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NSW Water Solutions

Bellingen Shire Council Integrated Water Cycle Management

Simplified Strategy

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Summary

In 2007, Bellingen Shire Council undertook a Concept Study which formed the first part of an Integrated Water Cycle Management (IWCM) strategy for the water, wastewater and stormwater services operated by the Council. The IWCM process aims to optimise the urban water cycle in such a way that the environmental, social and financial costs are minimised, generally by integrating the water services with each other.

The Concept Study identified a number of issues requiring action in the next 30 years that impact on the health of catchments where Council supplies services and in Council's management and service delivery practices. These issues were reviewed by a Project Reference Group (PRG) to confirm that they were valid.

The validated issues were split into two groups based on whether the responsibility to address the issue was held by Council's water and wastewater services section or whether it was held by another authority (for example the Catchment Management Authority) or a separate area of Council (for example the public health section). The issues were then ranked in priority by the PRG.

A review of the Business as Usual (BAU) scenario showed that formal commitments have been made to undertake a number of major capital works in the next 10 years. Therefore while the BAU does not address all of the IWCM issues, Council had the option to prepare a simplified scenario and Strategy rather than a Detailed Strategy with full scenarios. The Simplified Scenario consists of a number of relatively minor measures and works required in the short term, with any major works additional to the BAU expected to be required at least 10 years into the future.

This document details the actions required under the Simplified Strategy, these actions are summarised in the table below. Please note that where multiple actions are required to address a single issue, that issue will be listed multiple times.

Summary of Actions required under the Simplified Strategy for Coastal System

Issue ID	Issues	Additional responses required under IWCM to fully address issues	Cost	Date
C7	The water sharing plan indicates that the Bellingen water supply borefield to be within the revised tidal limits. This would lead to an increased risk of salt water contamination/intrusion of the Bellingen aquifer. This risk would be exacerbated with sea level rises due to climate change.	Undertake a groundwater yield & impact modelling with & without climate change impacts for current & future demands.	$15,000	2015-16
C8C	Climate change has the potential to increased sea level leading to a greater risk of saline intrusion to groundwater around the Bellingen aquifer			
WR5	Over-extraction of groundwater (as defined by the LBWS extraction licence) leading to potential salt water intrusion at Bellingen Borefield.			
C7	The water sharing plan indicates that the Bellingen water supply borefield to be within the revised tidal limits. This would lead to an increased risk of salt water contamination/intrusion of the Bellingen aquifer. This risk would be exacerbated with sea level rises due to climate change.	Develop a water supply borefield Operating Protocol:	$10,000	2015-16

Issue ID	Issues	Additional responses required under IWCM to fully address issues	Cost	Date
C7	The water sharing plan indicates that the Bellingen water supply borefield to be within the revised tidal limits. This would lead to an increased risk of salt water contamination/intrusion of the Bellingen aquifer. This risk would be exacerbated with sea level rises due to climate change.	Investigate borefield salinity & level monitoring program:	$10,000	2013-14
WR5	Over-extraction of groundwater (as defined by the LBWS extraction licence) leading to potential salt water intrusion at Bellingen Borefield.			
C8C	Climate change has the potential to increased sea level leading to a greater risk of saline intrusion to groundwater around the Bellingen aquifer	Undertake a surface water secure yield study with & without climate change impacts for current & future demands due to the inter-connectivity of the ground and surface water systems.	$15,000	2016-17
BWS18	Raleigh Dam is to be decommissioned resulting in the loss of an identified emergency supply source.			
WR4	Climate change impacting on water quality, quantity and rainfall/streamflow distribution, frequency and intensity, flooding and salt-water intrusion.			
C8d	Climate change has the potential to increase sea level, the water table along the coastal areas and the salinity level of the groundwater potentially causing damage to water and sewer pipeline assets.	Develop a well-head protection plan	$10,000	2013-14
BWS3	Bellingen Borefield does not have a wellhead protection plan leading to high risk of aquifer contamination			
G1c	Data Gaps - BSC data collection and reporting required for raw water quality monitoring	Develop & Implement Bellingen raw water quality monitoring Program.	$5,000	2012-13
G10	The frequency of potable water quality testing in the Lower Bellinger and Dorrigo Water Supply Systems does not comply with the ADWG Guidelines. This may result in inadequate public health protection.	Undertake a water quality investigation to determine the reasons for failure including monitoring methods, monitoring strategy and operator training.	$3,000	2012-13
BWS5	A small frequency of ADWG non-compliance for iron (2%), turbidity (2%), pH (2%) and total coliforms (4%) in the distribution system (results from 2001 – 2006).			
BWS13	O'Connors Reservoir has a relatively large storage (2.7 ML) but a small demand. This may result in extended residence times for treated water and subsequent decay of chlorine residual.			
G10	The frequency of potable water quality testing in the Lower Bellinger and Dorrigo Water Supply Systems does not comply with the ADWG Guidelines. This may result in inadequate public health protection.	Prepare a water quality management plan as per ADWG.	$15,000	2013-14
BWS14	There are a small number of properties near Urunga reservoir that are affected by low-pressure events. This results in a reduced level of service and also a reduced fire fighting capacity.	Modelling of fire fighting capacity for properties near Urunga Reservoir to be undertaken by in-house hydraulic modeller.	on-going by BSC	2012-13
C8d	Climate change has the potential to increase sea level, the water table along the coastal areas and the salinity level of the groundwater potentially causing damage to water and sewer pipeline assets.	Map the network assets that could potentially be affected by a rise in saline groundwater and develop an early warning monitoring program.	$20,000	2013-14
G12	No known existing site-specific flood management strategies for the management of water supply and sewerage assets leading to potential public health and environmental impacts	Update the operations and maintenance manuals include protocols for the use of the backup generators for the Lower Bellingen Water Supply Scheme water pumps and disinfection system.	$15,000	2013-14
G14	All critical water supply assets (pump stations, treatment plants and critical mains) do not have emergency power supplies or plans.			
BWS18	Raleigh Dam is to be decommissioned resulting in a the loss of an identified emergency supply source.	Review of emergency supply options identified in the Drought Management Plan.	$2,000	2012-13
UWW6	Sewerage pump stations do not have emergency storage and alternative power supply posing significant environmental and health risk.	Opportunities for increasing the storage at Pilot St SPS to be investigated.	$2,000	2012-13

Issue ID	Issues	Additional responses required under IWCM to fully address issues	Cost	Date
G12	No known existing site-specific flood management strategies for the management of water supply and sewerage assets leading to potential public health and environmental impacts	Update the operations and maintenance manuals include protocols for the use of the backup generators and the monitoring of sewage pumping stations for the Bellingen Sewerage Scheme.	$10,000	2013-14
BWW6	A single rising main (250 DICL) transfers sewage from the southern Bellingen catchments to Bellingen STP on the northern side of Bellinger River. This represents a significant system risk if there were a failure with this main.			
BWW7	Sewerage pump stations do not have emergency storage and alternative power supply posing significant environmental and health risk.			
G12	No known existing site-specific flood management strategies for the management of water supply and sewerage assets leading to potential public health and environmental impacts	Update the operations and maintenance manuals include protocols for the use of the backup generators and the monitoring of sewage pumping stations for the Urunga Sewerage Scheme.	$10,000	2013-14
G11	No formal process exists for the escalation of water supply and stormwater complaints to appropriate levels of management. This may result in some incidents having a slow (or non-existent) response time.	Develop & Implement a formal customer complaint work requests process	$2,000	2012-13
BWS16	1 major user (Norco) constitutes 6.5% (or 65 ML) of consumption. No water management plan exists for this user leading to potential inefficient use of water resource.	Norco has greatly reduced demand in recent years, Council water pricing strategy to include contingency for widely varying Norco demand.	on-going by BSC	2012-13
WR1	Poor surface water quality results relating to turbidity, nutrients, acidity and indicators of faecal contamination in the Lower Bellinger River mainly due to poor performing OSS in Newry Island and Atherton Drive area.	Include in financial & revenue plan modelling the maintenance, operating, etc costs associated with the sewer extension to Newry Island.	on-going by BSC	2012-13 onwards
G1a	Data Gaps - BSC data collection and reporting required for stormwater quality	Stormwater monitoring program to be scoped and costed.	$3,000	2014-15

Summary of Actions required under the Simplified Strategy for Dorrigo System

Issue ID	Issues	Additional responses required under IWCM to fully address issues	Cost	Date
DWS2	A small frequency (4%) of ADWG non-compliance for total coliforms in the distribution system (results from 2001 – 2006).	Undertake a water quality investigation to determine the reasons for failure including monitoring methods, monitoring strategy and operator training.	$2,000	2012-13
DWS3	A high frequency (64%) of ADWG non-compliance for pH in the distribution system (results from 2001 – 2006).	Prepare a water quality management plan as per ADWG.	$7,000	2013-14
DWS4	Paucity of data available with regards to several water quality parameters for the distribution system	Undertake an investigation into the potential for alkalinity buffering.	$2,000	2013-14
G12	No known existing site-specific flood management strategies for the management of water supply and sewerage assets leading to potential public health and environmental impacts	Update the operations and maintenance manuals include protocols for the use of the backup generators for Dorrigo water pumps.	$10,000	2013-14
G14	All critical water supply assets (pump stations, treatment plants and critical mains) do not have emergency power supplies or plans.			
DWS5	Known areas of low pressure on the eastern ridge within Dorrigo leading to failure of levels of service.	Review service level for properties near Dorrigo reservoir.	on-going by BSC	2012-13
G12	No known existing site-specific flood management strategies for the management of water supply and sewerage assets leading to potential public health and environmental impacts	Update the operations and maintenance manuals include protocols for the use of the backup generators and the monitoring of sewage pumping stations for the Dorrigo Sewerage Scheme.	$10,000	2013-14
DWS3	Sewerage pump stations do not have emergency storage and alternative power supply posing significant environmental and health risk.			
G11	No formal process exists for the escalation of water supply and stormwater complaints to appropriate levels of management. This may result in some incidents having a slow (or non-existent) response time.	Develop & Implement a formal customer complaint work requests process	$1,000	2012-13
G1a	Data Gaps - BSC data collection and reporting required for stormwater quality	Stormwater monitoring program to be scoped and costed.	$1,000	2014-15

In order to aid Council in budgeting for these works, the timing of the actions has been staggered over the period leading up to the next scheduled major review in 2017. The timing of the actions is dependent on balancing the ease and cost of the works with the priority assigned to the issue by the PRG during the IWCM Concept phase and the dependence of some of the works on earlier stages.

Proposed staged expenditure by year

Year	Proposed Expenditure
2012/2013	$17,000
2013/2014	$119,000
2014/2015	$4,000
2015/2016	$25,000
2016/2017	$15,000
Total	**$180,000**

Abbreviations

Abbreviation	Description
ABS	Australian Bureau of Statistics
ADWG	Australian Drinking Water Guidelines
ADWF	Average Dry Weather Flow
ADPW	Average Day Peak Week Demand
BAU	Business as Usual
BSC	Bellingen Shire Council
CMA	Catchment Management Authority
DCP	Development Control Plan
EP	Equivalent Persons
ET	Equivalent Tenements
Commerce	The former NSW Department of Commerce
IWCM	Integrated Water Cycle Management
ILI	Infrastructure Leakage Index
LWU	Local Water Utility
NOW	The New South Wales Office of Water, the Office of the NSW Department of Primary Industries responsible for the management of the State's surface and ground water resources
NSW	New South Wales
OSMS	On-Site Management System, a small scale wastewater treatment facility used in un-sewered areas. The effluent is generally disposed on the lot.
PDD	Peak Day Demand
PWWF	Peak Wet Weather Flow
STP	Sewage Treatment Plant

1 Introduction

Bellingen Shire Council has previously undertaken an Integrated Water Cycle Management Strategy (IWCM) Concept Study (NSW Water Solutions, 2007) and a Demographic and Water Cycle Projection (NSW Water Solutions, 2012). These documents identified a number of issues that require actions from Council's water and wastewater services section. A summary of the identified issues is included in Appendix A. A summary of the IWCM process is included in Figure 1-1.

