

# Coastal Shire Council



## Risk-based Drinking Water Management System

### Coastal River water supply system

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## DOCUMENT INFORMATION

<b>Information</b>	<b>Details</b>
<b>Document version</b>	Version 5.0. General release version. De-identified.
<b>Date issued</b>	29 <sup>th</sup> June 2012
<b>Document controller</b>	Water Quality Manager
<b>Key document authors</b>	Council staff; NSW Health stakeholders; Office of Water stakeholders; Water science consultant; Water treatment engineering consultant.
<b>Document history</b>	Version 1.0. Template document. Version 2.0. Pre risk assessment workshop. Version 3.0. Post risk assessment workshop. Version 4.0. De-identified. Version 5.0. General release version. De-identified.
<b>Filename</b>	Coastal NSW DWMS V5.docx

## EXECUTIVE SUMMARY

### PURPOSE OF THIS DOCUMENT

As part of a pilot program involving four NSW council local water utilities, Coastal Shire Council has partnered with NSW Health and the NSW Office of Water in developing a Drinking Water Management System consistent with the Framework for Management of Drinking Water Quality in the Australian Drinking Water Guidelines 2011 - "the Framework" (NHMRC/NRMMC 2011). The implementation of such a system is required to conform to the *Public Health Act 2010* (NSW) (the Act) (NSW Government 2010) and its supporting regulation (in development). The Act sets out the need for a *Quality Assurance Program* (QAP), which would ideally be consistent with the Framework as a model for best practice.

This document sets out in outline how Council conforms to the Framework at the time of writing and summarises the actions planned to increase the level of conformity with the Framework in future. The Framework, and this document, is structured into 12 Elements, 32 Components and 76 Actions. The document was developed using the following steps:

- Complete an on site audit (termed a Gap Analysis) against the Framework.
- Undertake actions to fill many of the identified gaps, including a system description, water quality data analysis, risk assessment workshop, risk management workshop and the development of procedures.
- Summarising the way in which Council conforms to the Framework through this document, largely by referencing other documents and systems.

### PROCESS CONTROL AT CRITICAL CONTROL POINTS

The Critical Control Points (CCPs) and their associated monitoring and response procedures constitute the core of a DWMS. Therefore, the CCPs are summarised upfront within this document.

All operators are trained and made aware of the CCPs relating to the water supply systems that they work with. The CCP summaries are displayed prominently at treatment plants and at the Water Office of Council. Operators retain records of system performance against the CCP requirements and record the actions taken in response to excursions outside operational and critical limit criteria.

It is important to note that the CCP tables are not exhaustive in that there are many other actions taken by Council and other stakeholders to protect and enhance drinking water quality. The CCPs are, however, those process steps that require the most attention and, wherever practicable, continuous monitoring linked to urgent response to excursions outside of the critical limits.

Further details of the CCPs and supporting operating procedures are given in Appendix A. Broader supporting information on CCPs, including calibration and maintenance of monitoring equipment, is given in the Operations and Maintenance Manual for Coastal NSW Shire Council.

### ADDRESSING THE ADWG FRAMEWORK

The remainder of this document addressed the ADWG Framework, either directly, within the body of the document, or by reference to other documents and systems. It should be noted that, at the time of writing, there are some significant gaps between current practice and where Council and NSW Health would ideally be. Therefore, a key part of this document is the Improvement Plan (Section 3.12.2) which sets out numerous drinking water quality management improvement actions that Council will address in the coming years.

### Critical Control Points and operational criteria for the Coastal River system

Critical Control Point	Hazard(s) of concern	Operational Monitoring	Location of Measurement	Target	Operational limit	Critical limit
1. Raw water abstraction	Turbidity Pathogens	River level (via BOM and NOW river height data)	At BOM and NOW gauging station (to be identified)	Normal Level (to be defined)	0.5 m below inundation level (to be defined)	Pumps not isolated
		Raw water turbidity (via daily manual testing) (to be upgraded to on line)	Bore pumps	< 0.5 NTU	0.5 NTU	1 NTU
2. Well head protection	Pathogens	Monthly inspection of well head	Well head and surrounding area	Intact casing well head	Any integrity breach of the casing	Evidence of contamination associated with an integrity breach, e.g. hazardous substance spill
3. Chlorine disinfection	Chlorine-sensitive pathogens Taste and odour Disinfection by-products	Treated water pH (via online pH meter and daily manual testing)	Outlet of transfer pumps	7.5	> 8.0	> 8.5
		Treated water free chlorine (on line as well as via daily manual testing)	Outlet of transfer pumps	0.75 mg/L	0.65 mg/L	0.4 mg/L
4. Fluoride dosing	Fluoride	Treated water fluoride (via on line monitoring)	Outlet of balance tanks	1.0 mg/L	< 0.9 mg/L or > 1.1 mg/L	1.5 mg/L
5. Distribution reservoirs	Pathogens	Integrity of reservoirs (checked visually quarterly)	Around the full perimeter and on top of the roof of the reservoir	Secure and vermin-proof	Evidence of breeches or potential breeches, e.g. holes that could permit entry of vermin, faeces or other water entry points	Evidence of contamination, e.g. bird or animal entry or adverse water quality results
		Free chlorine (via daily manual testing)	Sampling tap on the storage	> 0.5 mg/L	< 0.3 mg/L	< 0.2 mg/L
5. Reticulation	Pathogens	System pressure (or surrogate) (measured on line): reservoir minimum service levels and/or pump station low pressure set points	Reservoirs or pump stations, as applicable	Above low alarm set points (specific to each asset)	< low alarm set points (specific to each asset)	< low-low alarm set points (specific to each asset)
		Residual chlorine (sampled weekly)	Sampling tap at customer properties	> 0.3 mg/L	< 0.2 mg/L	N/A
		Water clarity (after completing works involving loss of system pressure, e.g. mains breaks)	Sampling at flushing points (hydrants or taps at customer properties)	Water is clear following flushing	Any discolouration, odour or particles visible in the water following flushing	Any evidence of contamination of the works site, e.g. sewer or hazardous substance spill
6. Customer connections	Chemicals and pathogens	Backflow prevention devices for high and medium hazard connections (in line with the plumbing code)	Testing of testable devices at customer property connections annually	Connections are compliant and have been tested within the past 12 months	Connections lack a suitable device or it is over 15 months since the last test	Any evidence of contamination back flowing into the water supply
		Backflow prevention devices for high and medium hazard connections (in line with the plumbing code)	Testing of testable devices at customer property connections annually	Connections are compliant and have been tested within the past 12 months	Connections lack a suitable device or it is over 15 months since the last test	Any evidence of contamination back flowing into the water supply

# 1 INTRODUCTION

Coastal Shire Council partnered with NSW Health and the NSW Office of Water in developing a drinking water quality management system consistent with the Framework for Management of Drinking Water Quality in the Australian Drinking Water Guidelines 2011 (ADWG) - “the Framework” (NHMRC/NRMMC 2011). The document has been developed to conform to the Part 3, Clause 25 of the *Public Health Act 2010* (NSW) (the Act) (NSW Government 2010) and the Part 5, Clause 27 of the Public Health Regulation (public consultation draft, 2011). The Act sets out the need for *Quality Assurance Programs* (QAP) and the Regulation sets out the need for the QAP to be consistent with relevant aspects of the Framework. The Framework was developed to guide the design of a structured and systematic approach for the management of drinking water quality and includes twelve elements that are considered good practice for systematic management of drinking water supplies. The Framework is effectively a quality management system that has been developed specifically for the water industry. The framework incorporates a preventive risk management approach from catchment to consumer.

# 2 DOCUMENT STRUCTURE

Each element of the Framework has a number of components with a corresponding set of actions (12 Elements, 32 Components and 76 Actions). This Drinking Water Management System (DWMS) document follows that structure (Table 2-1). In some cases, subordinate documents are referenced for further details.

**Table 2-1. Framework for Management of Drinking Water Quality (ADWG).**

<p>1. Commitment to Drinking Water Quality Management</p> <ul style="list-style-type: none"> <li>Drinking water quality policy</li> <li>Regulatory and formal requirements</li> <li>Engaging stakeholders</li> </ul> <p>2. Assessment of the Drinking Water Supply System</p> <ul style="list-style-type: none"> <li>Water supply system analysis</li> <li>Assessment of water quality data</li> <li>Hazard identification and risk assessment</li> </ul> <p>3. Preventive Measures for Drinking Water Quality Management</p> <ul style="list-style-type: none"> <li>Preventive measures and multiple barriers</li> <li>Critical control points</li> </ul> <p>4. Operational Procedures and Process Control</p> <ul style="list-style-type: none"> <li>Operational procedures</li> <li>Operational monitoring</li> <li>Corrective action</li> <li>Equipment capability and maintenance</li> <li>Materials and chemicals</li> </ul> <p>5. Verification of Drinking Water Quality</p> <ul style="list-style-type: none"> <li>Drinking water quality monitoring</li> <li>Consumer satisfaction</li> <li>Short-term evaluation of results</li> <li>Corrective action</li> </ul>	<p>6. Management of Incidents and Emergencies</p> <ul style="list-style-type: none"> <li>Communication</li> <li>Incident and emergency response protocols</li> </ul> <p>7. Employee Awareness and Training</p> <ul style="list-style-type: none"> <li>Employee awareness and involvement</li> <li>Employee training</li> </ul> <p>8. Community Involvement and Awareness</p> <ul style="list-style-type: none"> <li>Community consultation</li> <li>Communication</li> </ul> <p>9. Research and Development</p> <ul style="list-style-type: none"> <li>Investigative studies and research monitoring</li> <li>Validation of processes</li> <li>Design of equipment</li> </ul> <p>10. Documentation and Reporting</p> <ul style="list-style-type: none"> <li>Management of documentation and records</li> <li>Reporting</li> </ul> <p>11. Evaluation and Audit</p> <ul style="list-style-type: none"> <li>Long-term evaluation of results</li> <li>Audit of drinking water quality management</li> </ul> <p>12. Review and Continual Improvement</p> <ul style="list-style-type: none"> <li>Review by senior executive</li> <li>Drinking water quality management</li> <li>Improvement plan</li> </ul>
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### 3 ADDRESSING THE ADWG FRAMEWORK

#### 3.1 ELEMENT 1 - COMMITMENT TO DRINKING WATER QUALITY MANAGEMENT

##### 3.1.1 DRINKING WATER QUALITY POLICY

###### Actions

- Formulate a drinking water quality policy endorsed by senior executives to be implemented throughout the organisation.
- Ensure that the policy is visible, communicated, understood and implemented by employees.

