)	0	LS			120	115	112	109
	Pump, Motor and Valves	1	LS			205	197	192	186
	Switchboard	0	LS			0	0	0	0
1.5.3	VB SPS6 in 2010	5	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			147	141	137	134
	Switchboard	0	LS			0	0	0	0
1.5.4	VB SPS7 (existing) in 2010	21	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			210	202	196	191
	Switchboard	0	LS			0	0	0	0
1.5.5	VB SPS7b (new) in 2016	31	kW						
	Civil - (New Well)	0	LS			241	183	150	124
	Pump, Motor and Valves	1	LS			181	137	113	93
	Switchboard	1	LS			60	46	37	31
	300mm PVC Rising Main to NH STP	1,350	m	$305		412	313	256	211
1.5.7	VB Urban Growth Area SPS7 in 2016	56	kW						
	Civil - (New Well)	1	LS			200	152	125	103
	Pump, Motor and Valves	2	LS			293	222	182	150
	Switchboard	1	LS			100	76	62	51
	300mm PVC Rising Main to VB SPS7	2,360	m	$305		3,360	2,553	2,092	1,724
2.0	Direct Cost					55,418	47,417	42,746	38,913
2.1	Contingency				20%	11,084	9,483	8,549	7,783
3.0	Construction Cost					66,502	56,900	51,295	46,695
3.1	Project Management and Engineering				20%	13,300	11,380	10,259	9,339
TOTAL CAPITAL COST						**79,803**	**68,280**	**61,554**	**56,034**
						79.8		61.6	
4.0	Operations & Maintenance Costs								
4.1	Power Consumption		c per kWh			8,202	3,919	2,577	1,858
4.2	Chemicals (Wastewater)		$/ML			5,276	2,515	1,647	1,181
4.3	LBL Costs					433	207	136	97
4.4	Labour Costs	0%	Operator	55,000		3,712	1,701	1,067	728
4.5	Maintenance Costs	see below	of Capex			22,812	10,600	6,719	4,622
4.6	Inflow / Infiltration Works					6,432	5,217	4,518	3,952
TOTAL O&M ANNUAL COST						**46,867**	**24,159**	**16,664**	**12,438**
								16.7	
TOTAL PRESENT WORTH						**126,669**	**92,439**	**78,218**	**68,472**