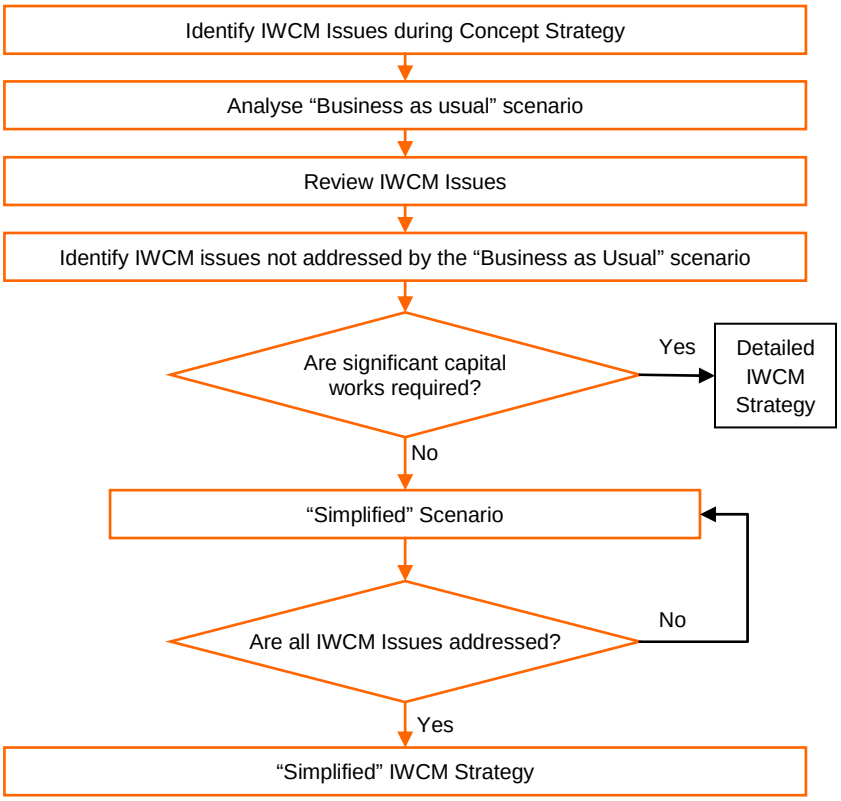


Figure 1-1: Bellingen IWCM Strategy Process

1.1 Review of IWCM Issues

A brief review of the IWCM issues was undertaken to ensure that the issues identified in the Concept Study (NSW Water Solutions, 2007) were: included in the IWCM under the revised guidelines; and relevant given more recent works or studies.

In addition to the issues Identified in the Concept Study (NSW Water Solutions, 2007), some new issues were identified including:

- From a change in circumstances:
  - Raleigh Dam is expected to be demolished, therefore it is no longer a potential emergency water source;
- From the Demographic and Water Cycle projections:
  - Peak day demand exceeds the licensed daily extraction limit of the Bellingen Borefield (5.5 ML/d) for the entire planning horizon.

1.2 Overview of IWCM Targets

The revised guidelines for IWCM Preparation released since the completion of the Concept Study report requires the identification of IWCM Targets.

The major IWCM Targets consist of ensuring:

1. Water Supply Security, that is;

    a. the provision of adequate potable water supply for current and future generations with reasonable level of restrictions;

    b. projected town water supply extraction is within the upper limit of the water extraction licence;

2. River and Catchment Health, this is achieved through;

    a. Compliance with environmental protection Licences;

    b. Implementation of catchment management and action plans, River Health plans, Estuary Management Plans etc.;

3. Systems Management & Reliability, this is achieved through;

    a. Compliance with Operational Regulatory requirements;

    b. Compliance with NSW Best Practice Management guidelines;

    c. Sustainable wastewater treatment plant effluent and biosolids management practices;

    d. Reliability of water supply infrastructure, through the sizing of components to ensure that equipment limitations do not cause restrictions on peak demand days;

    e. Reliability of wastewater collection and treatment infrastructure though the sizing of components to ensure that there are no uncontrolled overflows; and

    f. Cost effective operation of water supply and sewerage systems.

While these targets were not listed in the same words during the preparation of the IWCM Concept Study Report, the principles behind them were all used in the audit undertaken to identify the issues.

2 Overview of Existing System

Bellingen Shire Council provides water, wastewater and stormwater services to a number of communities in the shire.

2.1 Water Supply Services

Potable water is supplied in two discrete systems, the Lower Bellinger Water Supply Scheme and the Dorrigo Water Supply Scheme, the water extraction licences for these two schemes are included in Appendix B. The Lower Bellinger Water Supply Scheme supplies water to the communities of Bellingen, Fernmount, Raleigh, Repton, Myleston, Urunga as well as a number of smaller localities and rural customers, a diagram of the reservoir zones is included in Appendix C. The Dorrigo Water Supply Scheme supplies water to the town of Dorrigo and a small number of customers nearby.

2.2 Wastewater Services

Wastewater services operate as three discrete systems, the:

1. Bellingen Wastewater Scheme, serving customers in the town of Bellingen;

2. Urunga Wastewater Scheme, serving customers in the areas of Newry Island, Yellow Rock, Bellingen Keys and Urunga;

3. Dorrigo Wastewater Scheme, serving customers in the town of Dorrigo.

In addition to these services areas, there are a number of residences, business and community facilities that use onsite sewage management systems. These systems are audited by Council's Public Health section to ensure their safe operation and therefore minimise public health risk.

There is little incentive for wastewater reuse as there is generally high rainfall, leading to:

- A relatively low frequency of occasions where supplementary irrigation water is required;

- A relatively high density of water ways and consequently a significant proportion of the potential irrigation areas being unsuitable for effluent irrigation as it must be kept as a buffer zone to protect water quality in the rivers.

2.3 Stormwater Services

There are artificial drainage structures in use in the urban areas in Bellingen, Urunga, Dorrigo, Repton, Raleigh, Mylestom and Fernmount.

Stormwater reuse is slightly more economically viable than effluent reuse as there are no restrictions on the irrigation of stormwater near waterways or the overflow of stormwater storage areas into waterways. At this stage the only stormwater reuse occurring is at the Bellingen Golf Course. Other opportunities for stormwater reuse will be assessed by Council on an as needed basis.

3 Population and Water Cycle Projections

The results of the Demographic and Water Cycle Projection (NSW Water Solutions, 2012) have been summarised and included.

3.1 Water Supply

The population supplied with water supply services is summarised in Table 3-1. This projection has been used as the basis for the equivalent tenement projection summarised in Table 3-2, as well as the annual demand projection included in Table 3-3 and the peak day demand projection included in Table 3-4.

Table 3-1: Summary of Water Supply Population Projection

Population Group			2006	2009	2014	2019	2024	2029	2039	Growth[1]
Bellingen	Permanent Connected[2]	Bellingen	3,088	3,206	3,224	3,372	3,561	3,699	3,918	0.7%
		Valley	555	573	562	558	557	552	542	-0.2%
		Urunga	3,047	3,085	3,079	3,194	3,314	3,412	3,530	0.5%
		Villages	1,468	1,470	1,441	1,422	1,412	1,399	1,376	-0.2%
		Total	8,158	8,334	8,307	8,546	8,843	9,062	9,365	0.4%
	Connected Visitors[3]		2,382	2,522	2,514	2,587	2,677	2,743	2,835	0.4%
	Total Peak Connected		10,540	10,856	10,821	11,132	11,520	11,805	12,200	0.4%
	Unconnected[4]		2,432	2,593	2,755	2,742	2,651	2,628	2,632	0.1%
Dorrigo	Total Permanent Connected		1,225	1,223	1,240	1,262	1,298	1,313	1,372	0.4%
	Connected Visitors[2]		141	141	143	146	150	152	159	0.4%
	Total Peak Connected		1,366	1,364	1,383	1,407	1,448	1,464	1,531	0.4%
	Unconnected[4]		1,134	1,210	1,286	1,280	1,237	1,226	1,229	0.0%
Permanent Total LGA			12,959	13,369	13,589	13,829	14,029	14,229	14,598	0.3%

1. Growth in % per year between 2009 and 2039
2. The boundary definition for urban / rural location is based on the following reservoir zones: Bellingen = 3 and 4; Valley = 5; Urunga = 8, 9 and 10; Villages = 6, 7, 11 and 12. Appendix C outlines the reservoir zone boundaries.
3. Visitor Population has been projected in proportion with permanent connected population
4. The unconnected population is for the areas around each water supply system and represents a potential drought dependent population for water carting.

As can be seen in Table 3-1, the majority of the population growth is expected to occur in Bellingen, with some growth in the Urunga and Dorrigo areas and little or negative growth in the more rural areas.

It has been noted that in recent years the average size of households has decreased and this trend is expected to continue. Therefore the growth rate is in equivalent tenements is expected to exceed that of the population, as can be seen in Table 3-2. Non-residential Equivalent Tenements are a useful mechanism for including non-residential demand.

Table 3-2: Summary of Water Supply Equivalent Tenement Projection

Population Group			2006	2009	2014	2019	2024	2029	2039	Growth[1]
Bellingen	Permanent Connected[2]	Bellingen	1,154	1,232	1,261	1,345	1,441	1,513	1,635	1.1%
		Valley	405	442	444	448	451	452	452	0.1%
		Urunga	1,221	1,253	1,281	1,349	1,414	1,469	1,542	0.8%
		Villages	728	745	748	751	755	756	756	0.1%
		Total	3,508	3,672	3,734	3,893	4,061	4,189	4,385	0.7%
	Non Residential		1,294	1,290	1,285	1,309	1,339	1,360	1,391	0.3%
	Total Permanent Connected		4,802	4,962	5,019	5,202	5,400	5,549	5,776	0.5%
Dorrigo	Residential		542	549	571	591	616	629	667	0.7%
	Non-Residential		269	263	266	271	278	281	293	0.4%
	Total Permanent Connected		811	812	837	862	894	909	960	0.6%

1. Growth in % per year between 2009 and 2039
2. The boundary definition for urban / rural location is based on the following reservoir zones: Bellingen = 3 and 4; Valley = 5; Urunga = 8, 9 and 10; Villages = 6, 7, 11 and 12. Appendix C outlines the reservoir zone boundaries.

By using a combination of the growth in population, tenements and the continuing growth in the use of water efficient appliances, the annual demand for water was projected. Climate has a strong impact on water demand for irrigation and therefore the demand for an average rainfall and temperature year was projected, as was that for a repeat of the 2002 and 1980 dry years. Climate Change is expected to lead to changes in temperature, rainfall, extreme rainfall and evapotranspiration, and therefore a change in irrigation demand. The assumptions made were based on the results contained in the CSIRO and Bureau of Meteorology "Climate Change in Australia Technical Report 2007" and are summarised in Appendix D. The projected annual demands are summarised in Table 3-3.