Coastal Shire Council does not have a standalone *Drinking Water Quality Policy* as such. However, through Council endorsement and commitment to this system, Council can demonstrate the commitment of the senior management of Coastal Shire Council to drinking water quality and safety. An action for Council to endorse and commit to this system at final draft stage has been recorded in the Improvement Plan, as Action No. 1, (Section 3.12.2).

##### 3.1.2 REGULATORY AND FORMAL REQUIREMENTS

###### Actions

- Identify and document all relevant regulatory and formal requirements.
- Ensure responsibilities are understood and communicated to employees.
- Review requirements periodically to reflect any changes.

Council maintains a detailed summary of its Legislative Framework and associated requirements in its Strategic Business Plan. Therefore, this DWMS has not reiterated that information. A summary of the legislative and formal requirements of most relevance to drinking water quality management is given here for ease of reference (Table 3-1). An action arising out of the Risk Assessment involves further establishing the regulatory and formal requirements for catchment management (Improvement Plan, Action No. 2, Section 3.12.2).



**Table 3-1. Regulatory and Formal Requirements summary (Strategic Business Plan has details).**

<b>Regulatory or formal requirement</b>	<b>Relevance to drinking water quality</b>	<b>How Council meets this requirement</b>
<i>Public Health Act 2010</i> and Regulation (2011 draft) (NSW), Part 3, Clause 25.	Sets out the need for Quality Assurance Programs and notes that the Australian Drinking Water Guidelines Framework provides the point of reference for developing such a program	Through this DWMS
Australian Drinking Water Guidelines (2011, or as revised from time to time)	Sets out appropriate practice for drinking water quality management within Australia	Through this DWMS
<i>Fluoridation of Public Water Supplies Act 1957</i>	Sets out the requirements for fluoridation of public water supplies	Described in various parts of this DWMS
NSW Code of Practice for the Fluoridation of Public Water Supplies 2011		
NSW Health Drinking Water Monitoring Program	Provides for independent testing by NSW Health of Council's treated water as supplied to consumers	Described in more detail under Section 3.5 of this DWMS.
Public Health (General) Regulation 2002 (NSW)	Requires Council to notify NSW Health if there is reason to suspect that drinking water quality might pose a risk to public health	Described in more detail under Section 3.6 of this DWMS.
NSW Code of Practice Plumbing and Drainage 3 <sup>rd</sup> Edition 2006	Sets out requirements for plumbing in Council's area of operations	Through Council's Plumbing Department
AUS SPEC 0071 Water supply - Reticulation and pump stations (Design)	Sets out the specifications for the design of Council drinking water reticulation system assets	Through Council's Engineering Department
Local Government (General) Regulation 2005 (NSW)	Sets out the requirements for on site sewage management systems (noting that these may be in the drinking water catchment) to be of an accredited (by NSW Health) design, to be registered with Council and to be subject to inspection	Through Council's Health and Building Department who maintain the register and undertake the inspections
<i>Protection of the Environment Operations Act 1997</i> (NSW)	Sets out the requirements for the control of water pollution from certain activities (noting that these may be in the drinking water catchment) which are registered with the Office of Environment and Heritage	Through notification to OEH if concerns are raised
Local Environment Plan 2010	Limits what can be developed and/or undertaken in a particular location (noting that these locations may be in the drinking water catchment)	Through Council's Planning Department which has drinking water catchment overlays that are used to ensure drinking water quality is considered when assessing development applications

### 3.1.3 ENGAGING STAKEHOLDERS

<p>Actions</p> <ul style="list-style-type: none"> <li>• Identify all the stakeholders who could affect, or be affected by, decision or activities of the drinking water supplier.</li> <li>• Develop appropriate mechanisms and documentation for stakeholder commitment and involvement.</li> <li>• Regularly updated the list or relevant agencies.</li> </ul>
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**Table 3-2. Stakeholder summary (refer Strategic Business Plan for further details).**

<b>Stakeholder</b>	<b>Relevance to drinking water quality</b>	<b>How Council engaged with this party</b>
NSW Health	Provides expertise, advice, regulatory requirements and water quality monitoring services to Council	Annual meetings with the Local Area Health Service to discuss the DWMS and progress on the Improvement Plan Participation of NSW Health in drinking water quality risk assessments, both the initial assessment and future review and updates Annual reporting to NSW Health on the DWMS and water quality test results Providing water samples for testing by NSW Health
NSW Office of Water	Provides expertise, advice and regulatory requirements to Council	Annual reporting to the Office of Water on performance of the Water Business Unit Inspections by the Office of Water of treatment plants and systems
Aboriginal communities	Two aboriginal communities are supplied from the scheme.	These schemes run independent Drinking Water Management Systems that are managed separately to this one. Council and the Office of Water work with NSW Health to manage the quality of water to these communities.
Catchment Management Authority	Coordinates actions in the drinking water supply catchment	Council provides a representative that sits on the Catchment Management Authority and assists with its planning and delivery

## 3.2 ELEMENT 2 - ASSESSMENT OF THE DRINKING WATER SUPPLY SYSTEM

### 3.2.1 WATER SUPPLY SYSTEM ANALYSIS

#### Actions

- Assemble a team with appropriate knowledge and expertise.
- Construct a flow diagram of the water supply system from catchment to consumer.
- Assemble pertinent information and document key characteristics of the water supply to be considered.
- Periodically review the water supply system analysis.

#### 3.2.1.1 SYSTEM ASSESSMENT TEAM

The System Assessment Team continued to work on this management plan following the risk assessment workshop and their identity is summarised in Table 3-3.

**Table 3-3. Risk Assessment Team**

<i>Organisation</i>	<i>Position</i>
Coastal Shire Council	Manager Water & Sewerage
	Water & Sewerage Engineer
	Water & Sewerage Supervisor
	Water Leader/Operator
	Water Operator
NSW Department of Health	Area Health Service Public Health Unit Environmental Health
	NSW Health Water Unit representative
Office of Water	Regional representative
	Inspector for the area
	Head Office representative
Independent technical consultant	Water engineering consultant involved in assisting Council develop procedures to support the DWMS
Water quality management system consultant	Facilitation and water quality risk assessment consultant to independently facilitate the workshop and assist Council develop the DWMS (team of two used)

#### 3.2.1.2 PROCESS FLOW DIAGRAMS

A process flow diagram was constructed for the water supply system as shown in Figure 3-1.

