Shoalhaven Council's Water Utility
WATER

Asset Management Plan Water Supply

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1 Executive Summary

Shoalhaven City Council has responsibility for the provision of water supply services in most urban areas of the Shoalhaven Local Government Area (LGA). Council meets these responsibilities and delivers water and wastewater services through Shoalhaven Water, a defined Business Group of Council.

Shoalhaven Water seeks to manage the assets associated with the provision of water supply services in a manner that meets the agreed level of service in the most cost-effective manner for present and future consumers.

This Asset Management Plan (AMP) has been developed to provide a sustainable approach to the management of water supply assets (and the services provided by those assets) for the Shoalhaven LGA. This AMP is prepared under the umbrella of Council's Community Strategic Plan and its vision, mission, objectives and strategies. This AMP is a support document to Council's Delivery Program and Operations Plan and complements the overall Shoalhaven Water Strategic Business Plan to ensure that the facilities are provided within economic, environmental and social sustainable criteria.

The water supply assets consist of water storage dams, treatment plants, service reservoirs, pipe system (including meters, valves and hydrants), pump stations and building assets with an overall asset replacement value of over $650M. The water supply asset base is generally in good condition, however greater focus on asset renewal will reduce the risk of renewal gaps in future years. Future work includes the extension of the mains replacement program, upgrades to critical infrastructure, Mundamia and Moss Vale Rd URA's and investigation into the North South Transfer Main.

1.1 Key Achievements

The asset management improvements achieved over the past 2-3 years are summarised below:

- Development of a Shoalhaven Water Asset Management Policy.
- Review of Shoalhaven City Council Asset Management Strategy.
- Adoption of a Community Engagement Policy, customer surveys and reporting.
- Critical and Trade Waste customers being mapped into GIS.
- Development of an Asset Information Framework.
- Development of a Capital Investment Framework and Prioritisation Methodology and documentation of the business processes and policy.
- Water and Wastewater servicing strategies to provide a program for system augmentation and capital works.
- Asset Criticality Framework and Management strategies, Criticality Framework Implementation and Critical Assets Management Strategies.
- Development of a Framework for the Water and Sewer Asset Management Plans.
- Asset Management Plan Review.
- Established a Shoalhaven Water Asset Management Steering Group and a Terms of Reference.
- Asset Data Hierarchy Review.
- Asset Information Confidence Rating.
- Development of Customer Service Plan
- Development and Implementation of One Council (TechOne), integrated Asset Management System (AMS)
- Development and implementation of Worx Online to manage workorder through One Council in TechOne.

- Development of the Investment Review Committee and PPM capability
- Componentisation of complex assets in the AMS.
- Development of Scheduled Maintenance program in TechOne.

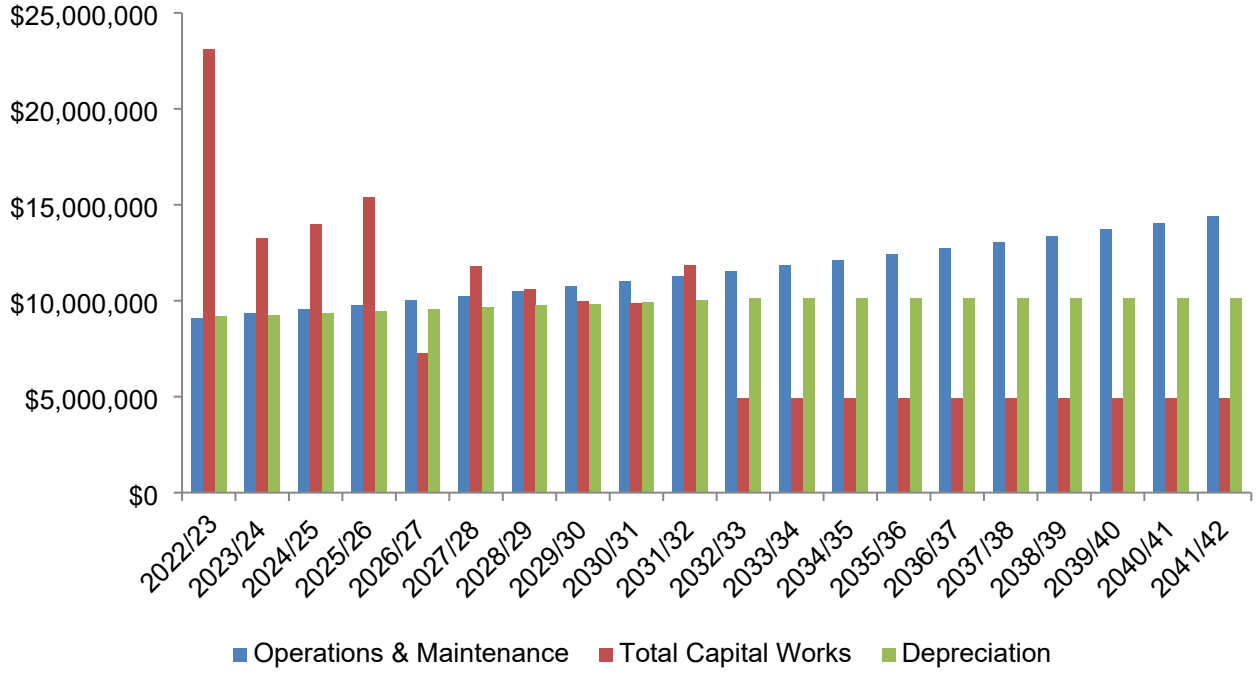
As the integration of Council's various information technology systems becomes more mature, this asset management plan will be improved through access to more data.