Table 3-3: Projected Annual Demands for the Water Supply Systems

Projected Demand (ML)			2009	2014	2019	2024	2029	2034	2039	Growth[1]
Bellingen	Average Year	Historic Climate	1,180	1,169	1,195	1,228	1,253	1,272	1,288	0.30%
		2050 Climate Change Impact	1,226	1,214	1,241	1,276	1,302	1,322	1,338	0.31%
	Dry Year (2002 event)	Historic Climate	1,360	1,348	1,379	1,418	1,447	1,470	1,489	0.32%
		2050 Climate Change Impact	1,409	1,400	1,432	1,473	1,504	1,528	1,548	0.33%
	Dry Year (1980 event)	Historic Climate	1,455	1,445	1,479	1,522	1,554	1,579	1,599	0.33%
		2050 Climate Change Impact	1,558	1,548	1,585	1,632	1,666	1,693	1,715	0.34%
Dorrigo	Average Year	Historic Climate	172	172	174	177	179	182	185	0.25%
		2050 Climate Change Impact	182	181	183	187	189	192	196	0.26%
	Dry Year	Historic Climate	244	247	250	255	258	263	268	0.33%
		2050 Climate Change Impact	251	254	258	263	265	271	276	0.33%

1. Growth in % per year between 2009 and 2039

The results in Table 3-3 show that:

- For Bellingen, the annual demand may exceed the licensed annual extraction limit of 1613ML/day after 2019 in a 2050 climate change impacted repeat of the 1980 dry event and
- For Dorrigo, the annual demand is not expected to exceed the licensed annual extraction limit of 300ML for the duration of the projection.

Through the analysis of the recorded peak day reservoir demands, the peak day demands were projected for the major reservoir zones and the water treatment plants. The water treatment plant demands for Bellingen include a correction factor to allow for the low likelihood of a peak day demand occurring in both the inland (Bellingen township) and the coastal areas of the water supply scheme. The peak day demand are summarised in Table 3-4.

Table 3-4: Projected Peak Day Demands for the Water Supply Systems

PDD Demand Component			Capacity (ML)	2009	2014	2019	2024	2029	2039	Growth[1]
Bellingen	Historic Climate	Inland (Bellingen Reservoir)	0.88	2	2	2.1	2.2	2.3	2.4	0.60%
		Coastal (Marx Hill Reservoir)	3.39	5	4.9	5	5.1	5.1	5.2	0.20%
		Urunga & Raleigh Reservoirs	6.25	2.1	2.1	2.2	2.3	2.4	2.5	0.60%
		Water Treatment Plant [3]	11.2 [2]	6.5	6.5	6.6	6.8	6.9	7.1	0.30%
	2050 Climate Impacts	Inland (Bellingen Reservoir)	0.88	2.1	2.1	2.2	2.3	2.4	2.5	0.60%
		Coastal (Marx Hill Reservoir)	3.39	5.3	5.3	5.4	5.4	5.5	5.6	0.20%
		Urunga & Raleigh Reservoirs	6.25	2.2	2.2	2.3	2.4	2.5	2.6	0.60%
		Water Treatment Plant [3]	11.2 [2]	6.9	6.9	7	7.2	7.3	7.5	0.30%
Dorrigo	Historic Climate		2.7	1.26	1.28	1.3	1.33	1.35	1.41	0.41%
	2050 Climate Impacts		2.7	1.31	1.33	1.36	1.4	1.41	1.48	0.42%

1. Growth in % per year between 2009 and 2039
2. Note the yield capacity of the Bellingen Borefield is 9.0 ML/d and the total daily extraction limit is 5.5 ML
3. A correction factor of 0.93 (an average of 1999-2009) has been applied to the addition of the inland and coastal components to derive the headworks projection

As can be seen in Table 3-4, it is expected that:

- The Dorrigo Peak Day Demand is not expected to exceed the treatment plant capacity (2.7ML), daily extraction limit (1.5ML) or reservoir capacity (2.7ML);
- The demand on the Bellingen Reservoir will exceed the current capacity of 0.88ML for the duration of the projection, though it is not expected to exceed the increased capacity of the Reservoir after augmentation works are completed later this year,
- The demand on the Marx Hill Reservoir exceeds capacity, this is of little concern given the capacity of the other reservoirs servicing the coastal areas of the system (the 0.65ML Repton

Reservoir, the 2.7ML O'Conners Road Reservoir, the 5ML Raleigh Reservoir and the 1.25ML Urunga Reservoir); and

- The Bellingen peak day headworks demand will exceed the licensed maximum daily extraction of 5.5ML for the entire period of the projection, therefore a persistence analysis was undertaken for the Lower Bellingen Water Supply Scheme and a summary of the results is presented in Table 3-5 with the details of the method and assumptions used presented in Appendix E.

Table 3-5: Results of Persistence Analysis

		2009	2014	2019	2024	2029	2039
Total Reservoir Volume		14.15	16.27	16.27	18.27	18.27	18.27
Peak Day Demand	Historic Climate	6.51	6.48	6.59	6.76	6.88	6.90
	CC (2050)	6.91	6.88	7.01	7.19	7.32	7.34
Average Day Peak Week Demand	Historic Climate	5.86	5.83	5.93	6.08	6.19	6.21
	CC (2050)	6.22	6.19	6.31	6.47	6.59	6.61
Number of days of ADPWD able to be supplied at peak extraction	Historic Climate	39	49	37	31	26	25
	CC (2050)	20	24	20	19	17	17

As can be seen in Table 3-5, the persistence analysis showed that assuming the reservoirs start full, the average day peak week demand can be met for more than 10 days, without water restrictions. Under the current licence, 10 days is the maximum number of consecutive days that the licensed daily extraction may be reached.

3.2 Wastewater Services

The Equivalent Population (EP) and Equivalent Tenements (ET) connected to each of the wastewater services have been projected and are summarised in Table 3-6.

Table 3-6: Summary of Projected Biological and Hydraulic Loads for the Sewerage Schemes

Load Component			2006	2009	2014	2019	2024	2029	2039	Growth[1]
Bellingen	EP	Residential Permanent	2,711	2,808	2,832	2,983	3,175	3,314	3,536	0.9%
		Non-Residential Permanent	961	970	949	964	994	1,014	1,042	0.2%
		Permanent	3,673	3,778	3,780	3,947	4,169	4,328	4,578	0.7%
		Visitor	95	94	95	100	106	110	117	0.8%
		Peak	3,767	3,872	3,875	4,047	4,275	4,438	4,695	0.7%
	ET	Residential Permanent	1,055	1,088	1,126	1,210	1,306	1,379	1,501	1.3%
		Non-Residential Permanent	372	385	387	401	420	433	454	0.6%
		Permanent	1,428	1,472	1,513	1,611	1,725	1,812	1,955	1.1%
		Visitor	35	36	36	38	40	42	45	0.8%
		Peak	1,463	1,508	1,549	1,649	1,766	1,854	2,000	1.1%
Urunga	EP	Residential Permanent	2,751	2,763	2,760	2,876	2,995	3,096	3,219	0.9%
		Non-Residential Permanent	197	196	189	193	197	201	205	0.2%
		Permanent	2,948	2,959	2,949	3,069	3,192	3,297	3,424	0.7%
		Visitor	1,241	1,265	1,264	1,316	1,370	1,416	1,471	0.8%
		Peak	4,189	4,225	4,213	4,385	4,563	4,713	4,895	0.7%
	ET	Residential Permanent	1,095	1,116	1,141	1,207	1,269	1,323	1,397	1.3%
		Non-Residential Permanent	76	76	76	79	83	85	88	0.6%
		Permanent	1,171	1,192	1,217	1,286	1,352	1,408	1,485	1.1%
		Visitor	239	245	245	255	265	274	285	0.8%
		Peak	1,409	1,437	1,462	1,541	1,617	1,682	1,770	1.1%
Dorrigo	EP	Residential Permanent	990	988	1,002	1,017	1,046	1,060	1,123	0.5%
		Non-Residential Permanent	338	326	321	320	324	325	338	0.1%
		Permanent	1,329	1,314	1,323	1,337	1,370	1,386	1,461	0.4%
		Visitor	101	100	98	97	99	99	103	0.1%
		Peak	1,429	1,414	1,421	1,434	1,469	1,485	1,564	0.4%
	ET	Residential Permanent	407	413	430	444	463	475	513	0.8%
		Non-Residential Permanent	133	133	134	136	140	142	150	0.5%
		Permanent	540	545	564	580	603	616	663	0.7%
		Visitor	42	42	42	43	44	45	47	0.5%
		Peak	582	587	606	623	647	661	710	0.7%

1. Growth in % per year between 2009 and 2039

As can be seen in Table 3-6, it is expected that:

- The Bellingen STP capacity of 4000EP is expected to be exceeded during 2018, the augmentation of the plant is currently scheduled for 2019/2020 therefore the augmentation may need to be brought forward;
- The Urunga STP capacity of 6650 EP is expected to be sufficient beyond the duration of the forecast; and
- The new Dorrigo STP capacity of 2000EP is expected to be sufficient beyond the duration of the forecast.

The projected Average Dry Weather Flow (ADWF), Peak Dry Weather Flow (PDWF), and Peak Wet Weather Flows for each of the wastewater collection systems have been summarised in Table 3-7.

Table 3-7: Projected Dry Weather and Wet Weather Sewage Flows

Flow Component			Unit	2009	2014	2019	2024	2029	2039
Bellingen	ADWF[1]		kL/d	735	735	768	810	841	889
	ADWF with Savings[2]		kL/d	735	708	708	724	733	749
			L/EP/d	190	183	175	169	165	159
			L/s	8.5	8.2	8.2	8.4	8.5	8.7
	PDWF	Actual[3]	L/s	No data available					
		Theoretical[4]	L/s	22.1	21.3	21.3	21.6	21.8	22.1
	PWWF	Actual[5]	L/s	114.4	116.6	123.9	133.1	140.1	152
		Theoretical[6]	L/s	109.6	111.2	116.9	124	129.3	138.1
Urunga	ADWF[1]		kL/d	856	854	889	925	955	992
	ADWF with Savings[2]		kL/d	856	816	808	811	816	817
			L/EP/d	203	193	184	177	172	165
			L/s	9.9	9.4	9.4	9.4	9.4	9.5
	PDWF	Actual[3]	L/s	No data available					
		Theoretical[4]	L/s	30	28.5	28.2	28.2	28.2	28.1
	PWWF	Actual[5]	L/s	117.9	118	122.5	127.2	131.2	136.4
		Theoretical[6]	L/s	113.3	113.3	117.6	122	125.8	130.7
Dorrigo	ADWF[1]		kL/d	222	223	225	231	233	245
	ADWF with Savings[2]		kL/d	222	211	201	199	196	200
			L/EP/d	157	148	140	135	131	127
			L/s	2.6	2.4	2.3	2.3	2.3	2.3
	PDWF	Actual[3]	L/s	No data available					
		Theoretical[4]	L/s	7.1	6.8	6.5	6.4	6.3	6.4
	PWWF	Actual[5]	L/s	28.9	29.2	29.6	30.4	30.8	32.8
		Theoretical[6]	L/s	41.2	42	42.7	44	44.7	47.7

It has been noted by Council that during floods the infiltration to the Bellingen Sewerage System is very high as there are a number of manholes that are submerged. During these times the daily outflow from the STP exceeds the licence. Therefore increased wet weather storage is to be investigated as a part of the augmentation planning.

4 The Business as Usual IWCM Scenario

The BAU IWCM Scenario identifies all of the Council's actions and plans that have been put into place between the completion of the IWCM Concept Study and the commencement of the IWCM Strategy Study, including any formally adopted plans for significant capital works projects.