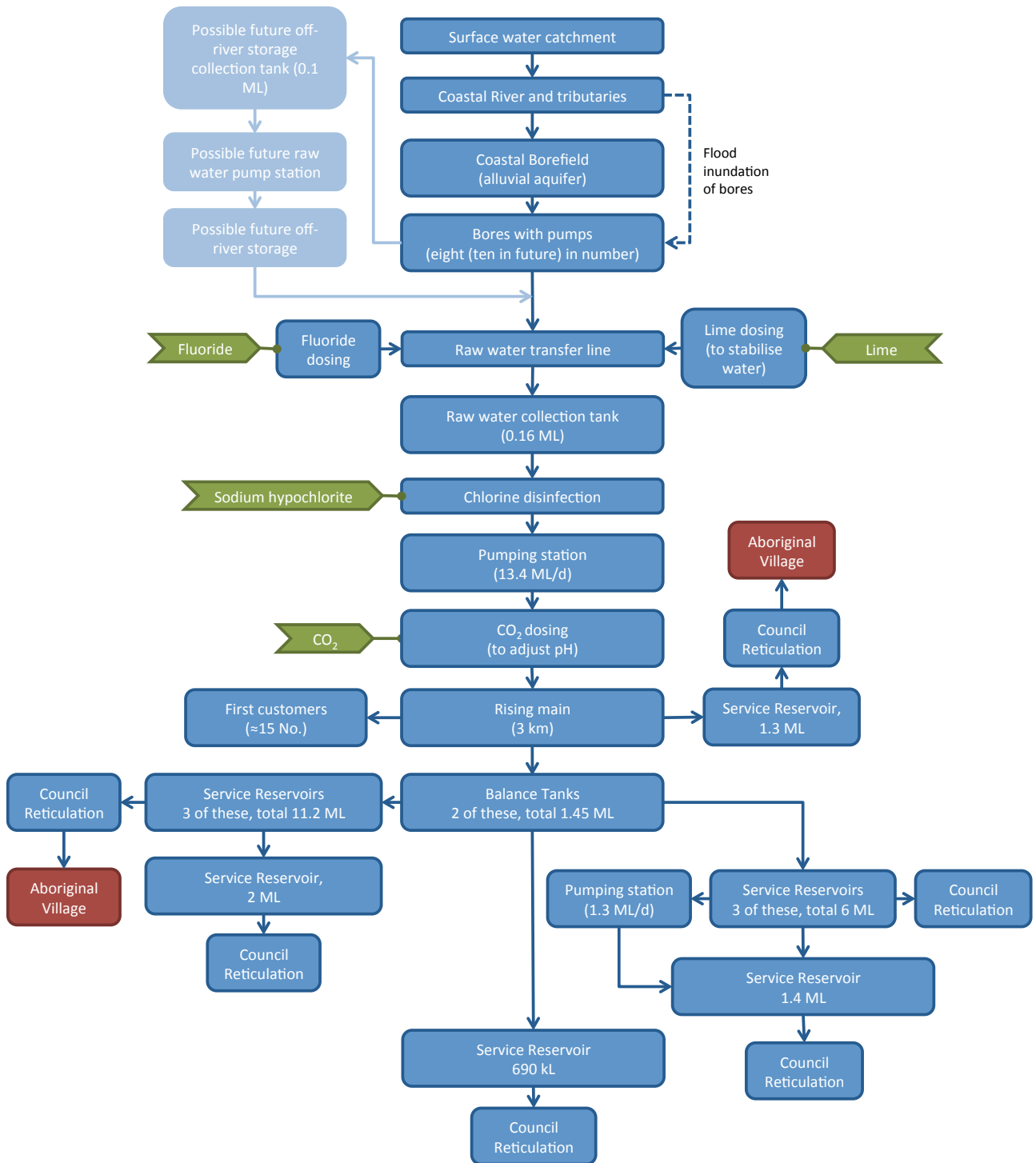


Figure 3-1. Conceptual process flow diagram of the Coastal District water supply system.

### 3.2.1.3 PERTINENT INFORMATION AND KEY CHARACTERISTICS

This section summarises the Coastal District Water Supply (CWSS) scheme. An overview of the scheme is given in Table 3-4 and in further detail in the following sections.

**Table 3-4. Water supply system – overview description.**

SYSTEM COMPONENT	DETAILS
<b>Population Served (2007 estimate)</b>	Town 1 992 Town 2 2,705 Town 3 5,984 Town 4 1,486 Town 5 1804 Rural area 1,069 Total 13,040
<b>Water Source</b>	Open rural residential, grazing and horticultural catchments supplying the Bores, pumping from an alluvial aquifer borefield (eight bores) on Coastal River upstream of the tidal limit with a capacity of 23.4 ML/d.
<b>Raw Water Storage</b>	Alluvial aquifer
<b>Water Treatment</b>	Coastal Water Treatment Plant: <ul style="list-style-type: none"> <li>• 0.16 ML collection tank</li> <li>• Lime dosing</li> <li>• Carbon dioxide dosing</li> <li>• Fluoride dosing</li> <li>• Chlorine dosing with sodium hypochlorite dosed on automatic feedback loop</li> </ul>
<b>Storage After Treatment</b>	<ul style="list-style-type: none"> <li>• 13.4 ML/d pumping station</li> <li>• 3 km of 450 mm MSCSL rising main</li> <li>• Two balance tanks to the east of the site with combined capacity of 1.45 ML.</li> </ul>
<b>Distribution of Product</b>	<ul style="list-style-type: none"> <li>• Gravitates from the treatment plant balance tanks to the first set of service reservoirs (three, combined capacity 11.2 ML), or a second set of three reservoirs (three, combined capacity 6.0 ML).</li> <li>• 1.3 ML/d capacity booster pump station downstream of the service reservoir supplies a secondary reservoir (1.4 ML capacity) during periods of high demand. All other times the secondary reservoir service area is served via gravity flow.</li> <li>• Water gravitates from the main service reservoirs to additional service reservoirs (2.0 ML capacity).</li> <li>• An off-take from the main balance tank rising main serves an additional service reservoir (1.3 ML reservoir).</li> <li>• A 690 kL concrete reservoir serves a rural residential estate.</li> <li>• There are two aboriginal villages at that are serviced by council (covered in separate plans).</li> </ul>
<b>Any Special Controls Required</b>	Avoidance of inundated bores following flood events and cleaning of bores after those events Peak tourism periods

## Overview of Current Scheme

The majority of residents as well as commercial and industrial premises within the urban centres are provided with water supply, sewerage and stormwater services. The majority of the rural population have their own on-site water supply and sewerage systems.

There is one main water supply system in the Coastal Shire, that being the Coastal Water Supply Scheme (CWSS). The CWSS Scheme was constructed in 1953 and serves all the urban centres within the Shire.

Figure 3-1 provides a flow diagram of the CWSS. Separate to this document are maps of the major natural water catchments of the region and the major components and layout of the CWSS. Some rural properties along the pipeline route are also connected to the CWSS.

## Source

The water is sourced from a borefield which consists of 8 bores with a maximum pumping capacity of 23.4 ML/d arranged in the Coastal River Alluvium (see separate maps and plot level schematics of the source).

The region is semi-tropical with summer dominant rainfall. The average daily maximum temperature is around 23.2°C, while the daily minimum temperature is around 14°C. Long-term average annual rainfall over the estuary area is between 1,300mm and 1,400mm. Annual rainfall typically ranges from 1,300 mm to 1,600 mm in the northern and eastern section of the high ridge country and between 1,200 mm and 1,600 mm to the south and west along the river.

Much of the urban and agricultural development of the shire is undertaken on the Coastal River floodplain. Approximately 76 km<sup>2</sup> (5.1% of the LGA) of the floodplain is underlain by potential acid sulphate soils (PASS). Much of the original vegetation of the coastal catchments has been cleared (approximately 15%). Rainforest areas were logged in the 1830s and cleared for cropping and cattle grazing. Much of the original riparian vegetation has been removed for grazing and the installation of flood mitigation works, or impacted by logging. Approximately 39% of the LGA is either National Parks or State Forest.

Agriculture is one of the major land uses in the shire with 23% of the Coastal LGA dedicated to this pursuit. Major agricultural activities include:

- banana growing;
- macadamia industry; and
- intensive animal production.

Other industries in the LGA include forestry, aquaculture (oyster farming in the Coastal estuary, so not in the recharge area of the aquifer), meat rendering, cement works and sand mining.

Recreation is a potential pollution source since key attractions to the area for tourists include its natural beauty, unpolluted beaches, low scale development, recreational fishing opportunities, water sports activities and nature reserves.

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

## Treatment

The water prior to distribution to customers is buffered with lime and carbon dioxide, disinfected with chlorine and fluoridated. The treatment comprises of:

- 0.16 ML collection tank
- Chemical dosing facilities for
  - Lime
  - Carbon dioxide
  - Fluoride
  - Chlorine using sodium hypochlorite dosed on automatic feedback loop

## Distribution

The scheme supplies small urban and rural customers. Key process steps are:

- A 13.4 ML/d pumping station capable of transferring the water through 3 km of 450 mm MSCL rising main to two balance tanks with a combined capacity of 1.45 ML.
- Water gravitates to additional reservoirs, of which there is one set with a combined capacity of 11.2 ML, or another set of three reservoirs with a combined capacity of 6.0 ML.
- A 1.3 ML/d capacity booster pump station downstream of the reservoir services a secondary reservoir (1.4 ML capacity) during periods of high demand. All other times the site is served via gravity flow.
- Water gravitates from the main reservoirs to an additional service reservoir (2.0 ML capacity).
- An off-take from the balance tank rising main serves an additional service reservoir (1.3 ML reservoir).
- A 690 kL concrete reservoir serves an additional rural residential estate.

Tourism is a major and growing industry for Coastal Shire. During peak Christmas holiday periods the population increases significantly leading to peak demands.

There are two aboriginal villages that are serviced by council. The ownership of the reticulation system is thought to be with the land councils and Council services the village under contract to NSW Health in liaison with NSW Office of Water. Separate Aboriginal Village Water and Sewerage Management Plans have been developed for these sites by the Office of Water (documents dated July 2011, identified as Version 2).

The existing aquifer (in this case, alluvial deposits adjacent to the river from which groundwater can be extracted) leaks and cannot meet the demands for the Coastal system during an extended drought period. There is a plan to provide the Shire with a secure water supply. The project involves construction of a series of new bores, collection tank, water transfer pipeline, water pumping stations and a new water storage, of the order 4.5 GL in volume. The water storage area will be filled by pumping water from an enlarged borefield during times when river flow is not low. The project has yet to be provided with sufficient funding to go ahead, but is likely to proceed at some point in the future.

#### **Periodic review of the water supply system analysis**

The information contained within this document is current at the time of writing. The information will need to be periodically reviewed and updated. The information will be formally reviewed annually and updated in response to significant system changes.

### 3.2.2 ASSESSMENT OF WATER QUALITY DATA

#### Actions

- Assemble historical data from source waters, treatment plants and finished water supplied to consumers (over time and following specific events).
- List and examine exceedances.
- Assess data using tools such as control charts and trend analysis to identify trends and potential problems.

#### 3.2.2.1 HISTORICAL DATA FROM SOURCE WATERS, TREATMENT PLANTS AND FINISHED WATER SUPPLIED TO CONSUMERS (OVER TIME AND FOLLOWING SPECIFIC EVENTS)

Water quality is summarised in a separate document (Risk Assessment Workshop Summary).

### 3.2.3 HAZARD IDENTIFICATION AND RISK ASSESSMENT

The hazard identification and risk assessment is discussed in a separate document (Risk Assessment Workshop Summary).