Integrated Scenario 1

• Wastewater Management

ITEM	DESCRIPTION	June '08 rates				COST	PRESENT WORTH		
						$K	4%	7%	10%
1.0	Direct Costs	Quantity	Unit	Rate ($/Unit)					
1.1	**Bowraville Sewerage Scheme**								
1.1.1	Option B3 - Optimise Bowraville STP operation until 2015, new 1,500 plant in 2015								
	Optimise Bowraville STP operation and dose with coagulant chemicals			$ 190,310		190	183	178	173
	Renew existing plant by constructing a new 1,500 EP STP in 2015 with a new wet-weather storage and appropriate buffer zones from residents	1,500	EP	$ 3,988,525		3,989	3,152	2,658	2,251
1.1.2	Bowraville SPS1	5	kW						
	Civil - (New well)	0	LS			50	40	33	28
	Pump, Motor and Valves	1	LS			205	189	178	169
	Switchboard	0	LS			0	0	0	0
1.2	**Macksville Sewerage Scheme**								
1.2.1	Opportunity M1 – Optimise Current STP operation and add a new reactor in parallel to the existing reactor in 2017								
	Initial Optimisation in 2011			$ 936,837		937	866	818	774
	New Reactor & Tertiary Filters in 2017	3,000	EP	$ 6,249,589		6,250	4,567	3,637	2,915
1.2.2	Macksville SPS2 in 2010	5	kW						
	Civil - (New Well)	1	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			155	149	145	141
	Switchboard	0	LS			0	0	0	0
1.2.3	Macksville SPS3 in 2010	6	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			147	141	137	134
	Switchboard	0	LS			0	0	0	0
	Replace Rising main with 150mm PVC to SPS6	670	m	$113		76	73	71	69
1.2.4	Macksville SPS4 in 2010	15	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			200	192	187	182
	Switchboard	0	LS			0	0	0	0
	Replace Rising main with 200mm PVC to SPS8	440	m	$190		84	80	78	76
1.2.5	Macksville SPS8 in 2010	18	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			200	192	187	182
	Switchboard	0	LS			0	0	0	0
1.2.6	Macksville SPS9 in 2010	29	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			225	216	210	205
	Switchboard	0	LS			0	0	0	0
1.2.7	Macksville SPS10 in 2012	21	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			175	156	143	131
	Switchboard	0	LS			0	0	0	0
	Replace Rising main with 150mm PVC to SPS13	400	m	$113		45	40	37	34
1.2.8	Macksville SPS13 in 2010	18	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			160	154	150	145
	Switchboard	0	LS			0	0	0	0
	Replace Rising main with 200mm PVC to SPS4	290	m	$190		55	53	51	50
1.2.9	Macksville DCP 17 SPS in 2010	10	kW						
	Civil - (New Well)	1	LS			55	53	51	50
	Pump, Motor and Valves	1	LS			152	146	142	138
	Switchboard	1	LS			30	29	28	27
1.2.10	Macksville Nursing Home SPS in 2010	5	kW						
	Civil - (New Well)	1	LS			50	48	47	45
	Pump, Motor and Valves	1	LS			135	130	126	123
	Switchboard	1	LS			30	29	28	27
	100mm PVC Rising Main to SPS3	650	m	$86		56	54	52	51
1.2.11	Increased Emergency Storage at SPS 2	1	LS	$50,000		50	48	47	45
1.2.12	Increased Emergency Storage at SPS 3	1	LS	$50,000		50	48	47	45
1.3	**Scotts Head Sewerage Scheme**								
1.3.1	Opportunity SH3 – Upgrade existing STP capacity by 2,500 EP to 4,500 EP	4,500	EP						
	New Chemical Dosing Facility in 2010		LS	$ 308,542		309	297	288	280
	Stage 1 Reactor in 2011 & Upgrade Inlet Works	1,500	EP	$ 4,709,274		4,401	4,069	3,844	3,637
	Stage 2 Reactor in 2016	1,000	EP	$ 2,669,122		2,669	2,028	1,662	1,370
1.3.2	SH SPS1 in 2011	31	kW						
	Civil - (New Well)	0	LS			150	139	131	124
	Pump, Motor and Valves	1	LS			210	194	183	174
	Switchboard	0	LS			0	0	0	0
1.3.3	SH SPS8 in 2038	16	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			180	58	25	11
	Switchboard	0	LS			0	0	0	0
1.3.3	South SH Release SPS in 2016	8	kW						
	Civil - (New Well)	0	LS			175	133	109	90
	Pump, Motor and Valves	1	LS			147	112	92	75
	Switchboard	0	LS			30	23	19	15
	150mm PVC Rising Main to SPS8	713	m	$113		81	61	50	41
1.4	**Nambucca Heads Sewerage Scheme (Nambucca Heads)**								
1.4.1	Opportunity NH3 – Upgrade Nambucca Heads STP to 22,000 EP capacity	22,000	EP						
	New IDEA Reactor	10,000	EP	##########		17,181	16,520	16,057	15,619
	Additional IDEA Reactor in 2016	7,000	EP	$ 7,696,060		7,696	5,848	4,793	3,949
1.4.2	NH SPS1 in 2010	6	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			142	137	133	129
	Switchboard	0	LS			0	0	0	0
1.4.3	NH SPS2 in 2014	40	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			210	173	150	130
	Switchboard	0	LS			0	0	0	0
	250mm PVC Rising Main to SPS8	1,610	m	$245		394	324	281	245
1.4.4	NH SPS4 in 2016	88	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			310	236	193	159
	Switchboard	0	LS			0	0	0	0
1.4.5	NH SPS5 in 2010	2	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			119	114	111	108
	Switchboard	0	LS			0	0	0	0
1.4.6	NH SPS6 in 2010	17	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			175	168	164	159
	Switchboard	0	LS			0	0	0	0
1.4.7	NH SPS8 in 2010	87	kW						
	Civil - (New Well)	0	LS			102	98	95	93
	Pump, Motor and Valves	1	LS			350	337	327	318
	Switchboard	0	LS			0	0	0	0
1.4.8	NH SPS13 in 2012	11	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			152	135	124	114
	Switchboard	0	LS			0	0	0	0
	150mm PVC Rising Main to SPS2	380	m	$113		43	38	35	32
1.4.9	NH SPS14 in 2013	1	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			119	102	91	81
	Switchboard	0	LS			0	0	0	0
1.4.10	NH SPS15 in 2028	1	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			119	56	33	19
	Switchboard	0	LS			0	0	0	0
1.5	**Nambucca Heads Sewerage Scheme (Valla Beach)**								
1.5.1	VB SPS1 in 2010	17	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			180	173	168	164
	Switchboard	0	LS			0	0	0	0
	200mm PVC Rising Main to SPS2	990	m	$190		188	181	176	171
1.5.2	VB SPS5 in 2010	31	kW						
	Civil - (New Well)	0	LS			120	115	112	109
	Pump, Motor and Valves	1	LS			205	197	192	186
	Switchboard	0	LS			0	0	0	0
1.5.3	VB SPS6 in 2010	5	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			147	141	137	134
	Switchboard	0	LS			0	0	0	0
1.5.4	VB SPS7 (existing) in 2010	21	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			210	202	196	191
	Switchboard	0	LS			0	0	0	0
1.5.5	VB SPS7b (new) in 2016	31	kW						
	Civil - (New Well)	0	LS			241	183	150	124
	Pump, Motor and Valves	1	LS			181	137	113	93
	Switchboard	1	LS			60	46	37	31
	300mm PVC Rising Main to NH STP	1,350	m	$305		412	313	256	211
1.5.7	VB Urban Growth Area SPS7 in 2016	56	kW						
	Civil - (New Well)	1	LS			80	61	50	41
	Pump, Motor and Valves	2	LS			255	194	159	131
	Switchboard	1	LS			30	23	19	15
	300mm PVC Rising Main to VB SPS7	2,360	m	$305		2,920	2,219	1,818	1,498
2.0	**Direct Cost**					54,442	46,612	42,041	38,287
2.1	Contingency				20%	10,888	9,322	8,408	7,657
3.0	**Construction Cost**					65,331	55,935	50,449	45,945
3.1	Project Management and Engineering				20%	13,066	11,187	10,090	9,189
TOTAL CAPITAL COST						**78,397**	**67,122**	**60,539**	**55,133**
						78.4		60.5	
4.0	**Operations & Maintenance Costs**								
4.1	Power Consumption		c per kWh			8,171	3,905	2,569	1,853
4.2	Chemicals (Wastewater)		$/ML			5,276	2,515	1,647	1,181
4.3	LBL Costs					433	207	136	97
4.4	Labour Costs	0%	Operator	55,000		3,712	1,701	1,067	728
4.5	Maintenance Costs	see below	of Capex			24,961	11,629	7,387	5,092
4.6	Inflow / Infiltration Works					6,432	5,217	4,518	3,952
TOTAL O&M ANNUAL COST						**48,985**	**25,174**	**17,323**	**12,902**
								17.3	
TOTAL PRESENT WORTH						**127,382**	**92,296**	**77,862**	**68,036**