In the case of Bellingen Shire Council, the significant capital works in the BAU Scenario within the next 10 years are:

- the construction of the new Dorrigo Sewage Treatment Plant (STP), expected completion in 2013,
- The upgrading of the Bellingen Reservoir to approximately 3ML, this is expected to be completed during 2012.

The upgrade to the Dorrigo STP will enable the release of effluent meeting the sensitive waters criteria and so remove the need for an effluent reuse scheme. All supplementary funding that had been made available to Council to aid in the effluent reuse scheme as been transferred to the STP upgrade.

Council has completed a number of planning documents and scheduled a number of minor works that were outstanding at the time that the IWCM Concept was finalised. These documents and works are outlined in the summary tables included in Appendix A Summary of IWCM Issues in the column titled "How is this issue addressed by planned or completed works?". Some of the initiatives that address the majority of the issues are:

- Sewer investigations reports have been completed and the recommended works either completed or scheduled, as a result of these investigations the Bellinger River has re-opened to oyster farming;
- Water and sewerage services charges have been revised to meet the best practice guidelines;
- Backup generators mounted in trailers have been purchased for use to supply power to water and wastewater pump stations in the case of a power outage; and
- Raleigh Reservoir has been reconnected, this has increased the reservoir capacity available to serve Urunga and the areas served by Marx Hill Reservoir.

5 Consultation

Any feedback received from consultation with stakeholders and the community will be included in this section.

6 The Simplified IWCM Strategy and Scenario

The current Best Practice Guidelines for IWCM Strategies allow for the preparation of a Simplified IWCM Scenario and Simplified Strategy when there are no significant capital works projects required in the next 10 years that have not been formally adopted under the BAU.

6.1 Simplified Scenario Measures

The Simplified IWCM Strategy consists of the measures required to address the issues identified in the IWCM Concept that are not addressed or are insufficiently addressed under the Business as Usual Scenario and are the responsibility of Council's water and wastewater services section. A summary of the additional tasks required for the Coastal systems is included in Summary of Tasks Required under Simplified Scenario for Coastal Bellingen Shire Table 6-1, the summary of the tasks required for the Dorrigo systems is included in Table 6-2 and a summary of the tasks that may be the responsibility of Council's water and wastewater services section in future IWCMs is included in Table 6-3.

Table 6-1: Summary of Tasks Required under Simplified Scenario for Coastal Bellingen Shire

Audit Component	Issues	Priority	Actions required under Simplified Strategy
Catchment	The water sharing plan indicates that the Bellingen water supply borefield to be within the revised tidal limits. This would lead to an increased risk of salt water contamination/intrusion of the Bellingen aquifer. This risk would be exacerbated with sea level rises due to climate change.	H	Develop a water supply borefield Operating Protocol:
	Climate change has the potential to increased sea level leading to a greater risk of saline intrusion to groundwater around the Bellingen aquifer	M	Undertake a groundwater yield & impact modelling with & without climate change impacts for current & future demands.
	Climate change has the potential to increase sea level, the water table along the coastal areas and the salinity level of the groundwater potentially causing damage to water and sewer pipeline assets.	M	Map the network assets that could potentially be affected by a rise in saline groundwater and develop an early warning monitoring program.
Water Resources	Poor surface water quality results relating to turbidity, nutrients, acidity and indicators of faecal contamination in the Lower Bellinger River mainly due to poor performing OSS in Newry Island and Atherton Drive area.	H	Include in financial & revenue plan modelling the maintenance, operating, etc costs associated with the sewer extension to Newry Island.
	The current Draft Macro Water Sharing Plans for the Bellinger River and Coastal Bellinger sub-catchments make no reference to groundwater extraction however this is likely to change given the high interconnection between the groud & surface water sources. A changed regulatory environment will impact directly on the security of the Lower Bellinger Water Supply Scheme.	H	Undertake a surface water secure yield study with & without climate change impacts for current & future demands due to the inter-connectivity of the ground and surface water systems.
	Over-extraction of groundwater (as defined by the LBWS extraction licence) leading to potential salt water intrusion at Bellingen Borefield.	M	Undertake a groundwater yield & impact modelling with & without climate change impacts for current & future demands.
General Urban	Data Gaps - BSC data collection and reporting required for stormwater quality	M	Stormwater monitoring program to be scoped and costed.
	Data Gaps - BSC data collection and reporting required for raw water quality monitoring	M	Develop & Implement Bellingen raw water quality monitoring Program.
	The frequency of potable water quality testing in the Lower Bellinger and Dorrigo Water Supply Systems does not comply with the ADWG Guidelines. This may result in inadequate public health protection.	H	Undertake a water quality investigation to determine the reasons for failure including monitoring methods, monitoring strategy and operator training.

Audit Component	Issues	Priority	Actions required under Simplified Strategy
	No formal process exists for the escalation of water supply and stormwater complaints to appropriate levels of management. This may result in some incidents having a slow (or non-existent) response time.	H	Develop & Implement a formal customer complaint work requests process
	No known existing site-specific flood management strategies for the management of water supply and sewerage assets leading to potential public health and environmental impacts	H	Update the operations and maintenance manuals include protocols for the use of the backup generators and the monitoring of sewage pumping stations for the Dorrigo Sewerage Scheme.
	All critical water supply assets (pump stations, treatment plants and critical mains) do not have emergency power supplies or plans.	H	Update the operations and maintenance manuals include protocols for the use of the backup generators for the Lower Bellingen Water Supply Scheme water pumps and disinfection system..
Bellinger Water Supply	Bellingen Borefield does not have a wellhead protection plan leading to high risk of aquifer contamination	H	Develop a well-head protection plan
	Modelling of impact of groundwater extraction on low flows in the Bellinger River has been based on underestimated extraction rates.	M	Undertake a groundwater yield & impact modelling with & without climate change impacts for current & future demands.
	A small frequency of ADWG non-compliance for iron (2%), turbidity (2%), pH (2%) and total coliforms (4%) in the distribution system (results from 2001 – 2006).	L	Undertake a water quality investigation to determine the reasons for failure including monitoring methods, monitoring strategy and operator training.
	O'Connors Reservoir has a relatively large storage (2.7 ML) but a small demand. This may result in extended residence times for treated water and subsequent decay of chlorine residual.	H	Review of residence time and residual chlorine to be undertaken for O'Connors Reservoir.
	There are a small number of properties near Urunga reservoir that are affected by low-pressure events. This results in a reduced level of service and also a reduced fire fighting capacity.	M	Modelling of fire fighting capacity for properties near Urunga Reservoir to be undertaken by in-house hydraulic modeller.
	1 major user (Norco) constitutes 6.5% (or 65 ML) of consumption. No water management plan exists for this user leading to potential inefficient use of water resource.	H	Norco has greatly reduced demand in recent years, Council water pricing strategy to include contingency for widely varying Norco demand.
	Raleigh Dam is to be decommissioned resulting in the loss of an identified emergency supply source.	H	Review of emergency supply options identified in the Drought Management Plan.
Bellingen Sewerage	A single rising main (250 DICL) transfers sewage from the southern Bellingen catchments to Bellingen STP on the northern side of Bellinger River. This represents a significant system risk if there were a failure with this main.	H	Update operations and maintenance manuals including the protocol for the monitoring of the South Bellingen sewer pump stations
	Sewerage pump stations do not have emergency storage and alternative power supply posing significant environmental and health risk.	H	Update the operations and maintenance manuals include protocols for the use of the backup generators.
Urunga Sewerage	Sewerage pump stations do not have emergency storage and alternative power supply posing significant environmental and health risk.	H	Opportunities for increasing the storage at Pilot St SPS to be investigated.

Table 6-2: Summary of Tasks Required under Simplified Scenario for Dorrigo Region

Component	Issues	Priority	Actions required under Simplified Strategy
General Urban	Data Gaps - BSC data collection and reporting required for stormwater quality	M	Stormwater monitoring program to be scoped and costed.
	The frequency of potable water quality testing in the Lower Bellinger and Dorrigo Water Supply Systems does not comply with the ADWG Guidelines. This may result in inadequate public health protection.	H	Undertake a water quality investigation to determine the reasons for failure including monitoring methods, monitoring strategy and operator training.
	No formal process exists for the escalation of water supply and stormwater complaints to appropriate levels of management. This may result in some incidents having a slow (or non-existent) response time.	H	Develop & Implement a formal customer complaint work requests process
	No known existing site-specific flood management strategies for the management of water supply and sewerage assets leading to potential public health and environmental impacts	H	Update the operations and maintenance manuals include protocols for the use of the backup generators and the monitoring of sewage pumping stations for the Dorrigo Sewerage Scheme.
	All critical water supply assets (pump stations, treatment plants and critical mains) do not have emergency power supplies or plans.	H	Update the operations and maintenance manuals include protocols for the use of the backup generators for the Lower Bellingen Water Supply Scheme water pumps and disinfection system..
Dorrigo Water Supply	A small frequency (4%) of ADWG non-compliance for total coliforms in the distribution system (results from 2001 – 2006).	L	Undertake a water quality investigation to determine the reasons for failure including monitoring methods, monitoring strategy and operator training.
	A high frequency (64%) of ADWG non-compliance for pH in the distribution system (results from 2001 – 2006).	M	Undertake an investigation into the potential for alkalinity buffering.
	Paucity of data available with regards to several water quality parameters for the distribution system	H	Prepare a water quality management plan as per ADWG.
	Known areas of low pressure on the eastern ridge within Dorrigo leading to failure of levels of service.	M	Review service level for properties near Dorrigo reservoir.
Dorrigo Sewerage	Sewerage pump stations do not have emergency storage and alternative power supply posing significant environmental and health risk.	H	Update the operations and maintenance manuals include protocols for the use of the backup generators.

In addition to the actions required from the Shire Water and Wastewater business areas, there is the potential for additional actions to be undertaken by other business areas that would go some way to solving the current issues. These issues and responses are outlined in Table 6-3.

Table 6-3: Potential Additional Actions

Component	Issues	Priority	Additional actions Council may choose to take
Villages On-Site Systems	OSMS in Repton, Raleigh and Mylestom are potential contributors to faecal contamination in the alluvial and coastal groundwater systems.	H	An aquifer water quality monitoring program is to be scoped to monitor for groundwater contamination from OSMS. This would be a function of the Environmental Health section of Council.

Tables containing the details of all of the identified issues, Council's response and the additional actions required under the simplified strategy are included in Appendix A.