The key findings from the risk assessment were that there was a need to ensure the supply of safe water during periods of flood. During periods of flood concerns were raised about inundation of bores via overtopping or back flow through discharge lines. Furthermore, the catchment is compromised with grazing animals and on site sewage management systems and the water supply system does not filter the water so that any trace of surface water entering the bores presents an unacceptable risk. The most important immediate follow up actions relating to ensuring the security of water safety during wet weather events, e.g. by avoidance of abstraction during such events and possible further remedial works on the well heads. Longer term options were also discussed.



### 3.3 ELEMENT 3 - PREVENTIVE MEASURES FOR DRINKING WATER QUALITY MANAGEMENT

#### 3.3.1 PREVENTIVE MEASURES AND MULTIPLE BARRIERS

##### Actions

- Identify existing preventative measures from catchment to consumer for each significant hazard or hazardous event and estimate the residual risk.
- Evaluate alternative or additional preventative measures where improvement is required.
- Document the preventative measures and strategies into a plan addressing each significant risk.

##### 3.3.1.1 IDENTIFY EXISTING PREVENTIVE MEASURES AND ESTIMATE RESIDUAL RISK

An overview of the preventive measures is discussed in a separate document (Risk Assessment Workshop Summary).

##### 3.3.1.2 DOCUMENT THE PREVENTIVE MEASURES AND STRATEGIES INTO A PLAN

The preventive measures and strategies for addressing the significant risks are summarised in the following section that deals with Critical Control Points. It is important to note that the CCP tables are not exhaustive in that there are many other actions taken by Council and other stakeholders to protect and enhance drinking water quality. The CCPs are, however, those process steps that require the most attention and, wherever practicable, continuous monitoring linked to urgent response to deviations outside of the critical limits. Preventive measures that were not identified as CCPs have not been further developed as part of this iteration of the DWMS. However, ongoing work on recognising, formalising, and, where required, enhancing and better implementing those various programs is planned as part of the Improvement Plan (Section 3.12.2). Examples of preventive measures that are not captured as CCPs, and that are not explicitly captured elsewhere within the DWMS, but that are nonetheless important to manage drinking water quality, include the following:

- Development assessment and control via the Local Environmental Plan.
- Catchment management via the Catchment Management Authority – various environmental and catchment management activities to improve water quality.
- Council's program of regulating, (assessing, inspecting and enforcing) on site sewage management system compliance.
- Compliance with plumbing codes of practice both in relation to Council's activities and the regulation (assessing, inspecting and enforcing) of activities of others.

### 3.3.2 CRITICAL CONTROL POINTS

#### Actions

- Assess preventative measures from catchment to consumer to identify critical control points.
- Establish mechanisms for operational control.
- Document critical control points, critical limits and target criteria.

The Critical Control Points (CCPs) and their associated monitoring and response procedures constitute the core of a DWMS. Further details of the CCPs and supporting operating procedures are given in Appendix A. Broader supporting information on CCPs, including calibration and maintenance of monitoring equipment, is given in the Operations and Maintenance Manual for Coastal NSW Shire Council.

#### 3.3.2.1 ASSESS PREVENTIVE MEASURES TO IDENTIFY CRITICAL CONTROL POINTS

The preventive measures in place for the water supply are listed as part of the risk assessment (Appendix B). By reviewing these preventive measures, critical control points (CCPs) were identified on the following basis:

- Preventive measures are present that significantly reduce moderate, high or very maximum significant risks;
- Operational parameters can be identified that can be monitored and for which critical limits can be set;
- It is possible to monitor the operational monitoring parameters frequently enough to reveal any failures in a timely manner; and
- Procedures for corrective action can be implemented in a timely response to deviation from defined critical limits.

#### 3.3.2.2 ESTABLISH MECHANISMS FOR OPERATIONAL CONTROL

The controls required for each CCP were defined during the workshop, and further fine-tuned after the workshop. The controls are summarised in the process control table (Table 3-5).

#### 3.3.2.3 DOCUMENT CCPs, CRITICAL LIMITS AND TARGET CRITERIA

Council has documented its CCPs and critical limits in Table 3-5. In this context, these terms are used as follows:

- Targets represent the target to be aimed for by the operator for each CCP.
- Operational limits have been defined that occur somewhere between the target value and critical limit. Deviation outside the adjustment limit indicates a possible trend towards the critical limit and may be symptomatic of a loss of control. Therefore, some adjustment is required to bring the process back under control if the operational limit is exceeded.
- Critical limits are performance criteria that separate acceptability from unacceptability in terms of hazard control and drinking water safety. Deviation outside the critical limits indicates a loss of control of the process and creates a situation in which confidence in the safety of the water may be lost.

Further and full details of the operation of the CCPs are given in separate standard operating procedures managed by Council (Appendix A).

**Table 3-5. Critical Control Points and operational criteria for the Coastal River system**

<b>Critical Control Point</b>	<b>Hazard(s) of concern</b>	<b>Operational Monitoring</b>	<b>Location of Measurement</b>	<b>Target</b>	<b>Operational limit</b>	<b>Critical limit</b>
1. Raw water abstraction	Turbidity Pathogens	River level (via BOM and NOW river height data)	At BOM and NOW gauging station (to be identified)	Normal Level (to be defined)	0.5 m below inundation level (to be defined)	Pumps not isolated
		Raw water turbidity (via daily manual testing) (to be upgraded to on line)	Bore pumps	< 0.5 NTU	0.5 NTU	1 NTU
2. Well head protection	Pathogens	Monthly inspection of well head	Well head and surrounding area	Intact casing well head	Any integrity breach of the casing	Evidence of contamination associated with an integrity breach, e.g. hazardous substance spill
3. Chlorine disinfection	Chlorine-sensitive pathogens Taste and odour Disinfection by-products	Treated water pH (via online pH meter and daily manual testing)	Outlet of transfer pumps	7.5	> 8.0	> 8.5
		Treated water free chlorine (on line as well as via daily manual testing)	Outlet of transfer pumps	0.75 mg/L	0.65 mg/L	0.4 mg/L
4. Fluoride dosing	Fluoride	Treated water fluoride (via on line monitoring)	Outlet of balance tanks	1.0 mg/L	< 0.9 mg/L or > 1.1 mg/L	1.5 mg/L
5. Distribution reservoirs	Pathogens	Integrity of reservoirs (checked visually quarterly)	Around the full perimeter and on top of the roof of the reservoir	Secure and vermin-proof	Evidence of breaches or potential breaches, e.g. holes that could permit entry of vermin, faeces or other water entry points	Evidence of contamination, e.g. bird or animal entry or adverse water quality results
		Free chlorine (via daily manual testing)	Sampling tap on the storage	> 0.5 mg/L	< 0.3 mg/L	< 0.2 mg/L
5. Reticulation	Pathogens	System pressure (or surrogate) (measured on line): reservoir minimum service levels and/or pump station low pressure set points	Reservoirs or pump stations, as applicable	Above low alarm set points (specific to each asset)	< low alarm set points (specific to each asset)	< low-low alarm set points (specific to each asset)
		Residual chlorine (sampled weekly)	Sampling tap at customer properties	> 0.3 mg/L	< 0.2 mg/L	N/A*
		Water clarity (after completing works involving loss of system pressure, e.g. mains breaks)	Sampling at flushing points (hydrants or taps at customer properties)	Water is clear following flushing	Any discolouration, odour or particles visible in the water following flushing	Any evidence of contamination of the works site, e.g. sewer or hazardous substance spill
6. Customer connections	Chemicals and pathogens	Backflow prevention devices for high and medium hazard connections (in line with the plumbing code)	Testing of testable devices at customer property connections annually	Connections are compliant and have been tested within the past 12 months	Connections lack a suitable device or it is over 15 months since the last test	Any evidence of contamination back flowing into the water supply
		Backflow prevention devices for high and medium hazard connections (in line with the plumbing code)	Testing of testable devices at customer property connections annually	Connections are compliant and have been tested within the past 12 months	Connections lack a suitable device or it is over 15 months since the last test	Any evidence of contamination back flowing into the water supply

\*In practice the final chlorine will sometimes be not detectable, e.g. during periods of low flow to the system extremities.

## 3.4 ELEMENT 4 - OPERATIONAL PROCEDURES AND PROCESS CONTROL

### 3.4.1 OPERATIONAL PROCEDURES

#### Actions

- Identify procedures required from processes and activities from catchment to consumer.
- Document all procedures and compile into an operations manual.

As part of the development of the DWMS, Council reviewed the need for specific procedures. At the time of writing, not all of the procedures that were identified as being required have been developed. However, a prioritised set of procedures has been drafted.

The Operations and Maintenance Manual for Coastal Shire Council provides detailed operating procedures for the treatment plant and bore. However, in some respects, the Manual is out of date and serves the purpose as a reference document rather than a guide to day-to-day operations. Therefore, concise operational procedures have been developed to guide operators at the day-to-day level. The current draft of the procedures that have been developed are given as Appendix A of this document.

### 3.4.2 OPERATIONAL MONITORING

#### Actions

- Develop monitoring protocols for operational performance of the water supply system, including the selection of operational parameters and criteria and the routine analysis of results.
- Document monitoring protocols into an operational monitoring plan.

Operational monitoring protocols were integrated with the operating procedures for the preventive measures. The current draft of the procedures that have been developed are given as Appendix A of this document.

Detailed records are currently kept in relation to operational monitoring for fluoridation. Specifically, as required under the NSW Code of Practice for Fluoridation of Public Water Supplies 2011, daily records are collected, and retained under retrievable archive for at least seven years, relating to:

- The volume of water treated.
- The quantity of fluoridating agent added over the same time period.
- The corresponding average calculated fluoride dose.
- The fluoride analysis result from the treated water sample taken during this time period.
- The stock of fluoridating agent on hand.