Integrated Scenario 2

• Wastewater Management

ITEM	DESCRIPTION	June '08 rates				COST	PRESENT WORTH		
						$K	4%	7%	10%
1.0	**Direct Costs**	Quantity	Unit	Rate ($/Unit)					
1.1	**Bowraville Sewerage Scheme**								
1.1.1	Option B3 - Optimise Bowraville STP operation until 2015, new 1,500 plant in 2015								
	Optimise Bowraville STP operation and dose with coagulant chemicals			$ 190,310		190	183	178	173
	Construct new 1,500 EP STP in 2015 with a new wet-weather storage and appropriate buffer zones from residents	1,500	EP	$ 3,988,525		3,989	3,152	2,658	2,251
1.1.2	Bowraville SPS1	0	kW						
	Civil - (New well)	0	LS			0	0	0	0
	Pump, Motor and Valves	0	LS			50	40	33	28
	Switchboard	0	LS			0	0	0	0
1.2	**Macksville Sewerage Scheme**								
1.2.1	Opportunity M1 – Optimise Current STP operation and add a new reactor in parallel to the existing reactor in 2017								
	Initial Optimisation in 2011			$ 936,837		937	866	818	774
	New Reactor in 2017	3,000	EP	$ 4,249,589		4,250	3,105	2,473	1,982
1.2.2	Reuse to Regenerate Gumma Wetland in 2011	1	LS	$ 2,250,000		2,250	2,080	1,965	1,860
1.2.3	Macksville SPS2 in 2010	5	kW						
	Civil - (New Well)	1	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			155	149	145	141
	Switchboard	0	LS			0	0	0	0
1.2.3	Macksville SPS3 in 2010	5	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			140	135	131	127
	Switchboard	0	LS			0	0	0	0
	Replace Rising main with 150mm PVC to SPS6	670	m	$113		76	73	71	69
1.2.4	Macksville SPS4 in 2010	14	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			200	192	187	182
	Switchboard	0	LS			0	0	0	0
	Replace Rising main with 200mm PVC to SPS8	440	m	$190		84	80	78	76
1.2.5	Macksville SPS8 in 2010	17	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			200	192	187	182
	Switchboard	0	LS			0	0	0	0
1.2.6	Macksville SPS9 in 2010	29	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			225	216	210	205
	Switchboard	0	LS			0	0	0	0
1.2.7	Macksville SPS10 in 2012	20	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			175	156	143	131
	Switchboard	0	LS			0	0	0	0
	Replace Rising main with 150mm PVC to SPS13	400	m	$113		45	40	37	34
1.2.8	Macksville SPS13 in 2010	17	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			160	154	150	145
	Switchboard	0	LS			0	0	0	0
	Replace Rising main with 200mm PVC to SPS4	290	m	$190		55	53	51	50
1.2.9	Macksville DCP 17 SPS in 2010	10	kW						
	Civil - (New Well)	1	LS			55	53	51	50
	Pump, Motor and Valves	1	LS			152	146	142	138
	Switchboard	1	LS			30	29	28	27
1.2.10	Macksville Nursing Home SPS in 2010	5	kW						
	Civil - (New Well)	1	LS			50	48	47	45
	Pump, Motor and Valves	1	LS			135	130	126	123
	Switchboard	1	LS			30	29	28	27
	100mm PVC Rising Main to SPS3	650	m	$86		56	54	52	51
1.2.11	Increased Emergency Storage at SPS 2	1	LS	$50,000		50	48	47	45
1.2.12	Increased Emergency Storage at SPS 3	1	LS	$50,000		50	48	47	45
1.3	**Scotts Head Sewerage Scheme**								
1.3.1	Opportunity SH3 – Upgrade existing STP capacity by 2,500 EP to 4,500 EP	4,500	EP						
	New Chemical Dosing Facility in 2010		LS	$ 308,542		309	297	288	280
	Stage 1 Reactor in 2011	1,500	EP	$ 4,786,129		4,478	4,140	3,911	3,700
	Stage 2 Reactor in 2016	1,000	EP	$ 2,669,122		2,669	2,028	1,662	1,370
1.3.2	SH SPS1 in 2011	30	kW						
	Civil - (New Well)	1	LS			150	139	131	124
	Pump, Motor and Valves	1	LS			210	194	183	174
	Switchboard	0	LS			0	0	0	0
1.3.3	SH SPS8 in 2038	16	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			175	56	25	11
	Switchboard	0	LS			0	0	0	0
1.3.3	South SH Release SPS in 2016	8	kW						
	Civil - (New Well)	1	LS			175	133	109	90
	Pump, Motor and Valves	1	LS			147	112	92	75
	Switchboard	0	LS			30	23	19	15
	150mm PVC Rising Main to SPS8	713	m	$113		81	61	50	41
1.4	**Nambucca Heads Sewerage Scheme (Nambucca Heads)**								
1.4.1	Opportunity NH3 – Upgrade Nambucca Heads STP to 22,000 EP capacity	22,000	EP						
	New IDEA Reactor	10,000	EP	$17,181,000		17,181	16,520	16,057	15,619
	Additional IDEA Reactor in 2016	7,000	EP	$ 7,696,060		7,696	5,848	4,793	3,949
1.4.2	NH SPS1 in 2010	6	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			142	137	133	129
	Switchboard	0	LS			0	0	0	0
1.4.3	NH SPS2 in 2016	34	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			210	160	131	108
	Switchboard	0	LS			0	0	0	0
	250mm PVC Rising Main to SPS8	1,610	m	$245		394	300	246	202
1.4.4	NH SPS4 in 2017	83	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			310	227	180	145
	Switchboard	0	LS			0	0	0	0
1.4.5	NH SPS5 in 2010	2	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			119	114	111	108
	Switchboard	0	LS			0	0	0	0
1.4.6	NH SPS6 in 2010	17	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			175	168	164	159
	Switchboard	0	LS			0	0	0	0
1.4.7	NH SPS8 in 2010	86	kW						
	Civil - (New Well)	0	LS			102	98	95	93
	Pump, Motor and Valves	1	LS			350	337	327	318
	Switchboard	0	LS			0	0	0	0
1.4.8	NH SPS13 in 2012	8	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			147	131	120	110
	Switchboard	0	LS			0	0	0	0
	150mm PVC Rising Main to SPS2	380	m	$113		43	38	35	32
1.4.9	NH SPS14 in 2013	1	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			119	102	91	81
	Switchboard	0	LS			0	0	0	0
1.4.10	NH SPS15 in 2028	1	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			119	56	33	19
	Switchboard	0	LS			0	0	0	0
1.5	**Nambucca Heads Sewerage Scheme (Valla Beach)**								
1.5.1	VB SPS1 in 2010	16	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			180	173	168	164
	Switchboard	0	LS			0	0	0	0
	200mm PVC Rising Main to SPS2	990	m	$190		188	181	176	171
1.5.2	VB SPS5 in 2010	14	kW						
	Civil - (New Well)	0	LS			120	115	112	109
	Pump, Motor and Valves	1	LS			160	154	150	145
	Switchboard	0	LS			0	0	0	0
1.5.3	VB SPS6 in 2010	4	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			140	135	131	127
	Switchboard	0	LS			0	0	0	0
1.5.4	VB SPS7 (existing) in 2010	17	kW						
	Civil - (New Well)	0	LS			0	0	0	0
	Pump, Motor and Valves	1	LS			180	173	168	164
	Switchboard	0	LS			0	0	0	0
1.5.5	VB SPS7b (new) in 2016	31	kW						
	Civil - (New Well)	0	LS			241	183	150	124
	Pump, Motor and Valves	1	LS			181	137	113	93
	Switchboard	1	LS			60	46	37	31
	300mm PVC Rising Main to NH STP	1,350	m	$305		412	313	256	211
1.5.7	VB Urban Growth Area SPS in 2016	56	kW						
	Civil - (New Well)	1	LS			80	61	50	41
	Pump, Motor and Valves	2	LS			255	194	159	131
	Switchboard	1	LS			30	23	19	15
	300mm PVC Rising Main to VB SPS7	2,360	m	$305		2,920	2,219	1,818	1,498
2.0	**Direct Cost**					54,465	46,975	42,576	38,943
2.1	Contingency				20%	10,893	9,395	8,515	7,789
3.0	**Construction Cost**					65,358	56,371	51,091	46,732
3.1	Project Management and Engineering				20%	13,072	11,274	10,218	9,346
TOTAL CAPITAL COST						**78,430**	**67,645**	**61,309**	**56,078**
						78.4		61.3	
4.0	**Operations & Maintenance Costs**								
4.1	Power Consumption		c per kWh			7,924	3,789	2,494	1,800
4.2	Chemicals (Wastewater)		$/ML			5,276	2,515	1,647	1,181