6.2 Cost Estimate for Simplified Scenario

The estimated costs for the measures to be undertaken in Coastal Bellingen Shire are included in Table 6-4

Table 6-4: Costs of Tasks Required under Simplified Scenario for Coastal Bellingen Shire

Additional responses required under IWCM to fully address issues	Date	Cost
Undertake a groundwater yield & impact modelling with & without climate change impacts for current & future demands.	2015-16	$15,000
Develop a water supply borefield Operating Protocol:	2015-16	$10,000
Investigate borefield salinity & level monitoring program:	2013-14	$10,000
Undertake a surface water secure yield study with & without climate change impacts for current & future demands due to the inter-connectivity of the ground and surface water systems.	2016-17	$15,000
Develop a well-head protection plan	2013-14	$10,000
Develop & Implement Bellingen raw water quality monitoring Program.	2012-13	$5,000
Undertake a water quality investigation to determine the reasons for failure including monitoring methods, monitoring strategy and operator training.	2012-13	$3,000
Prepare a water quality management plan as per ADWG.	2013-14	$15,000
Modelling of fire fighting capacity for properties near Urunga Reservoir to be undertaken by in-house hydraulic modeller.	2012-13	on-going by BSC
Map the network assets that could potentially be affected by a rise in saline groundwater and develop an early warning monitoring program.	2015-16	$20,000
Update the operations and maintenance manuals include protocols for the use of the backup generators for the Lower Bellingen Water Supply Scheme water pumps and disinfection system.	2013-14	$15,000
Review of emergency supply options identified in the Drought Management Plan.	2012-13	$2,000
Opportunities for increasing the storage at Pilot St SPS to be investigated.	2012-13	$2,000
Update the operations and maintenance manuals include protocols for the use of the backup generators and the monitoring of sewage pumping stations for the Bellingen Sewerage Scheme.	2013-14	$10,000
Update the operations and maintenance manuals include protocols for the use of the backup generators and the monitoring of sewage pumping stations for the Urunga Sewerage Scheme.	2013-14	$10,000
Develop & Implement a formal customer complaint work requests process	2012-13	$2,000
Norco has greatly reduced demand in recent years, Council water pricing strategy to include contingency for widely varying Norco demand.	2012-13	on-going by BSC
Include in financial & revenue plan modelling the maintenance, operating, etc costs associated with the sewer extension to Newry Island.	2012-13 onwards	on-going by BSC
Stormwater monitoring program to be scoped and costed.	2014-15	$3,000
	Total	$147,000

The estimated costs for the measures to be undertaken in the Dorrigo Region are included in Table 6-5.

Table 6-5: Costs of Tasks Required under Simplified Scenario for Dorrigo Region

Additional responses required under IWCM to fully address issues	Date	Cost
Undertake a water quality investigation to determine the reasons for failure including monitoring methods, monitoring strategy and operator training.	2012-13	$2,000
Prepare a water quality management plan as per ADWG.	2013-14	$7,000
Undertake an investigation into the potential for alkalinity buffering.	2013-14	$2,000
Update the operations and maintenance manuals include protocols for the use of the backup generators for Dorrigo water pumps.	2013-14	$10,000
Review service level for properties near Dorrigo reservoir.	2012-13	on-going by BSC
Investigate opportunities for pressure reduction in Dorrigo.	2013-14	on-going by BSC
Update the operations and maintenance manuals include protocols for the use of the backup generators and the monitoring of sewage pumping stations for the Dorrigo Sewerage Scheme.	2012-13	$10,000
Develop & Implement a formal customer complaint work requests process	2014-15	$1,000
Stormwater monitoring program to be scoped and costed.	2012-13	$1,000
	Total	$33,000

The estimated costs for the additional measures that may be undertaken are included in Table 6-6

Table 6-6: Costs of Potential Additional Actions

Additional actions Council may choose to take	Date	Cost
An aquifer water quality monitoring program is to be scoped to monitor for groundwater contamination from OSMS. This would be a function of the Environmental Health section of Council.	2012-13	$3,000

References

1. ABS 2006, *Census Dictionary Australia 2006 (Reissue)*, Catalogue No. 2901.0, 27 November 2006

2. ABS 2007, *2006 Census Data Packs, Basic Community Profile Release 2,* Catalogue no: 2069.0.30.001, July 2007

3. CSIRO and Bureau of Meteorology 2007, Climate Change in Australia – Technical Report 2007, CSIRO Marine and Atmospheric Research, accessed 29 May 2008, <http://www.climatechangeinaustralia.gov.au/technical_report.php>

4. NSW Water Solutions 2007, *Bellingen Shire Council Integrated Water Cycle Management Strategy, (Concept Study)*, NSW Department of Commerce, Sydney

5. NSW Water Solutions 2012, *Bellingen Shire Council Integrated Water Cycle Management Strategy, (Demographic and Water Cycle Projections),* NSW Public Works, Sydney.

Appendices

Appendix A Summary of IWCM Issues

A.1 IWCM Issues, Status and Response – Catchment

Information from IWCM Concept			Current Status		Additional responses required under IWCM to fully address issues
Issue ID	Issues	Priority	is issue relevant to current IWCM?	Business as Usual responses to issues	
C1	Historic land use and excessive land clearing has lead to the destabilization of a number of stream banks resulting in water quality and quantity issues.	M	No	N/A	N/A
C2	Re-vegetation with inappropriate species has led to water quality and flooding issues	M	No	N/A	N/A
C3	Historic and current land use leading to flooding of urban areas located within the Bellingen River floodplain	M	No	N/A	N/A
C4	A considerable area has been identified as having high potential for contamination from acid sulphate soils (ASS). BSC urban water activities (especially stormwater) can increase the risk of acidic runoff from urban areas.	H	Yes	No failures have been attributed to ASS, no ASS soils found during routine excavations, therefore ongoing monitoring to continue.	No other measures identified.
C5	Nutrients from land use, septic, stormwater & effluent discharge have resulted in deterioration of water quality in some waterways (Bielsdown River).	H	Yes	Raw water source for Dorrigo can be swapped to Rocky Creek when Bielsdown highly turbid, high turbidity in both sources has only occurred during wet weather when demands are low allowing for reduced raw water pumping.	No other measures identified.
C6	Nutrients from the catchment have exacerbated aquatic weed invasion impacting upon water quality and flow.	M	No	N/A	N/A
C7	The water sharing plan indicates that the Bellingen water supply borefield to be within the revised tidal limits. This would lead to an increased risk of salt water contamination/intrusion of the Bellingen aquifer. This risk would be exacerbated with sea level rises due to climate change.	H	Yes	Not Addressed	Develop a water supply borefield Operating Protocol: Investigate borefield salinity & level monitoring program: Undertake a groundwater yield & impact modelling with & without climate change impacts for current & future demands.
C8	Climate change has the potential to	M			
C8a	increase stream erosion, leading to degrated water quality		No	N/A	N/A
C8b	increased sea level and flood risk		No	N/A	N/A
C8C	increased sea level leading to a greater risk of saline intrusion to groundwater around the Bellingen aquifer		Yes	Not addressed	Undertake a groundwater yield & impact modelling with & without climate change impacts for current & future demands. Undertake a surface water secure yield study with & without climate change impacts for current & future demands due to the inter-connectivity of the ground and surface water systems.
C8d	increase sea level, the water table along the coastal areas and the salinity level of the groundwater potentially causing damage to water and sewer pipeline assets.		Yes	Not addressed	Map the network assets that could potentially be affected by a rise in saline groundwater and develop an early warning monitoring program .
C9	An Estuary Management Plan has not been prepared for the Bellinger River Estuary leading to the increased risk of the urban area impacting upon aquatic ecosystem, aquaculture and primary recreation objectives in the estuary.	H	No	Estuary management plan completed and adopted May 2008	No other measures identified.

A.2 IWCM Issues, Status and Response – Water Resources

Information from IWCM Concept			Current Status		Additional responses required under IWCM to fully address issues
Issue ID	Issues	Priority	is issue relevant to current IWCM?	Business as Usual responses to issues	
WR1	Poor surface water quality results relating to turbidity, nutrients, acidity and indicators of faecal contamination in the Lower Bellinger River mainly due to poor performing OSS in Newry Island and Atherton Drive area.	H	Yes	Bellingen and Urunga Sewer investigations reports completed and all recommendations either implemented or scheduled to be implemented within next few years. Also BSC is sewering residences on Newry Island and the Atherton Drive area near Urunga Golf and Sports Club through an extension of the Uranga sewer system. Bellinger River has re-opened for oyster farming.	Include in financial & revenue plan modelling the maintenance, operating, etc costs associated with the sewer extension to Newry Island.
				Premiers working group continuing to investigate contamination sources in the Kalang River	No other measures identified.
WR2	A number of sub-catchments are under high hydrologic stress during periods of low flow, when the potential competition for water is greatest. None of these subcatchments are upstream of the town water supply extraction points.	M	No	N/A	No other measures identified.
WR3	The current Draft Macro Water Sharing Plans for the Bellinger River and Coastal Bellinger sub-catchments make no reference to groundwater extraction however this is likely to change given the high interconnection between the groud & surface water sources. A changed regulatory environment will impact directly on the security of the Lower Bellinger Water Supply Scheme.	H	Yes	Not addressed	Undertake a surface water secure yield study with & without climate change impacts for current & future demands due to the inter-connectivity of the ground and surface water systems.
WR4	Climate change impacting on water quality, quantity and rainfall/streamflow distribution, frequency and intensity, flooding and salt-water intrusion.	M	No	Estuarine Seal Level Rise Inundation mapping was undertaken in the 2010-2011 financial year	No other measures identified.
WR5	Over-extraction of groundwater (as defined by the LBWS extraction licence) leading to potential salt water intrusion at Bellingen Borefield.	M	Yes	Not addressed	Undertake a groundwater yield & impact modelling with & without climate change impacts for current & future demands.
					Investigate borefield salinity & level monitoring program

A.3 IWCM Issues, Status and Response – General Urban Water

Information from IWCM Concept			Current Status		Additional responses required under IWCM to fully address issues
Issue ID	Issues	Priority	is issue relevant to current IWCM?	Business as Usual responses to issues	
G1	Data Gaps - BSC data collection and reporting required for	M			
G1a	stormwater quality		No	Not addressed	Stormwater monitoring program to be scoped and costed.
G1b	septic tank audits		Yes	Regular OSMS audits are undertaken	No other measures identified.
G1c	raw water quality monitoring		Yes	Dorrigo monitored regularly, Bellingen occasionally	Develop & Implement Bellingen raw water quality monitoring Program.
G1d	potable water quality monitoring		Yes	Regular monitoring as per NSW Health requirements	No other measures identified.
G1e	1% AEP flooding levels		Yes	Flood mapping undertaken in 2008	No other measures identified.
G1f	liquid trade waste quality		Yes	No heavy industry present therefore trade waste policy and inspection regime have been implemented without any plans for liquid trade waste sampling, trade waste customers installing grease traps where appropriate.	No other measures identified.
G2	Strategic Business Plan (SBP) for Water Supply is based on out of date information and an update in order to comply with BPM Guidelines is required.	M	Yes	Consultant engaged to complete plan	No other measures identified.
G3	SBP for Sewerage Services is based on out of date information and an update in order to comply with BPM Guidelines is required.	M	Yes	Consultant engaged to complete plan	No other measures identified.
G4	The current water pricing structure employed by BSC does not reflect BPM in terms of the low proportion (37% in 2006) of revenue collected through the usage charge and no inclining block for usage charge. This results in no price signal being sent to high water users and the undervaluing of natural resource extraction.	H	Yes	Revised water rates system now in use, including inclining block tariff	No other measures identified.
G5	The current access charge for sewerage services is not based on the equivalent water meter size resulting in non-compliance with BPM guidelines and a charge that is not reflective of the cost of providing these sewerage charges.	M	Yes	Revised Sewerage Charges now in use based on water meter size and charges have been revised to ensure cost recovery.	No other measures identified.
G6	The population and tenement growth rates adopted in the Bellingen GMS have not been applied to all of the BSC strategic planning documents (specifically SBP and DSP). This may lead to a lack of consistency across planning areas and potential implications for financing water supply and sewerage infrastructure in the future.	H	Yes	Integrated Water Cycle Management Strategy Demographic and Water Cycle Projections report is being completed.	No other measures identified.
G7	BSC has not implemented a comprehensive demand management plan / program leading to excess natural system extraction in the Bielsdown River and Bellinger River catchments.	H	Yes	BASIX and SaveWater Alliance programs in force, consultant has been engaged to undertake Demand Management Plan	No other measures identified.
G8	BSC owned land that is irrigated from the water supply systems is metered but not billed. This results in cost recovery loss and higher NRW estimates.	L	No	No significant council irrigation, all council use is metered.	Internal billing to be considered.
G9	The calculation of an environmental levy to be implemented by BSC (implementation date unknown) for the construction of high priority environmental protection works is not clearly defined. This may lead to a lack of future funding and the non-implementation of environmental protection works.	H	Yes	Environmental Levy is being used for catchment health monitoring and other projects,these projects are funded on an annual basis.	No other measures identified.
G10	The frequency of potable water quality testing in the Lower Bellinger and Dorrigo Water Supply Systems does not comply with the ADWG Guidelines. This may result in inadequate public health protection.	H	Yes	Water Quality monitoring program results for 1/1/2011 to 2/3/2012 show E. coli sample numbers over minimum required for Coastal, less than required for Dorrigo.	Undertake a water quality investigation to determine the reasons for failure including monitoring methods, monitoring strategy and operator training. Prepare a water quality management plan as per ADWG.
G11	No formal process exists for the escalation of water supply and stormwater complaints to appropriate levels of management. This may result in some incidents having a slow (or non-existent) response time.	H	Yes	Not addressed, not covered in Council's complaints system, all customer reported issues with water, wastewater and stormwater assets are termed "customer works requests"	Develop & Implement a formal customer complaint work requests process
G12	No known existing site-specific flood management strategies for the management of water supply and sewerage assets leading to potential public health and environmental impacts	H	Yes	All electricals as located above the 1% AEP flood level, backup generators mounted on trailers available for use in case of power outage at pump stations.	Update the operations and maintenance manuals include protocols for the use of the backup generators.
G13	The current Bellingen Local Flood Plan (1995 Bellingen SES) is out of data resulting in public safety issues.	H	Yes	The Lower Bellinger and Kalang River Flood Study	No other measures identified.
G14	All critical water supply assets (pump stations, treatment plants and critical mains) do not have emergency power supplies or plans.	H	Yes	Bellingen disinfection system and Dorrigo WTP have backup generators, backup generators mounted on trailers available for use in case of power outage at pump stations (except Marx Hill, where Raleigh Reservoir provides significant backup storage)	Update the operations and maintenance manuals include protocols for the use of the backup generators.