This information is recorded on a Council version of the Standard Form 2 and Standard Form 4 given in the Code.

### 3.4.3 CORRECTIVE ACTION

#### Actions

- Establish and document procedures for corrective actions to control excursions in operational parameters.
- Establish rapid communication systems to deal with unexpected results.

Operational procedures are attached as Appendix A.

### 3.4.4 EQUIPMENT CAPABILITY AND MAINTENANCE

#### Actions

- Ensure that equipment performs adequately and provide sufficient flexibility and process control.
- Establish a program for regular inspection and maintenance of all equipment, including monitoring equipment.

#### 3.4.4.1 ENSURE EQUIPMENT PERFORMS ADEQUATELY

During the risk assessment, the adequacy of existing equipment was considered in the context of its ability to manage water quality risks. Examples of items specifically considered as part of the assessment are:

- Reliability of equipment in the event of power failures.
- The ability of the system to respond to water quality changes due to, e.g., floods.
- Reliability of telemetry and on line monitoring systems.
- Overall capability of preventive measures, working in combination, to mitigate significant maximum risks (refer Section 3.9).

Areas where the adequacy of equipment was considered below the ideal level for safe, reliable process operation were noted in the Improvement Plan (3.12.2).

For new equipment, Council adopts a tendering process that involves appropriately qualified and experienced persons, (either in house or contracted, as applicable) in developing specifications and reviewing tenders against those specifications at the tender and delivery phase. The objective is to ensure that equipment purchased by council performs adequately and provides sufficient flexibility and process control.

#### 3.4.4.2 ESTABLISH INSPECTION AND MAINTENANCE

Council uses its Asset Management System to schedule the inspection and maintenance of equipment and assets. In general, all council assets are subject to some programmed inspections and maintenance.

With respect to monitoring equipment, all monitoring instruments are included within the asset register that is covered by the Asset Management System. Furthermore, additional, regular inspection and maintenance, including calibration, is undertaken by Council operators. For instance, operators test water quality each day and compare the readings from on-line instruments with those from hand held instruments used by the operators. If results deviate significantly from those measured by operators, as judged by operators, instrument checking, cleaning and calibration (if required) is undertaken. As a general principle, all critical limit monitoring that is subject to on line monitoring (refer to Appendix A and Section 3.3.1) is backed up by daily operator testing to provide such a check. This includes the following instruments:

- Free chlorine analyser.
- pH analyser.
- Fluoride analyser.
- Reservoir level gauges (that control reservoir fill and hence maintain system at positive pressure).
- Pressure gauges (that control water pump stations and hence maintain system at positive pressure).

Records of asset inspections and maintenance undertaken under the direction of the Asset Management System are retained within the Asset Management System. In addition, records are kept by operators via their daily Plant Logs of their own activity. At present, there is no pre-defined tolerance to enable systematic identification of deviations between hand-held and on line instruments. However, it is intended that a log sheet will be developed that includes a location to document the readings taken by operators as well as the tolerable deviations (refer Improvement Plan, Section 3.12.2).

### 3.4.5 MATERIAL AND CHEMICALS

#### Actions

- Ensure only approved materials and chemicals are used.
- Establish documented procedures for evaluating chemicals, material and suppliers.

#### Materials

Council requires conformity with plumbing regulations, industry codes of practice and standards to guide product selection and installation, with relevant codes and legislation being:

- NSW Code of Practice Plumbing and Drainage 3<sup>rd</sup> Edition 2006 (which calls up relevant aspects of the AS/NZS 3500 Plumbing and Drainage Standards). This is enforced by Council's Plumbing Department for works undertaken by others, and adhered to by Council's Engineering Department for work undertaken by Council.
- AUS SPEC 0071 Water supply - Reticulation and pump stations (Design) (which calls up relevant aspects of the WSA Water Supply Code and AS/NZS 4020 Products for use in contact with drinking water). This is enforced by Council's Engineering Department both for works undertaken by others, e.g. developers, and adhered to by Council's Engineering Department for work undertaken by Council.

#### Chemicals

Importantly, process monitoring at CCPs provides additional assurance for many possible failure modes. For example, incorrectly formulated or dosed chemicals typically do not perform adequately leading to process malfunction and critical limit nonconformities.

Chemical deliveries are attended by trained water treatment plant operators. The risk of delivery error is reduced both by the presence of the operator and by controls on filling points, such as labelling and fittings.

For the management of fluoride dosing, a range of statutory controls are required. Coastal Shire Council requires conformity with the NSW Code of Practice for Fluoridation of Public Water Supplies 2011 (*Fluoridation of Public Water Supplies Act 1957*), which can be found at:

[http://www.health.nsw.gov.au/resources/aboutus/legal/pdf/code\\_of\\_practice.pdf](http://www.health.nsw.gov.au/resources/aboutus/legal/pdf/code_of_practice.pdf)

All chemicals purchased by Council must be sourced via contract and must come from an approved supplier. Suppliers must meet the quality control and quality assurance requirements that were developed through consideration of Chapter 8 of the ADWG (2011) and include meeting specifications for contaminants and processes for quality assurance and quality control that must be in place by the supplier.

Process monitoring at CCPs provides additional assurance for many possible failure modes. For example, incorrectly formulated or dosed chemicals typically do not perform adequately leading to process malfunction and critical limit nonconformities. Chemical deliveries are attended by trained water treatment plant operators. The risk of delivery error is reduced both by the presence of the operator and by controls on filling points, such as labelling and the use of secure fittings. Simple tests, such as visual inspection and tests of pH and specific gravity, are conducted on chemicals when received. A certificate of analysis and certificate of delivery is completed for each delivery that is received that records batch number, delivery vehicle and other pertinent details relevant to drinking water quality, as well as occupational health and safety. A certificate of analysis is required with each delivery – in practice some chemical suppliers are not yet meeting this requirement and an Improvement Action has been created to promote all suppliers to do so (refer Improvement Plan, Section 3.12.2).

### 3.5 ELEMENT 5 - VERIFICATION OF DRINKING WATER QUALITY

#### 3.5.1 DRINKING WATER QUALITY MONITORING

##### Actions

- Determine the characteristic to be monitored in the distribution system and in water as supplied to the consumer.
- Establish and document a sampling plan for each characteristic, including the location and frequency of sampling.
- Ensure monitoring data is representative and reliable.

Reliable verification monitoring is undertaken by the accredited laboratories of the NSW Division of Analytical Laboratories through the NSW Health Drinking Water Monitoring Program with results being recorded on the NSW Drinking Water Database. The program is specified by NSW Health. The samples are collected by Council staff with the sampling program being designed to cover the full range of water qualities present in Council's water supply systems. Samples are submitted in accordance with the "Guide for Submitting Water Samples to DAL for Analysis".

The results of the program are maintained by NSW Health and Council can access this program via the recently updated database. The program is described in more detail in Section 5 of the Council Strategic Business Plan for Water Supplies and by NSW Health at [http://www.health.nsw.gov.au/publichealth/environment/water/drinkwater\\_nsw.asp](http://www.health.nsw.gov.au/publichealth/environment/water/drinkwater_nsw.asp).

#### 3.5.2 CONSUMER SATISFACTION

##### Action

- Establish a consumer complaint and response program including appropriate training of employees.

Consumer satisfaction is generally verified by an absence of complaints. Consumer satisfaction nonconformities include consumer enquiries relating to taste, odour, colour, air, particles, pressure, flow and suspected illness. Consumer complaints relating directly to water quality (taste, odour, dirty water, air in water), suspected water safety concerns and potential indirect water quality issues (low pressure) are received by the Council general switchboard and recorded. If contact staff members are able to resolve consumer enquiries, no further action may be required. Consumer complaint calls may be directed to operational staff. The target for customer levels of service are stated in the Strategic Business Plan. Consumer Complaints are reported annually to the NSW Office of Water which in turn reports the consumer complaints in its annual performance and benchmarking reports.

#### 3.5.3 SHORT TERM EVALUATION OF RESULTS

##### Actions

- Establish procedures for daily review of drinking water quality monitoring data and consumer satisfaction.
- Develop reporting mechanisms internally and externally where required.

Water quality test results from the Division of Analytical Laboratories are reported to Council's Operations Manager the day that the results become available within the laboratory. The target for assessing the acceptability of water quality results is the relevant ADWG guideline value. The Operations Manager

compares the results received with the guideline values and records and actions any exceedances within 24 hours.

Consumer complaints that cannot be readily resolved in liaison with staff at the Council switchboard are reported promptly to Council operators for review and resolution.

### 3.5.4 CORRECTIVE ACTION

#### Actions

- Establish and document procedures for corrective action in response to non-conformance or consumer feedback.
- Establish rapid communication systems to deal with unexpected events.

#### Customer complaints

Customer complaint calls may be directed to operational staff to investigate and solve the problem.

Consumer complaints are resolved on an urgent basis whereby complaints that cannot be readily resolved in liaison with staff at the Council switchboard are reported promptly to Council operators. The Council operators investigate and solve the problem. Council reports on the time taken to resolve consumer complaints as a key performance indicator under the Strategic Business Plan.

#### Drinking water quality monitoring exceedances

Drinking water quality monitoring nonconformities trigger a notification by the laboratory to the Operations Manager. Depending on the nature of the exceedance, the response may include re-testing (using the "Form for urgent sample submission to DAL"), investigation and, in some cases, notification to NSW Health which may result in boil water or water avoidance notices to consumers. In relation to health-related parameters, Council responds in line with the requirements of NSW Health with respect to the protocols listed under Section 3.6.2, below.