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Integrated Scenario 3

• Wastewater Management

ITEM	DESCRIPTION	June '08 rates			COST	PRESENT WORTH		
					$K	4%	7%	10%
1.0	Direct Costs	Quantity	Unit	Rate ($/Unit)				
1.1	**Bowraville Sewerage Scheme**							
1.1.1	Option B3 - Optimise Bowraville STP operation until 2015, new 1,500 plant in 2015							
	Optimise Bowraville STP operation and dose with coagulant chemicals			$ 190,310	190	183	178	173
	Construct new 1,500 EP STP in 2015 with a new wet-weather storage and appropriate buffer zones from residents	1,500	EP	$ 3,988,525	3,989	3,152	2,658	2,251
1.1.2	Bowraville SPS1	0	kW					
	Civil - (New well)	0	LS		0	0	0	0
	Pump, Motor and Valves	0	LS		50	40	33	28
	Switchboard	0	LS		0	0	0	0
1.2	**Macksville Sewerage Scheme**							
1.2.1	Opportunity M1 – Optimise Current STP operation and add a new reactor in parallel to the existing reactor in 2017							
	Initial Optimisation in 2011			$ 936,837	937	866	818	774
	New Reactor & Tertiary Filters in 2017	3,000	EP	$ 6,249,589	6,250	4,567	3,637	2,915
1.2.3	Macksville SPS2 in 2010	5	kW					
	Civil - (New Well)	1	LS		0	0	0	0
	Pump, Motor and Valves	1	LS		155	149	145	141
	Switchboard	0	LS		0	0	0	0
1.2.3	Macksville SPS3 in 2010	5	kW					
	Civil - (New Well)	0	LS		0	0	0	0
	Pump, Motor and Valves	1	LS		140	135	131	127
	Switchboard	0	LS		0	0	0	0
	Replace Rising main with 150mm PVC to SPS6	670	m	$113	76	73	71	69
1.2.4	Macksville SPS4 in 2010	14	kW					
	Civil - (New Well)	0	LS		0	0	0	0
	Pump, Motor and Valves	1	LS		200	192	187	182
	Switchboard	0	LS		0	0	0	0
	Replace Rising main with 200mm PVC to SPS8	440	m	$190	84	80	78	76
1.2.5	Macksville SPS8 in 2010	17	kW					
	Civil - (New Well)	0	LS		0	0	0	0
	Pump, Motor and Valves	1	LS		200	192	187	182
	Switchboard	0	LS		0	0	0	0
1.2.6	Macksville SPS9 in 2010	29	kW					
	Civil - (New Well)	0	LS		0	0	0	0
	Pump, Motor and Valves	1	LS		225	216	210	205
	Switchboard	0	LS		0	0	0	0
1.2.7	Macksville SPS10 in 2012	20	kW					
	Civil - (New Well)	0	LS		0	0	0	0
	Pump, Motor and Valves	1	LS		175	156	143	131
	Switchboard	0	LS		0	0	0	0
	Replace Rising main with 150mm PVC to SPS13	400	m	$113	45	40	37	34
1.2.8	Macksville SPS13 in 2010	17	kW					
	Civil - (New Well)	0	LS		0	0	0	0
	Pump, Motor and Valves	1	LS		160	154	150	145
	Switchboard	0	LS		0	0	0	0
	Replace Rising main with 200mm PVC to SPS4	290	m	$190	55	53	51	50
1.2.9	Macksville DCP 17 SPS in 2010	10	kW					
	Civil - (New Well)	1	LS		55	53	51	50
	Pump, Motor and Valves	1	LS		152	146	142	138
	Switchboard	1	LS		30	29	28	27
1.2.10	Macksville Nursing Home SPS in 2010	5	kW					
	Civil - (New Well)	1	LS		50	48	47	45
	Pump, Motor and Valves	1	LS		135	130	126	123
	Switchboard	1	LS		30	29	28	27
	100mm PVC Rising Main to SPS3	650	m	$86	56	54	52	51
1.2.11	Increased Emergency Storage at SPS 2	1	LS	$50,000	50	48	47	45
1.2.12	Increased Emergency Storage at SPS 3	1	LS	$50,000	50	48	47	45
1.3	**Scotts Head Sewerage Scheme**							
1.3.1	Opportunity SH1 – Urban Reuse 1 (Treatment enhancement of SH STP through chemical dosing)	4,500	EP					
	New Chemical Dosing Facility		LS	$ 308,542	309	297	288	280
	New Reactor in 2012	1,500	EP	$ 4,786,129	4,786	4,255	3,907	3,596
1.3.2	Opportunity SH1 – Urban Reuse 1 (New Sewer Mining Plant for Reuse)							
	New Sewer Mining Plant in 2016	1,000	EP	$ 4,875,109	4,875	3,705	3,036	2,502
	New CWT	Costed in Headworks NPV			0	0	0	0
1.3.3	SH SPS1 in 2011	29	kW					
	Civil - (New Well)	0	LS		150	139	131	124
	Pump, Motor and Valves	1	LS		200	185	175	165
	Switchboard	0	LS		0	0	0	0
1.3.4	SH SPS8 in 2038	16	kW					
	Civil - (New Well)	0	LS		0	0	0	0
	Pump, Motor and Valves	1	LS		175	56	25	11
	Switchboard	0	LS		0	0	0	0
1.3.5	South SH Release SPS in 2016	8	kW					
	Civil - (New Well)	0	LS		175	133	109	90
	Pump, Motor and Valves	2	LS		147	112	92	75
	Switchboard	0	LS		30	23	19	15
	100mm PVC Rising Main to MBR	300	m	$86	26	20	16	13
	150mm PVC Rising Main to SPS8	720	m	$113	81	62	51	42
1.4	**Nambucca Heads Sewerage Scheme (Nambucca Heads)**							
1.4.1	Opportunity NH1 – Urban Reuse 1 (Treatment enhancement of SH STP through chemical dosing)							
	New Reactor in 2010	10,000	EP	$17,181,000	17,181	16,520	16,057	15,619
	Upgrade Inlet Works in 2016		LS	20,000	20	15	12	10
	Additional IDEA Reactor in 2028	3,000	EP	$ 5,464,253	5,464	2,594	1,511	893
1.4.2	Opportunity NH1 – New Sewer Mining Plant for Valla Urban Growth Area							
	New Sewer Mining Plant in 2016	4,000	EP	$ 8,166,728	8,167	6,206	5,086	4,191
	New CWT	Costed in Headworks NPV			0	0	0	0
1.4.2	NH SPS1 in 2010	6	kW					
	Civil - (New Well)	0	LS		0	0	0	0
	Pump, Motor and Valves	1	LS		142	137	133	129
	Switchboard	0	LS		0	0	0	0
1.4.3	NH SPS2 in 2016	34	kW					
	Civil - (New Well)	0	LS		0	0	0	0
	Pump, Motor and Valves	1	LS		210	160	131	108
	Switchboard	0	LS		0	0	0	0
	250mm PVC Rising Main to SPS4	1,610	m	$245	394	300	246	202
1.4.4	NH SPS4 in 2017	83	kW					
	Civil - (New Well)	0	LS		0	0	0	0
	Pump, Motor and Valves	1	LS		310	227	180	145
	Switchboard	0	LS		0	0	0	0
1.4.5	NH SPS5 in 2010	2	kW					
	Civil - (New Well)	0	LS		0	0	0	0
	Pump, Motor and Valves	1	LS		119	114	111	108
	Switchboard	0	LS		0	0	0	0
1.4.6	NH SPS6 in 2010	17	kW					
	Civil - (New Well)	0	LS		0	0	0	0
	Pump, Motor and Valves	1	LS		175	168	164	159
	Switchboard	0	LS		0	0	0	0
1.4.7	NH SPS8 in 2010	86	kW					
	Civil - (New Well)	0	LS		102	98	95	93
	Pump, Motor and Valves	1	LS		350	337	327	318
	Switchboard	0	LS		0	0	0	0
1.4.8	NH SPS13 in 2012	8	kW					
	Civil - (New Well)	0	LS		0	0	0	0
	Pump, Motor and Valves	1	LS		147	131	120	110
	Switchboard	0	LS		0	0	0	0
	150mm PVC Rising Main to SPS2	380	m	$113	43	38	35	32
1.4.9	NH SPS14 in 2013	1	kW					
	Civil - (New Well)	0	LS		0	0	0	0
	Pump, Motor and Valves	1	LS		119	102	91	81
	Switchboard	0	LS		0	0	0	0
1.4.10	NH SPS15 in 2028	1	kW					
	Civil - (New Well)	0	LS		0	0	0	0
	Pump, Motor and Valves	1	LS		119	56	33	19
	Switchboard	0	LS		0	0	0	0
1.5	**Nambucca Heads Sewerage Scheme (Valla Beach)**							
1.5.1	VB SPS1 in 2010	15	kW					
	Civil - (New Well)	0	LS		0	0	0	0
	Pump, Motor and Valves	1	LS		180	173	168	164
	Switchboard	0	LS		0	0	0	0
	200mm PVC Rising Main to SPS2	990	m	$190	188	181	176	171
1.5.2	VB SPS5 in 2010	14	kW					
	Civil - (New Well)	0	LS		120	115	112	109
	Pump, Motor and Valves	1	LS		160	154	150	145
	Switchboard	0	LS		0	0	0	0
1.5.3	VB SPS6 in 2010	4	kW					
	Civil - (New Well)	0	LS		0	0	0	0
	Pump, Motor and Valves	1	LS		147	141	137	134
	Switchboard	0	LS		0	0	0	0
1.5.4	VB SPS7 (existing) in 2010	16	kW					
	Civil - (New Well)	0	LS		0	0	0	0
	Pump, Motor and Valves	1	LS		180	173	168	164
	Switchboard	0	LS		0	0	0	0
1.5.5	VB SPS7b (new) in 2016	22	kW					
	Civil - (New Well)	0	LS		210	160	131	108
	Pump, Motor and Valves	1	LS		130	99	81	67
	Switchboard	1	LS		30	23	19	15
	300mm PVC Rising Main to NH STP	1,350	m	$305	412	313	256	211
1.5.7	VB Urban Growth Area SPS in 2016	53	kW					
	Civil - (New Well)	1	LS		80	61	50	41
	Pump, Motor and Valves	2	LS		255	194	159	131
	Switchboard	1	LS		30	23	19	15
	150mm PVC Rising Main to BC MBR Plant	340	m	$113	38	29	24	20
	250mm PVC Rising Main to VB SPS7 Plant	2,360	m	$245	2,778	2,111	1,730	1,426
2.0	Direct Cost				62,493	50,969	44,841	40,091