A.4 IWCM Issues, Status and Response – Lower Bellingen Water Supply Scheme

Information from IWCM Concept			Current Status		
Issue ID	Issues	Priority	is issue relevant to current IWCM?	Business as Usual responses to issues	Additional responses required under IWCM to fully address issues
BWS1	Annual extraction from Bellingen Borefield is at or exceeding DNR Licence	H	Yes	Revised licence includes annual extraction limit sufficient for project demands until 2022.	No other measures identified.
BWS2	Peak day demand exceeds the licensed daily extraction limit of the Bellingen Borefield (5.5 ML/d) for the entire planning horizon.	H	No	Persistence analysis included in Appendix E shows that under normal operating conditions, Average Day Peak Week Demand should be able to be met for a longer duration than maximum extraction is allowed without any system failures.	No other measures identified.
BWS3	Bellingen Borefield does not have a wellhead protection plan leading to high risk of aquifer contamination	H	Yes	Not addressed	Develop a well-head protection plan
BWS4	Modelling of impact of groundwater extraction on low flows in the Bellinger River has been based on underestimated extraction rates.	M	Yes	Not addressed	Undertake a groundwater yield & impact modelling with & without climate change impacts for current & future demands.
BWS5	A small frequency of ADWG non-compliance for iron (2%), turbidity (2%), pH (2%) and total coliforms (4%) in the distribution system (results from 2001 – 2006).	L	Yes	Recent monitoring has shown improved results though there are still occasional non-conformances.	Undertake a water quality investigation to determine the reasons for failure including monitoring methods, monitoring strategy and operator training.
BWS6	Urunga peak day demand exceeds capacity of Urunga Reservoir	H	Yes	The 5ML Raleigh Reservoir has been re-commissioned and operates as a single reservoir along with Urunga Reservoir, Urunga now has sufficient reservoir capacity.	No other measures identified.
BWS7	Bellingen peak day demand frequently (80% of record) exceeds capacity of Bellingen Town Reservoir (0.88 ML)	H	Yes	New Bellingen reservoir to be built in 2012 with a capacity of 3ML, expected PDD for Bellingen is not expected to exceed 2.4ML/day during the planning horizon. New reservoir to be built in North Bellingen 2019/2020 with a capacity of 2ML.	No other measures identified except the financial model to include associated maintenance, operating, etc costs .
BWS8	Balance of system peak day demand occasionally (2% of record) exceeds capacity of Marx Hill Reservoirs (3.67 ML)	L	Yes	Raleigh Reservoir (5ML) has been re-commissioned, PDD of system now met for duration of plan.	No other measures identified.
BWS9	An error in the connection of Marx Hill Reservoirs results in a reduction in storage capacity (3.39 ML).	L	Yes	Raleigh Reservoir (5ML) has been re-commissioned, storage capacity now sufficient.	No other measures identified.
BWS10	A single pipeline (200 DICL) connects North Bellingen (including Bellingen STP) with the LBWS within the Bellingen Town Reservoir zone. This results in poor system reliability.	H	Yes	New trunk main scheduled for 2020/2021	No other measures identified.
BWS11	Raleigh Dam and Raleigh Reservoir are not connected to the system resulting in reduced intra-system storage and low utilisation of assets.	M	Yes	Raleigh Reservoir has been re-commissioned, Raleigh Dam is to be decommissioned.	No other measures identified.
BWS12	There are frequent mains breaks at Mylestom due to a high-pressure zone being supplied from O'Connors Reservoir. This results in system water losses and service issues.	M	Yes	Pressure reduction measures are now in place leading to a reduction is losses and service issues.	No other measures identified.
BWS13	O'Connors Reservoir has a relatively large storage (2.7 ML) but a small demand. This may result in extended residence times for treated water and subsequent decay of chlorine residual.	H	Yes	Not addressed	Review of residence time and residual chlorine to be undertaken for O'Connors Reservoir.
BWS14	There are a small number of properties near Urunga reservoir that are affected by low-pressure events. This results in a reduced level of service and also a reduced fire fighting capacity.	M	Yes	Monitoring has shown water pressure meets the minimum service level requirement.	Modelling of fire fighting capacity for properties near Urunga Reservoir to be undertaken by in-house hydraulic modeller.
BWS15	Reported ILI of 2.71 in 2006 resulting in 284 ML in real losses or $107,000 of annual lost revenue.	H	Yes	Leakage detection and repair program has been implemented resulting in a satisfactory ILI.	No other measures identified.
BWS16	1 major user (Norco) constitutes 6.5% (or 65 ML) of consumption. No water management plan exists for this user leading to potential inefficient use of water resource.	H	Yes	Not addressed	Norco has greatly reduced demand in recent years, Council water pricing strategy to include contingency for widely varying Norco demand.
BWS17	0.8% of residential connections are known to have rainwater tanks to supplement town water supply. This represents a very small amount within a high rainfall area resulting in a lost opportunity to harvest an alternative source.	M	Yes	Not addressed	No other measures identified.
BWS18	Raleigh Dam is to be decommissioned resulting in the loss of an identified emergency supply source.	H	Yes	Not addressed	Review of emergency supply options identified in the Drought Management Plan. Undertake a surface water secure yield study with & without climate change impacts for current & future demands due to the inter-connectivity of the ground and surface water systems.

A.5 IWCM Issues, Status and Response – Dorrigo Water Supply Scheme

Information from IWCM Concept			Current Status		Additional responses required under IWCM to fully address issues
Issue ID	Issues	Priority	is issue relevant to current IWCM?	Business as Usual responses to issues	
DWS1	The DPSWS WSP alludes to a change in licence condition that would not allow BSC to extract run of the river flows from either Rocky Creek or Bielsdown River if reference point flows were to drop below 23 ML/d. This condition would be implemented after 1/7/2009.	H	Yes	Licence was not changed. There is the potential for a cap of 1.5ML/day to be implemented during times of very low flow, this is listed in the water sharing plan but is not a condition of the licence at this stage. This is not expected to pose any difficulties for Dorrigo, given theforecast for a climate change impacted peak day in 2039 is still below this cap..	No other measures identified.
DWS2	A small frequency (4%) of ADWG non-compliance for total coliforms in the distribution system (results from 2001 – 2006).	L	Yes	Recent monitoring has shown improved results though there are still occasional non-conformances.	Undertake a water quality investigation to determine the reasons for failure including monitoring methods, monitoring strategy and operator training.
DWS3	A high frequency (64%) of ADWG non-compliance for pH in the distribution system (results from 2001 – 2006).	M	Yes	The limited (2) results from the 1/1/2011 to 2/3/2012 sampling period publically available complied.	Undertake an investigation into the potential for alkalinity buffering.
DWS4	Paucity of data available with regards to several water quality parameters for the distribution system	H	Yes	Current testing complies with DAL Guidelines.	Prepare a water quality management plan as per ADWG.
DWS5	Known areas of low pressure on the eastern ridge within Dorrigo leading to failure of levels of service.	M	Yes	Not addressed	Review service level for properties near Dorrigo reservoir.
DWS6	High-pressure areas in the western valley leading to frequent mains breaks, system water losses and service issues.	M	No	Has been addressed.	Investigate opportunities for pressure reduction in Dorrigo.
DWS7	Calculated ILI of 2.79 in 2006 resulting in 40 ML in real losses or $25,500 of annual lost revenue.	M	Yes	Ongoing trunk mains and reticulation leakage detection and repair program has resulted in ILI reduction to 1.49.	No other measures identified.
DWS8	Wide Bay Water calculated an ILI of 1.49 for 2006 reporting year.	M	Yes	Ongoing trunk mains and reticulation leakage detection and repair program has resulted in ILI reduction to 1.49.	No other measures identified.
DWS9	0.6% of residential connections are known to have rainwater tanks to supplement town water supply. This represents a very small amount within a high rainfall area resulting in a lost opportunity to harvest an alternative source.	M	Yes	Not addressed	No other measures identified.

A.6 IWCM Issues, Status and Response – Bellingen Sewerage Scheme

Information from IWCM Concept			Current Status		Additional responses required under IWCM to fully address issues
Issue ID	Issues	Priority	is issue relevant to current IWCM?	Business as Usual responses to issues	
BWW1	Non-compliance with 90th and 100 percentile DEC Environmental Protection Licence targets for ammonia (2006). 6 days exceeded maximum discharge limits (2006).	H	Yes	Blower issues and leaks have been repaired leading to compliance with ammonia targets. Daily maximum discharge limit exceeded during floods when some manholes are under water and therefore the pump stations are trying to pump out the river.	No other measures identified.
BWW2	High number of sewer overflow events (34 events per 100 km of main in 2006) compared to State Median (11 in 2005) resulting in potential water quality impacts in Bellinger River and health risk on Bellingen residents.	H	Yes	Sewer Overflow Investigations Report has been completed and an improved maintenance regime has been implemented resulting in the reduction of chokes and overflows from the reticulation system.	No other measures identified.
BWW3	McCristal Drive Pump Station has a controlled overflow to the environment resulting in potential water quality impacts in Bellinger River and health risk on Bellingen residents.	H	Yes	Controlled overflow has been decommissioned.	No other measures identified.
BWW4	No effluent reuse from Bellingen STP representing a loss of potential potable water savings.	M	Yes	Internal investigation into the viability of agricultural reuse showed reuse not economically viable.	No other measures identified.
BWW5	Peak tourist loads on Bellingen STP are approaching design capacity (5,000 EP) resulting in potential biological overloading of plant and subsequent impacts in the Bellinger River.	H	Yes	Capacity upgrade scheduled for 2019-2020	No other measures identified.
BWW6	A single rising main (250 DICL) transfers sewage from the southern Bellingen catchments to Bellingen STP on the northern side of Bellinger River. This represents a significant system risk if there were a failure with this main.	H	Yes	Not addressed	Update operations and maintenance manuals including the protocol for the monitoring of the South Bellingen sewer pump stations
BWW7	Sewerage pump stations do not have emergency storage and alternative power supply posing significant environmental and health risk.	H	Yes	The two main pump stations have 6 or more hours worth of storage at ADWF, all pump stations can be powered by trailer mounted generators if required.	Update the operations and maintenance manuals include protocols for the use of the backup generators.
BWW8	Bellingen STP does not have emergency alternative power supply posing significant environmental and health risk.	H	Yes	STP has permanent hard wired generators that switch on automatically in response to the failure of grid power.	No other measures identified.
BWW9	No classification of Biosolids is undertaken by BSC leading to a potential underutilisation of a beneficial resource.	L	Yes	Biosolids have been classified, currently awaiting EPA approval for farm reuse.	No other measures identified.