## 3.6 ELEMENT 6 - MANAGEMENT OF INCIDENT AND EMERGENCIES

### 3.6.1 COMMUNICATION

#### Actions

- Define communication protocols with the involvement of relevant agencies and prepare a contact list of key people, agencies and businesses.
- Develop a public and media communication strategy.

In response to specific water quality issues, Council follows the guidance of NSW Health, which, as noted under Corrective Action (Section 3.5.4) and below (Section 3.6.2), follows pre-defined protocols. If the Corrective Action fails to contain the situation and broader notification is required, Council continues to follow the guidance of NSW Health with respect to its recommended response protocols (Section 3.6.2). Contacts of key staff are kept within the Council's general Disaster Plan. In general, any water quality incident would be handled initially by the Operations Manager, and Council and other agencies would be brought in to assist as required.

### 3.6.2 INCIDENT AND EMERGENCY RESPONSE PROTOCOLS

#### Actions

- Define potential incident and emergencies and document procedures and response plans with the involvement of relevant agencies.
- Train employees and regularly test emergency response plans.
- Investigate and incident or emergencies and revise protocols as necessary.

Council has a general Disaster Plan but no specific water quality incident response plan. Other than the response protocols noted below, that have been prepared as guidance by other parties, Council does not have its own specific incident response protocols for foreseeable water quality incidents and would place a heavy reliance on the Public Health Unit to support Council. An Improvement Action has been recorded for Council to develop contingency plans for incidents and emergencies related to drinking water quality (Improvement Plan, Section 3.12.2). In the interim, the following protocols are accessible to Council to guide the response of Council and the Public Health Unit in the event of water quality incidents:

- NSW Health Response Protocol: for the management of physical and chemical quality.
- NSW Health Response Protocol: for the management of microbiological quality of drinking water.
- NSW Health Response Protocol: following failure in water treatment or detection of *Giardia* or *Cryptosporidium* in drinking water.
- NSW Fluoride Response Protocol: NSW Code of Practice for Fluoridation of Public Water Supplies 2011 Section 10.3 and Appendix C - Fluoridation Incident Management: Forms 5 and 6.
- NSW Health Drinking Water Monitoring Program December 2005. Appendix 2 NSW Health Response Protocols (except where superseded by the above, more recent, protocols):
  - NSW Health Response protocol for the management of microbiological quality of drinking water:
    - Action on the detection of *E. coli* or coliform bacteria.
    - Action in response to a failure in treatment or disinfection, or rapidly changing source water quality.
    - Corrective actions following the detection of contamination or treatment/disinfection failure.
    - Contamination investigation and sanitary survey - assessing the need for a boil water alert.
    - Factors to consider before issuing a boil water alert.

- Factors to consider before issuing a boil water alert.
- NSW Health Response protocol for the management of physical and chemical quality of drinking water:
  - Action on the exceedance of guideline values.
  - Risk assessment and considerations for public notification.
  - Public notification considerations.

One of most common responses to foreseeable drinking water quality problems is to issue a boil water notice or provide other notification. Notices would only be issued in liaison with the NSW Health Public Health Unit, and with consideration being given to the relevant guidance from NSW Health Water Unit, noted above. In practice, Council would most likely have to physically issue a boil water notice and in preparing such notices would make use of the NSW Health templates as starting points in preparing such notices:

- Example Boil water alert for *Cryptosporidium* and or *Giardia* contamination
- Example Boil Water Alert *E. coli* Contamination

In relation to cyanobacteria (blue-green algae), Council has adopted the Interim Blue-green Algae Management Protocols, NSW Water Directorate, November 2009. Incidents are managed with reference to this protocol and in liaison with the Regional Algal Coordinating Committee (RACC) of the NSW Office of Water.

Council has not undertaken formal training in relation to water quality incident response but intends to undertake exercises with other councils and NSW Health in future (Improvement Plan, Section 3.12.2).

## 3.7 ELEMENT 7 - EMPLOYEE AWARENESS AND TRAINING

### 3.7.1 EMPLOYEE AWARENESS AND INVOLVEMENT

#### Actions

- Develop mechanisms and communication procedures to increase employees' aware of and participation in drinking water quality management.

Council has a policy of ensuring staff are appropriately skilled and trained, as detailed in Section 2.4 of the Strategic Business Plan. One action proposed for the next 12 months is to provide drinking water quality awareness training to key Council staff to inform them of this DWMS and of the *Public Health Act 2010* (NSW) and associated Regulation (Improvement Plan, Section 3.12.2).

### 3.7.2 EMPLOYEE TRAINING

#### Actions

- Ensure that employees, including contractors, maintain the appropriate experience and qualification.
- Identify training need and ensure resources are available to support training programs.
- Document training and maintain records of all employee training.

Staff at the treatment plant have taken part in NOW training including the fluoridation course. In addition, staff have taken part in refresher training and are looking at Certificate level training in future. Plant operators hold the Fluoride Plant Operator's Certificate from NSW Health as required under the NSW Code of Practice for Fluoridation of Public Water Supplies 2011.

## 3.8 ELEMENT 8 - COMMUNITY INVOLVEMENT AND AWARENESS

### 3.8.1 COMMUNITY CONSULTATION

#### Actions

- Assess requirements for effective community involvement.
- Develop a comprehensive strategy for community consultation.

Council undertakes community consultation on an as needs basis relating to water supply system improvements. However, there is no general water quality consultation process in place at this time.

### 3.8.2 COMMUNICATION

#### Actions

- Develop an active two way communication program to inform consumers and promote awareness of drinking water quality issues.

Council is directly accountable to the public through control by elected officials. Council meeting minutes are published and made available to residents. Council tracks correspondence to that if consumers contact council to seek information in relation to water quality, Council systematically responds to that request for information. Council's water quality performance is published annually as part of the NSW Office of Water performance monitoring programs.

Council is currently engaging stakeholders and the community through its *Community Strategic Plan (CSP)*.

## 3.9 ELEMENT 9 - RESEARCH AND DEVELOPMENT

### 3.9.1 INVESTIGATIVE STUDIES AND RESEARCH MONITORING

#### Actions

- Establish programs to increase understanding of the water supply system
- Use information to improve management of the water supply system

Coastal Shire Council supports the NSW Water Directorate and staff members remain up to date through their involvement in industry bodies including the Australian Water Association and the Institute of Engineers and their attendance at industry seminars and conferences.

### 3.9.2 VALIDATION OF PROCESSES

#### Actions

- Validate processes and procedures to ensure that they are effective at controlling hazards.
- Revalidate process periodically or when variation in conditions occurs.

Validation involves gathering objective evidence that the treatment should be effective in providing safe, quality water. General validation of the system is listed in Table 3-6.

**Table 3-6. General validation of the system.**

Item validated	Validation	Reference
Effectiveness of control measure combinations	<p>The overall effectiveness of control measure combinations is validated based on a combination of system design specifications, design engineer expertise, judgement by the operators as well as with reference to industry guidance and practice.</p> <p>The control measure combinations have been systematically reviewed as part of the risk assessment. The control measure combinations in place have been judged to be adequate for the short-term. Improvement actions have been initiated where risks are considered inadequately controlled for the long-term. Therefore, control measure combinations are either considered adequate, or are subject to review with possible shortcomings having been identified.</p>	Risk assessment spreadsheet showing the cross-check of identified significant risks against existing control measure combinations (Coastal Shire Council (2012), given as Appendix B of this document).
Disinfection critical limits	Critical limits for disinfection are set based on a combination of system design specifications, design engineer expertise, judgement by the operators as well as with reference to industry guidance and practice. Explicit guidance is not always conformed to at all sites and judgement is used to inform critical limits. ADWG recommend turbidity of $\leq 1$ NTU during disinfection. ADWG recommend a chlorine concentration (measured in mg/L) multiplied by contact time (measured in minutes) (Ct) of $\geq 15$ mg•min/L with a pH of between 6.5 to 8.5.	ADWG (2011)
Closed storage controls	Throughout all systems, treated drinking water storages are kept closed to birds, vermin and ready access by humans. In most cases, operators check security and proofing at approximately weekly intervals at all storages. The process is considered adequate in water supply systems where Coastal Shire Council reliably maintains disinfectant residuals.	Operator's judgement
Reticulation system controls	Work undertaken by system operators is considered to be consistent with current good industry practice and adequate for control of the risks identified. Pressure maintenance is controlled using pumps, clear water tanks and service reservoirs as assessed using pressure or level. Verification of system pressure takes place indirectly through flow rate testing from time to time by operators. If customers complain of low pressure, or no water, operators test and rectify any low pressure zones. Flushing is undertaken as the principal means of removing possible contamination from water mains following any type of works, including for Coastal Shire Council connections and repair and replacement.	Operator's judgement

### 3.9.3 DESIGN OF EQUIPMENT

Actions

- Validate the selection and design of new equipment and infrastructure to ensure continuing reliability.

Coastal Shire Council acknowledges the importance of ensuring that equipment and infrastructure performs to meet the intended requirements. Coastal Shire Council relies on consultants to validate the selection and design of new equipment required for upgrades and process improvements.

## 3.10 ELEMENT 10 - DOCUMENTATION AND REPORTING

### 3.10.1 MANAGEMENT OF DOCUMENTATION AND RECORDS

#### Actions

- Document information pertinent to all aspects of drinking water quality management.
- Develop a document control system to ensure current versions are in use.
- Establish a records management system and ensure that employees are trained to fill out records.
- Periodically review and revise as necessary.