D.3 Stormwater NPV

Integrated Scenario 1

• Stormwater Management

ITEM	DESCRIPTION	June '08 rates Quantity	Unit	Rate ($/Unit)		COST $K	PRESENT WORTH 4%	7%	10%
1.0	Direct Costs								
1.1	Bowraville Stormwater System								
1.1.1	-					0	0	0	0
1.2	Macksville Stormwater System								
1.2.1	-					0	0	0	0
1.3	Scotts Head Stormwater System								
1.3.1	-					0	0	0	0
1.4	Nambucca Heads Stormwater System								
1.4.1	-					0	0	0	0
1.5	Valla Beach Stormwater System								
1.5.1	-					0	0	0	0
2.0	Direct Cost					0	0	0	0
2.1	Contingency				20%	0	0	0	0
3.0	Construction Cost					0	0	0	0
3.1	Project Management and Engineering				20%	0	0	0	0
TOTAL CAPITAL COST						0	0	0	0
4.0	Operations & Maintenance Costs								
4.1	Power Consumption		c per kWh			0	0	0	0
4.2	Chemicals					0	0	0	0
4.4	Labour Costs		Operator			0	0	0	0
4.5	Maintenance Costs	see below	of Capex			0	0	0	0
4.6	Street Sweeping					18,060	9,294	6,441	4,857
TOTAL O&M ANNUAL COST						18,060	9,294	6,441	4,857
TOTAL PRESENT WORTH						18,060	9,294	6,441	4,857

EXPENDITURE, YEAR BEGINNING JULY

ITEM	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
1.1.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.3.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.4.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.5.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.0 Direct Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.1 Contingency	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.0 Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.1 Project Management and Engineering	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL CAPITAL COST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.1 Power Consumption	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.2 Chemicals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.4 Labour Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.5 Maintenance Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.6 Street Sweeping	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452
TOTAL O&M ANNUAL COST	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452
TOTAL PRESENT WORTH	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452

ITEM	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
1.1.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.3.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.4.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.5.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.0 Direct Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.1 Contingency	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.0 Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.1 Project Management and Engineering	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL CAPITAL COST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.1 Power Consumption	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.2 Chemicals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.4 Labour Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.5 Maintenance Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.6 Street Sweeping	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452
TOTAL O&M ANNUAL COST	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452
TOTAL PRESENT WORTH	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452	452