A.7 IWCM Issues, Status and Response – Bellingen Stormwater

Information from IWCM Concept			Current Status		Additional responses required under IWCM to fully address issues
Issue ID	Issues	Priority	is issue relevant to current IWCM?	Business as Usual responses to issues	
BSW1	No stormwater quality monitoring program resulting in unknown impact on Bellinger River of stormwater discharge	H	No	N/A	Not an IWCM issue, needs to be addressed by other Council Operational areas
BSW2	No source water quantity or quality control measures implemented	M	No	N/A	
BSW3	No “end of pipe” water quality control measure implemented	M	No	N/A	
BSW4	High estimated average year TP loading on Bellinger River relative to catchment loads.	M	No	N/A	
BSW5	6 known sites with erosion issues	M	No	N/A	
BSW6	6 known sites with elevated turbidity and fine sediment loads in the waterways	M	No	N/A	
BSW7	8 known sites with elevated nutrients in the waterways	H	No	N/A	
BSW8	5 known sites with potentially high chemical concentrations in runoff, waterways and sediment	H	No	N/A	
BSW9	5 known sites with elevated faecal coliform and total coliform concentrations in the waterways	H	No	N/A	
BSW10	7 known sites with degraded aquatic habitats and mosquito breeding areas	H	No	N/A	
BSW11	5 known sites with inferior condition of riparian vegetation	M	No	N/A	
BSW12	4 known sites with increased flow rates and localised flooding	M	No	N/A	
BSW13	5 known sites with litter in the stormwater system and receiving waterways	M	No	N/A	
BSW14	No stormwater reuse representing a loss of potential potable water savings.	M	Yes	Limited reuse of stormwater occurring at Bellingen Golf Course.	No other measures identified.

A.8 IWCM Issues, Status and Response – Dorrigo Sewerage

Information from IWCM Concept			Current Status		Additional responses required under IWCM to fully address issues
Issue ID	Issues	Priority	is issue relevant to current IWCM?	Business as Usual responses to issues	
DWS1	Some non-compliance with DEC Environmental Protection Licence with regards to BOD (3%), TSS (11%) and maximum day discharge (1 event) (2004 to 2006).	0	Yes	New STP is currently being designed/built	No other measures identified.
DWS2	Current dry weather load (1,150 EP) is approaching STP design capacity of 1,500 EP potentially resulting in overloading of biological treatment.	H	Yes	New STP is currently being designed/built	No other measures identified.
DWS3	Sewerage pump stations do not have emergency storage and alternative power supply posing significant environmental and health risk.	H	Yes	Major sewage pump stations have 6 to 8 hours of storage.	Update the operations and maintenance manuals include protocols for the use of the backup generators.
DWS4	Dorrigo STP does not have emergency alternative power supply posing significant environmental and health risk.	M	Yes	Current STP is a gravity system. The new STP currently being designed will have backup generators.	No other measures identified.
DWS5	There is no information regarding a future agreement for reuse of treated STP effluent at the “Darley” Property leading to ambiguity with regards to cost recovery (if any), quality requirements, volume requirements and use of effluent.	H	Yes	Plan for beneficial reuse has been shelved with funding being used for the STP upgrade.	No other measures identified.

A.9 IWCM Issues, Status and Response – Dorrigo Stormwater

Information from IWCM Concept			Current Status		Additional responses required under IWCM to fully address issues
Issue ID	Issues	Priority	is issue relevant to current IWCM?	Business as Usual responses to issues	
DSW1	No Stormwater Management Plan has been prepared for Dorrigo. This has potentially lead to an uncoordinated approach to stormwater management, adverse stormwater quality impacts and resource under utilisation.	H	No	N/A	Not an IWCM issue, needs to be addressed by other Council Operational areas
DSW2	No stormwater quality monitoring program resulting in unknown impact on Bielsdown River of stormwater discharge	H	No	N/A	
DSW3	No source water quantity or quality control measures implemented	M	No	N/A	
DSW4	No “end of pipe” water quality control measure implemented	M	No	N/A	
DSW5	High estimated average year TP loading on Bielsdown River relative to catchment loads.	M	No	N/A	
DSW6	No stormwater reuse representing a loss of potential potable water savings.	L	Yes	Previous investigations have shown that due to the generally high rainfall environment stormwater demand reuse is low.	No other measures identified.

A.10 IWCM Issues, Status and Response – Urunga Sewerage

Information from IWCM Concept			Current Status		Additional responses required under IWCM to fully address issues
Issue ID	Issues	Priority	is issue relevant to current IWCM?	Business as Usual responses to issues	
UWW1	Non-compliance with 90th percentile DEC Environmental Protection Licence targets for TSS, ammonia and TP and with 100 percentile targets for TSS and pH (2006). This may be impacting upon recreational and aquatic ecosystem protection water objectives in Urunga Lagoon.	H	Yes	Recent samples show compliance with 100%ile limits, 90%limits expected to be complied with by end of current return period. Recent exceedance due to water removal from sludge lagoon required in response to wet weather.	No other measures identified.
UWW2	High number of sewer overflow events (50 events per 100 km of main in 2006) compared to State Median (11 in 2005) resulting in potential water quality impacts in the Kalang River and Urunga Lagoon and health risk on Urunga residents.	H	Yes	Implementation of recommendations from Sewer Overflow Investigations Report has resulted in a substantial reduction in overflow events. Current investigation and maintenance scheduled to be continued.	No other measures identified.
UWW3	The Hill Side Drive Pump Station is operating at capacity leading to a high risk of overflow events and potential water quality impacts in the Kalang River and health risk on Urunga residents.	H	Yes	Pump station has been recently upgraded.	No other measures identified.
UWW4	The trickling filter at Urunga STP is currently off line, reducing biological treatment capacity from 6,650 EP to 5,000 EP. Peak dry weather tourist loading on Urunga STP is below current capacity (3,930 EP in 2003/04 summer).	NP	Yes	Trickling filter has been decommissioned. 5000EP capacity not expected to be exceeded for duration of current projection.	No other measures identified.
UWW5	There were historic odour issues in Yellow Rock (northern side of Kalang River) due to low sewage flows and large pump station capacity. It is suspected that there are now odour issues directly on the southern side of the Kalang River at PS12197.	L	Yes	Biofilter has been installed at pump station, odour issue has been resolved.	No other measures identified.
UWW6	Sewerage pump stations do not have emergency storage and alternative power supply posing significant environmental and health risk.	H	Yes	Portable generators available for use in case of power failure.	Opportunities for increasing the storage at Pilot St SPS to be investigated.
UWW7	Urunga STP does not have emergency alternative power supply posing significant environmental and health risk.	H	Yes	STP has permanent hard wired generators that switch on automatically in response to the failure of grid power.	No other measures identified.
UWW8	No effluent reuse from Urunga STP representing a loss of potential potable water savings.	M	Yes	Investigations into potential for beneficial reuse have been undertaken, reuse is not currently economically viable due to usage limits required due to proximity to river and limited need for irrigation water.	No other measures identified.
UWW9	The Urunga community are concerned about the potential aquatic ecosystem and recreational impacts of Urunga STP effluent on the Urunga Lagoon.	H	Yes	Tertiary treatment processes are in use at Urunga STP, previous community education programs have had limited success in changing community perceptions.	No other measures identified.
UWW10	Rural residential properties on Newry Island are connected to the LBWS but not the Urunga Sewerage Scheme. This may be leading to overloading of on-site management systems (OSMS) and subsequent environmental (Kalang River) and health risks.	H	Yes	The connection of Newry Island properties to the Urunga Sewerage Scheme is planned during 2012.	No other measures identified.
UWW11	No classification of Biosolids is undertaken by BSC leading to a potential underutilisation of a beneficial resource.	L	Yes	Biosolids have been classified, currently awaiting EPA approval for farm reuse.	No other measures identified.

A.11 IWCM Issues, Status and Response – Urunga Stormwater

Information from IWCM Concept			Current Status		Additional responses required under IWCM to fully address issues
Issue ID	Issues	Priority	is issue relevant to current IWCM?	Business as Usual responses to issues	
USW1	No stormwater quality monitoring program resulting in unknown impact of stormwater discharge on Kalang River and Urunga Lagoon.	H	No	N/A	Not an IWCM issue, needs to be addressed by other Council Operational areas
USW2	No source water quantity or quality control measures implemented	M	No	N/A	
USW3	No “end of pipe” water quality control measure implemented	M	No	N/A	
USW4	High estimated average year TP loading on Kalang River and Urunga Lagoon relative to catchment loads.	M	No	N/A	
USW5	5 known sites with erosion issues	M	No	N/A	
USW6	5 known sites with elevated turbidity and fine sediment loads in the waterways	M	No	N/A	
USW7	5 known sites with elevated nutrients in the waterways	H	No	N/A	
USW8	7 known sites with potentially high chemical concentrations in runoff, waterways and sediment	H	No	N/A	
USW9	3 known sites with elevated faecal coliform and total coliform concentrations in the waterways	H	No	N/A	
USW10	3 known sites with degraded aquatic habitats and mosquito breeding areas	H	No	N/A	
USW11	4 known sites with inferior condition of riparian vegetation	M	No	N/A	
USW12	2 known sites with increased flow rates and localised flooding	M	No	N/A	
USW13	4 known sites with litter in the stormwater system and receiving waterways	M	No	N/A	
USW14	Station Creek is a potential source of faecal, arsenic and antimony contamination under all wether conditions. Station Creek drains a portion of Urunga Township and also contains an abandoned antimony processing facility. Water quality may be impacting on aquatic ecosystem protection and recreational objectives of Urunga Lagoon.	H	No	N/A	
USW15	Pipe Clay Creek is a potential source of faecal contamination under all wether conditions. Water quality may be impacting on recreational objectives of Urunga Lagoon.	H	No	N/A	
USW16	No stormwater reuse representing a loss of potential potable water savings.	M	Yes	Previous investigations have shown that due to the generally high rainfall, demand for stormwater reuse is low.	No other measures identified.