Not all critical operational procedures are fully documented. To the extent considered acceptable, staff members are permitted to adopt their own ways of achieving the documented drinking water quality management objectives. In such circumstances, Coastal Shire Council relies on staff experience, understanding and judgement as to how objectives are achieved rather than on adherence to documented procedures. The complexity, variability, remote and outdoor nature of many tasks makes the use of documented procedures impractical in many circumstances. Operator induction, initial and refresher training, mentoring and supervision and the maintenance of experienced staff are used to retain control of processes. The documents that are developed are summarised in Appendix A.

### 3.10.2 REPORTING

#### Actions

- Establish procedures for effective internal and external reporting.
- Produce an annual report to be made available to consumers, regulatory authorities and stakeholders.

#### Internal reporting

Internal reporting is undertaken through a number of reports e.g. Council monthly, quarterly and annual reports on the water supply system.

#### External Reporting

Council reports externally through, for instance, the:

- NSW Health compliance reports;
- *Water Supply and Sewerage NSW Benchmarking Report*; and
- Regional State of the Environment Report.

In addition, in relation to technical aspects of fluoridation, the Fluoride Communication Protocol (NSW Code of Practice for Fluoridation of Public Water Supplies 2011) is used when reporting to NSW Health and the NSW Office of Water.

### 3.11 ELEMENT 11 EVALUATION AND AUDIT

#### 3.11.1 LONG-TERM EVALUATION OF RESULTS

Actions

- Collect and evaluate long term data to assess performance and identify problems.
- Document and report results.

Coastal Shire Council undertakes a reviews of the monitoring results to assess the performance of the system against numerical guideline values as part of NOW and NSW Health reporting requirements. This includes:

- *Coastal Shire Council Annual Report*
- *Water Supply and Sewerage NSW Benchmarking Report*
- *Strategic Business Plan*

#### 3.11.2 AUDIT OF DRINKING WATER QUALITY MANAGEMENT

Actions

- Establish processes for internal and external audits
- Document and communicate audit results

The drinking water quality management system will be internally and externally audited in line with the other documents required for compliance with the current version of the NOW *Best Practice Management of Water Supply and Sewerage Guidelines* as the requirements of NSW Health become clearer. The drinking water management system will be internally and externally audited once the requirements of NSW Health for auditing of these DWMS documents have been clarified. In the meantime, it is noted that NSW Health can audit the document at any time so that Council maintains this DWMS in an audit-ready state.



## 3.12 ELEMENT 12 - REVIEW AND CONTINUAL IMPROVEMENT

### 3.12.1 REVIEW BY SENIOR EXECUTIVE

#### Actions

- Senior executive review of the effectiveness of the management system.
- Evaluate the need for change.

Council undertakes a review of the effectiveness of the management system and the underlying policies as part of the development of the *Annual Report*, *Strategic Business Plan* and the *Water Supply and Sewerage NSW Benchmarking Report*.

### 3.12.2 DRINKING WATER QUALITY MANAGEMENT IMPROVEMENT PLAN

#### Actions

- Develop a drinking water quality management improvement plan.
- Ensure that the plan is communicated and implemented and that improvements are monitored for effectiveness.

A detailed list of Improvement Actions has been identified following the risk assessment workshop and is shown in Table 3-7. In addition, this Improvement Plan captures additional improvements identified in the body of this document. The allocation of actions and associated timeframes given in this version of the document are indicative and have yet to be agreed with the responsible parties.

**Table 3-7. Improvement Actions**

Action No.	Action details.	Risk No. (if relevant)	Allocation	Timeframe
1.	Council to make a high level commitment to this DWMS once it has reached a final draft stage.		Council	End 2012
2.	Council to prepare a register of regulatory and formal requirements directly relevant to drinking water quality management.		Council	End 2012
3.	Develop incident and emergency response protocols related to drinking water quality incidents.		Council	Mid 2013
4.	Complete this document by providing further details of how Council meets the ADWG Framework.		Council	End 2012
5.	Refine operational and critical limits and update those that haven't yet been agreed		Council	End 2012
6.	Review some sort of warning system such as river level to enable early shut-off of bores.	3	Council	Mid-2012
7.	Review turbidity monitoring of bores to pick up inundation.	3	Council	Mid-2012
8.	Include bore sealing in capital works improvements.	3 and 8	Council	End 2016
9.	Start daily testing of Turbidity against a 1 NTU target value at the combined water.	3	Council	Early 2012
10.	Review bank stabilisation work options.	9 and 10	Council	End 2012
11.	Review erosion of aquifer buffer between river and bore.	10	Council	Mid-2012
12.	Measure CCPP and review against a 45 to 55 mg/L Ca hardness target as a rule of thumb for this system.	12 and 13	Council	Early 2012
13.	Formalise current procedures to reduce lime dosing if CO <sub>2</sub> dosing fails to ensure pH is within safe levels.	15	Council	End 2012
14.	Seek funding to replace equipment by writing to the Fluoridation Committee noting that the plant is becoming aged and unreliable and should be replaced	17	Council	Mid-2012
15.	Set up a high level fluoride alarm telemetry system.	18	Council	Mid-2012
16.	Develop a chart of flow rate vs dosage setting to calibrate the fluoride dosing process.	18	Council	Mid-2012
17.	Install dual pumps on chlorine dosing system.	20	Council	Mid-2013
18.	Review contact time to first customer off rising main then rank the risks associated with these customers given the C•t provided.	23	Council	End 2012

<b>Action No.</b>	<b>Action details.</b>	<b>Risk No. (if relevant)</b>	<b>Allocation</b>	<b>Timeframe</b>
19.	Advise property owners of their obligations relating to backflow prevention and continue rolling out the backflow prevention program	24 and 33	Council	Ongoing
20.	Vermin-proof the overflows on the balancing storages if necessary	25	Council	Mid-2013
21.	Consider a procedure to check utility installation works on reservoirs to ensure contamination has not arisen (possibly bring the standard check forward).	30	Council	Mid-2013
22.	Continue the flushing program at key dead ends	34	Council	Ongoing
23.	Consider discussions with fire fighters regarding timing and locations of fire hydrants during practices	35	Council	Mid-2013
24.	Re score risks once the new telemetry has come in.	40	Council	Mid-2013

## 4 REFERENCES

ABC. 2011. Report for Off-river Storage. Water Quality Risk Assessment Workshop. July 2011. Report to Coastal Shire Council. Draft Only. 22/15449/14736.

Coastal Shire Council. 2012. Summary of Drinking Water Quality Risk Assessment Workshop. Working Draft Version 2, January 2012. Given as Appendix B of this document.

Coastal Shire Council. 2008. Strategic Business Plan .

NHMRC/NRMMC (National Health and Medical Research Council/ Natural Resource Management Ministerial Council) (2011) Australian Drinking Water Guidelines (ADWG) National Water Quality Management Strategy (abbreviated in this paper as ADWG 2011).

XYZ. 2009. Coastal Shire Council Integrated Water Cycle Management Strategy *Draft* Report. Date: May 2009 Draft Version 3b.

NSW Government. 2010. Public Health Act 2010 No 127, An Act with respect to public health. Assented to by the Legislature of New South Wales on 7 December 2010.

## APPENDIX A OPERATING PROCEDURES

The following procedures have been drafted at the time of writing and are given in this Appendix. These procedures are subject to being improved, and additional procedures are being developed, as noted in the Improvement Plan (Section 3.12.2 of this document).

Name	Type	System	Version	Status
<b>Critical Control Points Quick Reference Guide</b>	Critical Control Points	Coastal Water Supply System	3	Draft
<b>CCP 1a – Raw Water Abstraction - River Level</b>	Critical Control Point Management Procedure	Coastal Water Supply System	3	Draft
<b>CCP 1b – Raw Water Abstraction – Raw Water Turbidity</b>	Critical Control Point Management Procedure	Coastal Water Supply System	3	Draft
<b>CCP 3a – Chlorine Disinfection - Free Chlorine</b>	Critical Control Point Management Procedure	Coastal Water Supply System	3	Draft
<b>CCP 3b – Chlorine Disinfection - pH</b>	Critical Control Point Management Procedure	Coastal Water Supply System	3	Draft
<b>CCP 4 – Fluoridation</b>	Critical Control Point Management Procedure	Coastal Water Supply System	3	Draft
<b>CCP 5 – Distribution Reservoirs</b>	Critical Control Point Management Procedure	Coastal Water Supply System	3	Draft
<b>CCP 6 – Reticulation</b>	Critical Control Point Management Procedure	Coastal Water Supply System	3	Draft

# Critical Control Points Monitoring

## Quick Reference Guide

Some of the critical parameters for safe management of your system.

	Target	Operational Limit	Critical Limit
<b>River Level</b>	Normal level	Inundation Level	Pumps not Isolated
<b>Raw Water Turbidity</b>	< 0.5 NTU	0.5 NTU	1 NTU
<b>Treated Water pH</b>	7.5	> 8.0	> 8.5
<b>Treated Water Chlorine</b>	0.75 mg/L	0.65 mg/L	0.4 mg/L
<b>Fluoride</b>	1.0 mg/L	< 0.9 or > 1.1 mg/L	1.5 mg/L
<b>Reservoir Integrity</b>	Secure and Vermin Proof	Evidence of Breaches	Breach not Rectified, or Serious Breach
<b>Reservoir chlorine</b>	0.5 mg/L	0.3 mg/L	0.2 mg/L
<b>Reticulation Chlorine</b>	0.3 mg/L	0.2 mg/L	N/A

### Target

This is where you should be operating. Aim to keep the system operating at this value

### Operational Limit

If you reach this limit, refer to CCP management sheet and try to get back to the operational target. Increase monitoring until returned to normal.