Integrated Scenario 2

• Stormwater Management

ITEM	DESCRIPTION	June '08 rates Quantity	Unit	Rate ($/Unit)		COST $K	PRESENT WORTH 4%	7%	10%
1.0	Direct Costs								
1.1	Bowraville Stormwater System								
1.1.1	-					0	0	0	0
1.2	Macksville Stormwater System								
1.2.1	Hughs Creek Built Measures								
	Gross Pollutant Traps					601	337	250	202
	Sediment Traps					527	295	219	177
1.3	Scotts Head Stormwater System								
1.3.1	Forsters Beach Built Measures								
	Gross Pollutant Traps					227	127	94	76
	Sediment Traps					163	91	68	55
1.4	Nambucca Heads Stormwater System								
1.4.1	Merry Park Built Measures								
	Infiltration Systems					2,448	1,494	1,162	974
	Pit Inserts					289	161	118	93
	Gross Pollutant Traps					126	71	53	42
1.4.2	Seaview St Built Measures								
	Infiltration Systems					1,807	1,102	858	719
1.4.3	Beer Creek Built Measures								
	Infiltration Systems					2,100	1,281	997	836
	Pit Inserts					265	147	108	85
1.4.4	Coronation Park Built Measures								
	Infiltration Systems					1,084	661	514	431
	Pit Inserts					176	98	71	57
	Gross Pollutant Traps					45	25	19	15
1.5	Valla Beach Stormwater System								
1.5.1	Kuta Road Built Measures								
	Pit Inserts					314	174	127	101
	Gross Pollutant Traps					196	110	82	66
	Sediment Traps					167	94	70	56
2.0	Direct Cost					10,535	6,269	4,808	3,986
2.1	Contingency				20%	2,107	1,254	962	797
3.0	Construction Cost					12,642	7,522	5,770	4,783
3.1	Project Management and Engineering				20%	2,528	1,504	1,154	957
TOTAL CAPITAL COST						**15,170**	**9,027**	**6,924**	**5,740**
4.0	Operations & Maintenance Costs								
4.1	Power Consumption		c per kWh			0	0	0	0
4.2	Chemicals					0	0	0	0
4.4	Labour Costs		Operator			0	0	0	0
4.5	Maintenance Costs	see below	of Capex			4,689	2,355	1,595	1,173
4.6	Street Sweeping					26,914	13,850	9,598	7,238
TOTAL O&M ANNUAL COST						31,603	16,205	11,193	8,411

EXPENDITURE, YEAR BEGINNING JULY

ITEM	DESCRIPTION	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
1.1.1	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.2.1	Gross Pollutant Traps	100	0	0	0	0	0	0	100	0	0	0	0	0	0	100	0	0	0	0	0
1.2.1	Sediment Traps	88	0	0	0	0	0	0	88	0	0	0	0	0	0	88	0	0	0	0	0
1.3.1	Gross Pollutant Traps	38	0	0	0	0	0	0	38	0	0	0	0	0	0	38	0	0	0	0	0
1.3.1	Sediment Traps	27	0	0	0	0	0	0	27	0	0	0	0	0	0	27	0	0	0	0	0
1.4.1	Infiltration Systems	612	0	0	0	0	0	0	0	0	0	612	0	0	0	0	0	0	0	0	0
1.4.1	Pit Inserts	36	0	0	0	0	36	0	0	0	0	36	0	0	0	0	36	0	0	0	0
1.4.1	Gross Pollutant Traps	21	0	0	0	0	0	0	21	0	0	0	0	0	0	21	0	0	0	0	0
1.4.2	Infiltration Systems	452	0	0	0	0	0	0	0	0	0	452	0	0	0	0	0	0	0	0	0
1.4.3	Infiltration Systems	525	0	0	0	0	0	0	0	0	0	525	0	0	0	0	0	0	0	0	0
1.4.3	Pit Inserts	33	0	0	0	0	33	0	0	0	0	33	0	0	0	0	33	0	0	0	0
1.4.4	Infiltration Systems	271	0	0	0	0	0	0	0	0	0	271	0	0	0	0	0	0	0	0	0
1.4.4	Pit Inserts	22	0	0	0	0	22	0	0	0	0	22	0	0	0	0	22	0	0	0	0
1.4.4	Gross Pollutant Traps	7	0	0	0	0	0	0	7	0	0	0	0	0	0	7	0	0	0	0	0
1.5.1	Pit Inserts	39	0	0	0	0	39	0	0	0	0	39	0	0	0	0	39	0	0	0	0
1.5.1	Gross Pollutant Traps	33	0	0	0	0	0	0	33	0	0	0	0	0	0	33	0	0	0	0	0
1.5.1	Sediment Traps	28	0	0	0	0	0	0	28	0	0	0	0	0	0	28	0	0	0	0	0
2.0	Direct Cost	2,332	0	0	0	0	130	0	342	0	0	1,990	0	0	0	342	130	0	0	0	0
2.1	Contingency	466	0	0	0	0	26	0	68	0	0	398	0	0	0	68	26	0	0	0	0
3.0	Construction Cost	2,799	0	0	0	0	157	0	410	0	0	2,388	0	0	0	410	157	0	0	0	0
3.1	Project Management and Engineering	560	0	0	0	0	31	0	82	0	0	478	0	0	0	82	31	0	0	0	0
TOTAL CAPITAL COST		**3,359**	**0**	**0**	**0**	**0**	**188**	**0**	**492**	**0**	**0**	**2,866**	**0**	**0**	**0**	**492**	**188**	**0**	**0**	**0**	**0**
4.1	Power Consumption	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.2	Chemicals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.4	Labour Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.5	Maintenance Costs	0	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
4.6	Street Sweeping	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673
TOTAL O&M ANNUAL COST		673	793	793	793	793	793	793	793	793	793	793	793	793	793	793	793	793	793	793	793