A.12 IWCM Issues, Status and Response – Villages On-Site Wastewater Systems

Information from IWCM Concept			Current Status		Additional responses required under IWCM to fully address issues
Issue ID	Issues	Priority	is issue relevant to current IWCM?	Business as Usual responses to issues	
VWW1	Residential properties at Repton, Raleigh and Mylestom are connected to the LBWS but not to any reticulated sewerage scheme. This may be leading to overload of OSMS and subsequent environmental (Bellinger River) and health risks.	H	Yes	Recent review of options has shown low community support for the connection of the villages to the sewerage scheme and that the cost to Council is currently unaffordable.	No other measures identified.
VWW2	OSMS in Repton, Raleigh and Mylestom are potential contributors to Bellinger River faecal contamination and closure of the Oyster Industry through poor OSMS management.	H	Yes	Bellingen and Urunga Sewer investigations reports completed, all recommendations either implemented or scheduled. Bellinger River has re-opened for oyster farming. Sewer has been extended to connect 1 residence, a Scout Hall and an amenities block near Urunga Golf Course Premiers working group continuing to investigate contamination sources in the Kalang River	No other measures identified.
VWW3	OSMS in Repton, Raleigh and Mylestom are potential contributors to faecal contamination in the alluvial and coastal groundwater systems.	H	Yes	Short term monitoring has previously been undertaken and not shown any contamination.	No other measures identified.

Information from IWCM Concept			Current Status		Additional actions Council may choose to take
Issue ID	Issues	Priority	is issue relevant to current IWCM?	Business as Usual responses to issues	
VSW3	The Boronia Avenue stormwater outlet is a source of elevated bacterial contamination in wet weather. Water quality may be impacting on recreational objectives for Mylestom Pool.	H	No	N/A	An aquifer water quality monitoring program is to be scoped to monitor for groundwater contamination from OSMS. This would be a function of the Environmental Health section of Council.

A.13 IWCM Issues, Status and Response – Villages Stormwater

Information from IWCM Concept			Current Status		Additional responses required under IWCM to fully address issues
Issue ID	Issues	Priority	is issue relevant to current IWCM?	Business as Usual responses to issues	
VSW1	The village areas do not fall under and stormwater management plan leading to an uncoordinated approach to stormwater management, potential adverse stormwater quality impacts and resource under utilisation.	M	No	N/A	Not an IWCM issue, needs to be addressed by other Council Operational areas
VSW2	No stormwater reuse is currently undertaken representing a loss of potential potable water savings.	M	Yes	Previous investigations have shown that due to the generally high rainfall environment stormwater demand reuse is low.	No other measures identified.
VSW3	The Boronia Avenue stormwater outlet is a source of elevated bacterial contamination in wet weather. Water quality may be impacting on recreational objectives for Mylestom Pool.	H	No	N/A	Not an IWCM issue, needs to be addressed by other Council Operational areas

Appendix B Summary of Water Licence Conditions

B.1 Lower Bellingen Water Supply Scheme

Annual Extraction Limit = 1613ML

Daily Extraction Limit = 5.5ML

Restrictions must be implemented if the maximum allowable water is extracted for:

- 5 consecutive days between 1 September and 31 March or
- 10 consecutive days between 1 April and 31 August.

The water level gauge on the Bellinger River at Thora (Gauge 205002) is the primary trigger for water restrictions. The restriction level and the gauged flow ranges for the water restrictions are:

- No Restrictions, estimated flow at gauge is greater than 47ML/day;
- Level 1, estimated flow at gauge is less than 47ML/day and greater than 31ML/day;
- Level 2, estimated flow at gauge is less than 31ML/day and greater than 23ML/day;
- Level 3, estimated flow at gauge is less than 23ML/day and greater than 5ML/day; and
- Level 4, estimated flow at gauge is 5ML/day or less.

B.2 Dorrigo Water Supply Scheme

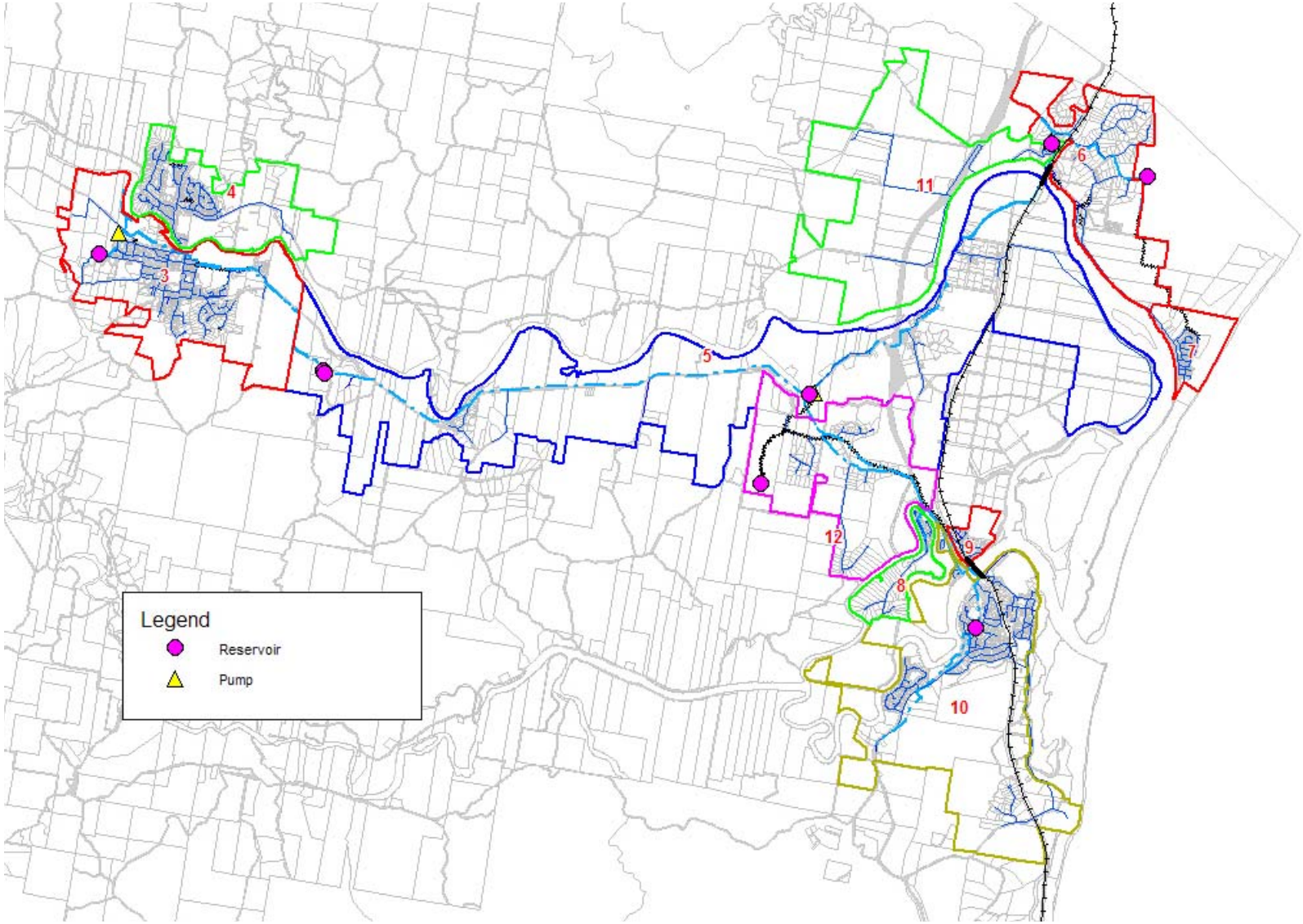
Annual Extraction Limit = 300ML

Daily Extraction Limit for Bielsdown River = 1.5ML/day during periods of “declared low flow”

There is no Daily Extraction Limit for Rocky Creek

Flow in the Bielsdown River at the Billings Road Gauge (Gauge 204017) must be at least 20ML and no blue green algae may have been detected near the pump site before water is extracted from the Bielsdown River.

Appendix C Bellingen Reservoir Zones



Lower Bellinger Water Supply Scheme Reservoir Zones

The boundary definition for urban / rural location is based on the following reservoir zones: Bellingen = 3 and 4; Valley = 5; Urunga = 8, 9 and 10; Villages = 6, 7, 11 and 12.

Appendix D Climate Change Assumptions

Using the information given in the CSIRO and Bureau of Meteorology report “Climate change in Australia, Technical Report 2007”, the following assumptions for the changes in climate expected in 2050 were made.

Parameter	Period	Minimum	Maximum	Average
Temperature (^{o}C of Change)	Annual	1.500	2.000	1.750
	Summer	1.500	2.000	1.750
	Autumn	1.500	2.000	1.750
	Winter	1.000	1.500	1.250
	Spring	1.500	2.000	1.750
Average Rainfall (% change)	Annual	-5.000	-2.000	-3.500
	Summer	-2.000	2.000	0.000
	Autumn	-10.000	-5.000	-7.500
	Winter	-10.000	-5.000	-7.500
	Spring	-10.000	-5.000	-7.500
Evapotranspiration (% Change)	Annual	4.000	8.000	6.000
Extreme Rainfall (% Change)	Annual	-2.000	-4.000	-3.000
	Summer	1.000	-1.000	0.000
	Autumn	-1.000	-2.000	-1.500
	Winter	-1.000	-2.000	-1.500
	Spring	1.000	2.000	1.500

Appendix E Persistence Analysis

Results of Historic Demand Analysis

The historic reservoir demands for the Lower Bellingen Water Supply Scheme were analysed for the peak day demand and the peak week demand. The results are summarised in the table below.

Demand (ML)	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Peak Day (PDD) in ML/day	5.84	5.71	**7.26**	5.61	5.73	5.01	5.47	5.20	4.18	6.07
Peak Week in ML/week	33.88	34.47	**45.18**	35.19	37.67	30.79	36.06	30.30	26.55	23.80
Average Day Peak Week (ADPWD) in ML/day	4.84	4.92	**6.45**	5.03	5.38	4.40	5.15	4.33	3.79	3.40
$\frac{\text{ADPW}}{\text{PDD}}$	82.9%	86.2%	**88.9%**	89.6%	93.9%	87.9%	94.2%	83.3%	90.7%	56.0%

Based on the results in the table above, the Average Day Peak Week Demand is approximately 90% of the Peak Day demand.

Assumptions made

A number of assumptions were made, these were:

1. The Average Day Peak Week Demand is 90% of the Peak Day demand;
2. The new Bellingen Reservoir will have a volume of 3ML, giving an additional storage of 2.12ML,
3. The proposed North Bellingen Reservoir will have a volume of 2ML and be built in 2020,
4. Maximum extraction from source is 5.5ML/day
5. The reservoirs start full and levels of service can be maintained when reservoirs are close to empty; and
6. There are no limits to the transfer of water between reservoirs; therefore no reservoir zones were modelled.

Method

The number of days supply can be maintained was estimated using the following maths:

Days demand met at a given rate = Reservoir volume + days extraction at extraction limit

Days demand met at a given rate - days extraction at extraction limit = Reservoir volume

Days (demand met at a given rate - extraction at extraction limit) = Reservoir Volume

Days = Reservoir volume ÷ (demand met at a given rate - extraction at extraction limit)

Results

		2009	2014	2019	2024	2029	2039
Total Reservoir Volume		14.15	16.27	16.27	18.27	18.27	18.27
Peak Day Demand	Historic Climate	6.51	6.48	6.59	6.76	6.88	6.90
	CC (2050)	6.91	6.88	7.01	7.19	7.32	7.34
Number of days of PDD able to be supplied at peak extraction	Historic Climate	14	16	14	14	13	13
	CC (2050)	10	11	10	10	10	9
Average Day Peak Week Demand	Historic Climate	5.86	5.83	5.93	6.08	6.19	6.21
	CC (2050)	6.22	6.19	6.31	6.47	6.59	6.61
Number of days of ADPWD able to be supplied at peak extraction	Historic Climate	39	49	37	31	26	25
	CC (2050)	20	24	20	19	17	17

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