### Critical Limit

If you reach this limit, you have lost control of your system. Refer to CCP management sheet and try to return to operational target as a matter of urgency.

## CCP 1a. Raw Water Abstraction. River level.

What is being measured?	River Level (bore inundation)
Where/how is it measured?	River level near bore field / BoM and NOW river height data
What are the hazards?	Turbidity, pathogens
What are the preventive measures?	No control over level - Bore pump operation controls extraction

Target Normal level of x.x m (to be decided)	Operational Limit 0.5 m below inundation level (to be decided)	Critical Limit Pumps not isolated
<b>Corrective actions</b>		
<ul style="list-style-type: none"> <li>Check river levels against inundation levels for each bore, switch off if suspected of inundation</li> </ul>	<ul style="list-style-type: none"> <li>Isolate (switch off pump) any bores where inundated</li> </ul>	<ul style="list-style-type: none"> <li>Check pump/s are isolated</li> <li>Notify Local Health Unit (XXXX XXXX)</li> <li>Consider increasing chlorine dosage</li> <li>Refer to Raw Water Turbidity CCP</li> </ul>

Note: Operators have no control over the river level, this sheet presents steps to manage increases above normal.

## CCP 1b. Raw Water Abstraction. Raw water turbidity.

What is being measured?	Raw Water Turbidity
Where/how is it measured?	Bore pumps / daily sampling and testing
What are the hazards?	Turbidity, pathogens
What are the preventive measures?	Not able to be controlled

**Target**  
**< 0.5 NTU**

**Operational Limit**  
**0.5 NTU**

**Critical Limit**  
**1 NTU**

### Corrective actions

- |  |   |  |
|--|---|--|
| <ul style="list-style-type: none"> <li>• Daily sampling and testing of combined raw water</li> <li>• Weekly inspection of bores</li> </ul> | <ul style="list-style-type: none"> <li>• Check river levels against inundation levels for each bore, switch off if suspected of inundation</li> <li>• Sample and test two raw water inlets to isolate bores 9 &amp; 10 from The Rest</li> <li>• Sample and test individual bores to try and isolate problem if necessary</li> <li>• Isolate (switch off pump) for any bores with high turbidity</li> <li>• Consider flushing suspect bores</li> </ul> | <ul style="list-style-type: none"> <li>• Consider increasing chlorine dosage</li> <li>• Visual inspection and testing of each bore</li> <li>• Continue adjustment actions until rectified</li> </ul> |
|--|---|--|

Note: Operators have very little control over the Raw Water Turbidity; this sheet presents steps to manage increases above normal.



## CCP 3a. Chlorine disinfection. Free chlorine.

What is being measured?	Treated Water Free Chlorine
Where/how is it measured?	Outlet of transfer pumps / online chlorine analyser, daily sampling & testing
What are the hazards?	Chlorine sensitive pathogens
What are the preventive measures?	Chlorine dosing system

**Target**  
**0.75 mg/L**

**Operational Limit**  
**0.65 mg/L**

**Critical Limit**  
**0.4 mg/L**

### Corrective actions

- Sample water from balance tanks
- Return to headworks and test for chlorine residual
- Compare result to residual analyser measurement
- Inspection of chlorination system

- Check calibration of online analyser
- Detailed system inspection and interrogation
- Sample and test from reticulation
- Check lab testing equipment
- Consider switching to manual dosing control

- Isolate transfer pumps
- Contact Water and Sewerage Supervisor
- Notify Local Health Unit if not rectified within 8 hours of detection
- Test raw water quality parameters
- Slug dose balance tanks
- Consider slug dosing reticulation reservoirs
- Refer to adjustment actions and return system to service

## CCP 3b. Chlorine disinfection. pH.

What is being measured?	Treated Water pH		
Where/how is it measured?	Outlet of transfer pumps / online pH meter, daily sampling and testing		
What are the hazards?	Chlorine sensitive pathogens		
What are the preventive measures?	Lime / CO2 dosing systems		
	<b>Target</b> <b>7.5</b>	<b>Operational Limit</b> <b>&gt; 8.0</b>	<b>Critical Limit</b> <b>&gt; 8.5</b>

### Corrective actions

<ul style="list-style-type: none"> <li>• Sample water from balance tanks</li> <li>• Test and compare result with online analyser</li> <li>• Compare online analyser result with pH monitor on CO<sub>2</sub> system</li> <li>• Visual inspection of lime system, including cleandown of solution tank</li> <li>• Visual inspection of CO<sub>2</sub> system, including level in tank</li> </ul>	<ul style="list-style-type: none"> <li>• Contact Supervisor (XXXX XXX XXX)</li> <li>• Detailed inspection of CO<sub>2</sub> and lime dosing systems</li> <li>• Check CO<sub>2</sub> injection on indication gauge flow meter</li> <li>• Sample from online meter to check meter calibration</li> <li>• Calibrate online meter with reagents</li> <li>• Consider switching CO<sub>2</sub> dosing to manual control</li> <li>• Check collection tank and test pH</li> <li>• Isolate lime dosing pump</li> <li>• Isolate transfer pumps</li> <li>• Drain collection tank</li> </ul>	<ul style="list-style-type: none"> <li>• Consider isolating balance tanks and/or service reservoirs</li> <li>• Refer to Critical Response to lack of primary chlorine disinfection</li> </ul>
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## CCP 4. Fluoridation.

What is being measured?	Treated Water Fluoride
Where/how is it measured?	Outlet of balance tanks on line monitoring
What are the hazards?	Fluoride overdosing and underdosing
What are the preventive measures?	Fluoride dosing system

**Target**  
**1.0 mg/L**

**Operational Limit**  
**< 0.9 mg/L or > 1.1 mg/L**

**Critical Limit**  
**1.5 mg/L**

### Corrective actions

<ul style="list-style-type: none"> <li>• Sample water from balance tanks</li> <li>• Visual inspection of plant</li> <li>• Enter weight loss into computer</li> <li>• Record water flow, calculate dosage</li> <li>• Calibrate test equipment</li> <li>• Test water sample</li> <li>• Compare result with online analyser</li> </ul>	<ul style="list-style-type: none"> <li>• Check Dosage vs Flow on calibration chart</li> <li>• Resample and test water</li> <li>• Adjust fluoride dosage a small amount (~2%)</li> <li>• Detailed inspection and interrogation of system</li> <li>• Resample and test water following day</li> <li>• Contact Supervisor (XXX XXX XXX) if not corrected</li> </ul>	<ul style="list-style-type: none"> <li>• Shutdown dosing plant</li> <li>• Contact Supervisor (XXX XXX XXX)</li> <li>• Contact Local Health Unit (XXXX XXXX)</li> <li>• Sample and test from collection tank</li> <li>• Sample and test for retic fluoride</li> <li>• Complete a thorough system inspection with Water Leader</li> <li>• Consider isolating and draining balance tanks</li> </ul> <p style="text-align: center;"><b>4.0 mg/L</b></p> <ul style="list-style-type: none"> <li>• Immediately shutdown water supply system and isolate reservoirs</li> <li>• Advise public not to consume water</li> </ul>
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## CCP 5. Distribution Reservoirs.

What is being measured?	Reservoir Integrity
Where/how is it measured?	Quarterly visual inspection of reservoirs
What are the hazards?	Chlorine sensitive pathogens (recontamination)
What are the preventive measures?	Reservoir maintenance and upkeep

<b>Target</b> <b>Secure and vermin proof</b>	<b>Operational Limit</b> <b>Evidence of breaches</b>	<b>Critical Limit</b> <b>Breach not rectified, or serious breach</b>
<b>Corrective actions</b>		
<ul style="list-style-type: none"> <li>Quarterly reservoir inspection (see checklist)</li> </ul>	<ul style="list-style-type: none"> <li>Notify supervisor of issues to organise repairs in a timely manner</li> <li>Sample and test chlorine residual from nearest sampling point</li> <li>Consider taking micro sample and send to DAL</li> <li>Increase frequency of inspections until repaired</li> </ul>	<ul style="list-style-type: none"> <li>Consider taking reservoir offline</li> <li>Take micro sample and send to DAL</li> <li>Contact PHU (XXXX XXXX) if water quality issue is suspected (eg low chlorine residual)</li> </ul>

## CCP 6. Reticulation.

What is being measured?	Reticulation Free Chlorine		
Where/how is it measured?	Various locations throughout reticulation / daily sampling and testing		
What are the hazards?	Chlorine sensitive pathogens		
What are the preventive measures?	Chlorine dosing system		
	<b>Target</b> <b>0.3 mg/L</b>	<b>Operational Limit</b> <b>0.2 mg/L</b>	<b>Critical Limit</b> <b>N/A</b>
<b>Corrective actions</b>			
<ul style="list-style-type: none"> <li>• Sampling and testing from retic (weekdays)</li> <li>• Chlorine dosing system inspection</li> </ul>	<ul style="list-style-type: none"> <li>• Contact Supervisor (XXXX XXX XXX)</li> <li>• Sample and test chlorine and pH from nearest reservoir</li> <li>• Sample and test from other location in same retic (chlorine trace)</li> <li>• Compare with Balance Tank residual</li> <li>• Consider flushing retic if reservoir residual is good (~0.5)</li> <li>• Consider bacto test if reservoir residual is low</li> <li>• Inspect reservoir integrity</li> <li>• Contact local fire brigades to check recent hydrant use</li> <li>• Resample and test in retic</li> </ul>		<ul style="list-style-type: none"> <li>•</li> </ul>