ITEM	DESCRIPTION	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
1.1.1	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.2.1	Gross Pollutant Traps	0	100	0	0	0	0	0	0	100	0	0	0	0	0	0	100	0	0	0	0
1.2.1	Sediment Traps	0	88	0	0	0	0	0	0	88	0	0	0	0	0	0	88	0	0	0	0
1.3.1	Gross Pollutant Traps	0	38	0	0	0	0	0	0	38	0	0	0	0	0	0	38	0	0	0	0
1.3.1	Sediment Traps	0	27	0	0	0	0	0	0	27	0	0	0	0	0	0	27	0	0	0	0
1.4.1	Infiltration Systems	612	0	0	0	0	0	0	0	0	0	612	0	0	0	0	0	0	0	0	0
1.4.1	Pit Inserts	36	0	0	0	0	36	0	0	0	0	36	0	0	0	0	36	0	0	0	0
1.4.1	Gross Pollutant Traps	0	21	0	0	0	0	0	0	21	0	0	0	0	0	0	21	0	0	0	0
1.4.2	Infiltration Systems	452	0	0	0	0	0	0	0	0	0	452	0	0	0	0	0	0	0	0	0
1.4.3	Infiltration Systems	525	0	0	0	0	0	0	0	0	0	525	0	0	0	0	0	0	0	0	0
1.4.3	Pit Inserts	33	0	0	0	0	33	0	0	0	0	33	0	0	0	0	33	0	0	0	0
1.4.4	Infiltration Systems	271	0	0	0	0	0	0	0	0	0	271	0	0	0	0	0	0	0	0	0
1.4.4	Pit Inserts	22	0	0	0	0	22	0	0	0	0	22	0	0	0	0	22	0	0	0	0
1.4.4	Gross Pollutant Traps	0	7	0	0	0	0	0	0	7	0	0	0	0	0	0	7	0	0	0	0
1.5.1	Pit Inserts	39	0	0	0	0	39	0	0	0	0	39	0	0	0	0	39	0	0	0	0
1.5.1	Gross Pollutant Traps	0	33	0	0	0	0	0	0	33	0	0	0	0	0	0	33	0	0	0	0
1.5.1	Sediment Traps	0	28	0	0	0	0	0	0	28	0	0	0	0	0	0	28	0	0	0	0
2.0	Direct Cost	1,990	342	0	0	0	130	0	0	342	0	1,990	0	0	0	0	472	0	0	0	0
2.1	Contingency	398	68	0	0	0	26	0	0	68	0	398	0	0	0	0	94	0	0	0	0
3.0	Construction Cost	2,388	410	0	0	0	157	0	0	410	0	2,388	0	0	0	0	567	0	0	0	0
3.1	Project Management and Engineering	478	82	0	0	0	31	0	0	82	0	478	0	0	0	0	113	0	0	0	0
TOTAL CAPITAL COST		**2,866**	**492**	**0**	**0**	**0**	**188**	**0**	**0**	**492**	**0**	**2,866**	**0**	**0**	**0**	**0**	**680**	**0**	**0**	**0**	**0**
4.1	Power Consumption	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.2	Chemicals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.4	Labour Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.5	Maintenance Costs	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
4.6	Street Sweeping	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673
TOTAL O&M ANNUAL COST		793	793	793	793	793	793	793	793	793	793	793	793	793	793	793	793	793	793	793	793

Integrated Scenario 3

• Stormwater Management

ITEM	DESCRIPTION	June '08 rates				COST	PRESENT WORTH			EXPENDITURE, YEAR BEGINNING JULY																																							
						$K	4%	7%	10%	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
1.0	Direct Costs	Quantity	Unit	Rate ($/Unit)																																													
	1.1 Bowraville Stormwater System																																																
1.1.1	-					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1.2 Macksville Stormwater System																																																
1.2.1	Hughs Creek Built Measures																																																
	Gross Pollutant Traps					601	337	250	202	100	0	0	0	0	0	0	100	0	0	0	0	0	0	100	0	0	0	0	0	0	100	0	0	0	0	0	0	100	0	0	0	0	0	0	100	0	0	0	0
	Sediment Traps					527	295	219	177	88	0	0	0	0	0	0	88	0	0	0	0	0	0	88	0	0	0	0	0	0	88	0	0	0	0	0	0	88	0	0	0	0	0	0	88	0	0	0	0
1.2.2	Macksville High School Built Measures																																																
	Gross Pollutant Traps					202	113	84	68	34	0	0	0	0	0	0	34	0	0	0	0	0	0	34	0	0	0	0	0	0	34	0	0	0	0	0	0	34	0	0	0	0	0	0	34	0	0	0	0
	Sediment Traps					141	79	58	47	23	0	0	0	0	0	0	23	0	0	0	0	0	0	23	0	0	0	0	0	0	23	0	0	0	0	0	0	23	0	0	0	0	0	0	23	0	0	0	0
1.2.3	Macksville Train Station Built Measures																																																
	Gross Pollutant Traps					173	119	102	94	86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	86	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Sediment Traps					112	63	46	38	19	0	0	0	0	0	0	19	0	0	0	0	0	0	19	0	0	0	0	0	0	19	0	0	0	0	0	0	19	0	0	0	0	0	0	19	0	0	0	0
1.2.4	Dawkins Park Lake Built Measures																																																
	Gross Pollutant Traps					219	123	91	74	36	0	0	0	0	0	0	36	0	0	0	0	0	0	36	0	0	0	0	0	0	36	0	0	0	0	0	0	36	0	0	0	0	0	0	36	0	0	0	0
	Sediment Traps					132	74	55	44	22	0	0	0	0	0	0	22	0	0	0	0	0	0	22	0	0	0	0	0	0	22	0	0	0	0	0	0	22	0	0	0	0	0	0	22	0	0	0	0
	1.3 Scotts Head Stormwater System																																																
1.3.1	Forsters Beach Built Measures																																																
	Gross Pollutant Traps					227	127	94	76	38	0	0	0	0	0	0	38	0	0	0	0	0	0	38	0	0	0	0	0	0	38	0	0	0	0	0	0	38	0	0	0	0	0	0	38	0	0	0	0
	Sediment Traps					163	91	68	55	27	0	0	0	0	0	0	27	0	0	0	0	0	0	27	0	0	0	0	0	0	27	0	0	0	0	0	0	27	0	0	0	0	0	0	27	0	0	0	0
1.3.2	Playing Fields																																																
	Gross Pollutant Traps					203	114	85	68	34	0	0	0	0	0	0	34	0	0	0	0	0	0	34	0	0	0	0	0	0	34	0	0	0	0	0	0	34	0	0	0	0	0	0	34	0	0	0	0
	1.4 Nambucca Heads Stormwater System																																																
1.4.1	Merry Park Built Measures																																																
	Infiltration Systems					2,448	1,494	1,162	974	612	0	0	0	0	0	0	0	0	0	612	0	0	0	0	0	0	0	0	0	612	0	0	0	0	0	0	0	0	0	612	0	0	0	0	0	0	0	0	0
	Pit Inserts					289	161	118	93	36	0	0	0	0	36	0	0	0	0	36	0	0	0	0	36	0	0	0	0	36	0	0	0	0	36	0	0	0	0	36	0	0	0	0	36	0	0	0	0
	Gross Pollutant Traps					126	71	53	42	21	0	0	0	0	0	0	21	0	0	0	0	0	0	21	0	0	0	0	0	0	21	0	0	0	0	0	0	21	0	0	0	0	0	0	21	0	0	0	0
1.4.2	Seaview St Built Measures																																																
	Infiltration Systems					1,807	1,102	858	719	452	0	0	0	0	0	0	0	0	0	452	0	0	0	0	0	0	0	0	0	452	0	0	0	0	0	0	0	0	0	452	0	0	0	0	0	0	0	0	0
1.4.3	Beer Creek Built Measures																																																
	Infiltration Systems					2,100	1,281	997	836	525	0	0	0	0	0	0	0	0	0	525	0	0	0	0	0	0	0	0	0	525	0	0	0	0	0	0	0	0	0	525	0	0	0	0	0	0	0	0	0
	Pit Inserts					265	147	108	85	33	0	0	0	0	33	0	0	0	0	33	0	0	0	0	33	0	0	0	0	33	0	0	0	0	33	0	0	0	0	33	0	0	0	0	33	0	0	0	0
1.4.4	Coronation Park Built Measures																																																
	Infiltration Systems					1,084	661	514	431	271	0	0	0	0	0	0	0	0	0	271	0	0	0	0	0	0	0	0	0	271	0	0	0	0	0	0	0	0	0	271	0	0	0	0	0	0	0	0	0
	Pit Inserts					176	98	71	57	22	0	0	0	0	22	0	0	0	0	22	0	0	0	0	22	0	0	0	0	22	0	0	0	0	22	0	0	0	0	22	0	0	0	0	22	0	0	0	0
	Gross Pollutant Traps					45	25	19	15	7	0	0	0	0	0	0	7	0	0	0	0	0	0	7	0	0	0	0	0	0	7	0	0	0	0	0	0	7	0	0	0	0	0	0	7	0	0	0	0
1.4.5	Gordon Park Built Measures																																																
	Pit Inserts					228	127	93	73	28	0	0	0	0	28	0	0	0	0	28	0	0	0	0	28	0	0	0	0	28	0	0	0	0	28	0	0	0	0	28	0	0	0	0	28	0	0	0	0
1.4.6	Bellwood Park Built Measures																																																
	Pit Inserts					360	200	147	116	45	0	0	0	0	45	0	0	0	0	45	0	0	0	0	45	0	0	0	0	45	0	0	0	0	45	0	0	0	0	45	0	0	0	0	45	0	0	0	0
	Gross Pollutant Traps					188	105	78	63	31	0	0	0	0	0	0	31	0	0	0	0	0	0	31	0	0	0	0	0	0	31	0	0	0	0	0	0	31	0	0	0	0	0	0	31	0	0	0	0
1.4.7	Industrial Estate Built Measures																																																
	Pit Inserts					312	174	127	101	39	0	0	0	0	39	0	0	0	0	39	0	0	0	0	39	0	0	0	0	39	0	0	0	0	39	0	0	0	0	39	0	0	0	0	39	0	0	0	0
	Gross Pollutant Traps					170	95	71	57	28	0	0	0	0	0	0	28	0	0	0	0	0	0	28	0	0	0	0	0	0	28	0	0	0	0	0	0	28	0	0	0	0	0	0	28	0	0	0	0
	Sediment Traps					140	79	58	47	23	0	0	0	0	0	0	23	0	0	0	0	0	0	23	0	0	0	0	0	0	23	0	0	0	0	0	0	23	0	0	0	0	0	0	23	0	0	0	0
	1.5 Valla Beach Stormwater System																																																
1.5.1	Kuta Road Built Measures																																																
	Pit Inserts					314	174	127	101	39	0	0	0	0	39	0	0	0	0	39	0	0	0	0	39	0	0	0	0	39	0	0	0	0	39	0	0	0	0	39	0	0	0	0	39	0	0	0	0
	Gross Pollutant Traps					196	110	82	66	33	0	0	0	0	0	0	33	0	0	0	0	0	0	33	0	0	0	0	0	0	33	0	0	0	0	0	0	33	0	0	0	0	0	0	33	0	0	0	0
	Sediment Traps					167	94	70	56	28	0	0	0	0	0	0	28	0	0	0	0	0	0	28	0	0	0	0	0	0	28	0	0	0	0	0	0	28	0	0	0	0	0	0	28	0	0	0	0
2.0	Direct Cost					13,114	7,732	5,903	4,877	2,782	0	0	0	0	243	0	593	0	0	2,103	0	0	0	593	243	0	0	0	0	2,103	593	0	0	0	329	0	0	593	0	2,103	0	0	0	0	836	0	0	0	0
2.1	Contingency				20%	2,623	1,546	1,181	975	556	0	0	0	0	49	0	119	0	0	421	0	0	0	119	49	0	0	0	0	421	119	0	0	0	66	0	0	119	0	421	0	0	0	0	167	0	0	0	0
3.0	Construction Cost					15,737	9,278	7,083	5,852	3,339	0	0	0	0	292	0	712	0	0	2,523	0	0	0	712	292	0	0	0	0	2,523	712	0	0	0	395	0	0	712	0	2,523	0	0	0	0	1,003	0	0	0	0
3.1	Project Management and Engineering				20%	3,147	1,856	1,417	1,170	668	0	0	0	0	58	0	142	0	0	505	0	0	0	142	58	0	0	0	0	505	142	0	0	0	79	0	0	142	0	505	0	0	0	0	201	0	0	0	0
TOTAL CAPITAL COST						**18,884**	**11,134**	**8,500**	**7,023**	**4,006**	**0**	**0**	**0**	**0**	**350**	**0**	**854**	**0**	**0**	**3,028**	**0**	**0**	**0**	**854**	**350**	**0**	**0**	**0**	**0**	**3,028**	**854**	**0**	**0**	**0**	**474**	**0**	**0**	**854**	**0**	**3,028**	**0**	**0**	**0**	**0**	**1,204**	**0**	**0**	**0**	**0**
4.0	Operations & Maintenance Costs																																																
4.1	Power Consumption		c per kWh			0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.2	Chemicals					0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.4	Labour Costs		Operator			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.5	Maintenance Costs	see below	of Capex			6,220	3,124	2,116	1,556	0	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159
4.6	Street Sweeping					26,914	13,850	9,598	7,238	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673	673
TOTAL O&M ANNUAL COST						33,134	16,974	11,714	8,794	673	832	832	832	832	832	832	832	832	832	832	832	832	832	832	832	832	832	832	832	832	832	832	832	832	832	832	832	832	832	832	832	832	832	832	832	832	832	832	832
TOTAL PRESENT WORTH						**52,019**	**28,108**	**20,214**	**15,817**	**4,679**	**832**	**832**	**832**	**832**	**1,182**	**832**	**1,686**	**832**	**832**	**3,860**	**832**	**832**	**832**	**1,686**	**1,182**	**832**	**832**	**832**	**832**	**3,860**	**1,686**	**832**	**832**	**832**	**1,307**	**832**	**832**	**1,686**	**832**	**3,860**	**832**	**832**	**832**	**832**	**2,036**	**832**	**832**	**832**	**832**

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The customer life cycle costs are defined as follows:

- Traditional Scenario
  - Rainwater tank costs for new dwellings (as part of BASIX)
- Scenario 1
  - Rainwater tank costs for new dwellings (as part of BASIX)
  - Basic Residential Tune-up Retrofit
- Scenario 2
  - Rainwater tank costs for new dwellings (as part of BASIX)
  - Enhanced Residential Tune-up Retrofit
  - Rainwater Tank Retrofit Program (50% of target)
- Scenario 3
  - Rainwater tank costs for new dwellings (as part of BASIX – less than Scenario 2 due to dual reticulation at Valla Urban Growth Are and South Scotts Head)
  - Enhanced Residential Tune-up Retrofit
  - Rainwater Tank Retrofit Program (100% of target)