The detailed actions to improve this asset management plan and to take it to an intermediate approach are set out in Section 12.

1.2 Forecast Key Projects and Financials

Shoalhaven Water has developed Water and Wastewater Servicing Strategies (June 2013) to understand the demand for water supply services over the period from 2011 – 2041 and to identify the capital works requirements to accommodate this. The water supply demand is expected to increase over the period to 2041 with the highest growth rate anticipated in the Nowra/Bomaderry area as demonstrated in Section 6.4 of this AMP. The current 20 year financial plan allows for a capital works program of approximately $176M which includes renewals, growth, asset enhancement and other works. The capital works expenditure profile is shown below.

Figure 1-1 20-Year Financial Forecast (June 2022)



The key capital works projects are summarised below.

Table 1-1 Key Projects, Costs and Timing (Full List is available in Appendix)

Project	Relevant Expenditure Categories			Approximate Project Cost and Timing ($M)				
	Growth	Renewal	Asset Enhancement	2023/24	2024/25	2025/26	2027/28	2029/30
Bamarang WTP Renewal & Upgrade	✓	✓	✓	$1.7	$1.5	$1.5	$1.4	$1.0
Moss Vale Road URA	✓			9				
Mains Replacement Programs		✓	✓	$2.5	$2.5	$2.5	$2.5	$2.5
Cambewarra Dam Decommissioning		✓	✓	0.2	0.6			
Relocation of Bream Beach Water Main			✓	0.7	0.4			
Bamarang To Milton Stage 2	✓	✓		0.2	35	35		
KV WTP Membrane Replacement	✓	✓	✓	$0.6				

Full details of Shoalhaven Water's capital program is available in Appendix 2.

Current water supply expenditure is considered sufficient to meet current service levels, however it has been noted that further work is required to develop more robust projections of future renewal and to achieve best practice, particularly in the mechanical and electrical areas. The implementation of the Works Management System (TechOne) will remedy issues associated with data management from field inspections. Mains replacement in years 2023/24 also need to be developed with a more strategic approach and to refine the program of work.

1.3 Future Improvements

The following key asset management improvements are planned for the next three year period.

- Progressively update the new AMP framework.
- Regular updates to Shoalhaven Water's Asset Management Strategy.
- Develop a Replacement Costs Reference Database.
- Develop a water and wastewater Capital Program Plan for projects approved within the program (eg over 4-5 years) and those projects that fall outside of the program to be undertaken at a later date.
- Develop and implement a proactive operational, maintenance and renewals program, placing the initial focus on the most critical assets as identified in the critical asset identification process, as per the critical asset policy and implementation project.
- Review of Asset Information Handover Procedures and Asset Data and Drawing Standards.

- Undertake analysis to determine success rates and criteria for measuring future investment benefits.
- Continue to develop a risk register and risk action plan for Risk Management.
- Implement the identified management actions as specified in the Critical Assets Management Strategies Report.
- Develop and implement mobile device inspection and condition assessment capacity for asset management and maintenance.

Develop scheduled maintenance program for large or critical component assets.

2 Introduction

2.1 Background

Shoalhaven City Council has responsibility for the provision of water supply services for the Shoalhaven Local Government Area. Council exercises its water supply functions under Division 2 Part 3 Chapter 6 Local Government Act 1993. Council ensures its legal and regulatory requirements are met, and delivers water and sewerage services, through Shoalhaven Water, a defined Business Group of Council.

The purpose of this Asset Management Plan (AMP) is to formally document the management philosophy that is applied to all of Shoalhaven's water supply assets. This approach ensures that acceptable levels of service are provided in the most cost-effective manner. AMPs are a key component of the strategic planning and management of Council, with links to the Shoalhaven Water Strategic Business Plan and Community Strategic Plan.

2.2 The Shoalhaven Region

Shoalhaven, although designated a city, is a dispersed region of 4,567 km2 in the south-eastern coastal region of New South Wales, spread over 125 km of coastline with most of its population located in the north-east around Nowra, Jervis Bay and Sussex Inlet. The estimated resident population of the City of Shoalhaven for 2022 is 107,857.

Shoalhaven is bordered by the mountains, coastal plains and 109 magnificent beaches, and includes 49 towns and villages. From Sydney, it's an easy two hours' drive 160 km south, and from Canberra, it's a two and a half hour's drive north of around 200 km.

2.3 Economy

The Shoalhaven has a mature but growing economic base. With broad diversity in many value adding sectors such as aircraft maintenance and overhaul, general manufacturing and logistics, the economic base is supported by domestic and international trade. Government administration and services are strong as is education, health and the construction industry. Many localities are also highly oriented to tourism and retail.

Population growth, based on in-migration from metropolitan areas, continues to grow the labour force and provide extension to existing and new businesses. A skilled workforce supports the business base and utilises the resources of local training facilities of the University of Wollongong and TAFE NSW.

2.4 Population Growth

The Shoalhaven population forecast for 2022 is 107,857 and is forecast to grow to 137,673 by 2051 (.idcommunity).The growth and demand section shows how the population, age structure and household types will change each year between 2016 and 2051. The forecasts are designed to

provide community groups, Council, investors, business, students and the general public with knowledge to make confident decisions about the future.

These forecasts were last updated in 2022 by .id, the population experts, on behalf of Shoalhaven City. Forecasts are available for each year from 2016 to 2051 which an estimated 21.6% increase https://forecast.id.com.au/shoalhaven

2.5 Overview of Asset Management Planning

2.5.1 Goals and Objectives of Asset Management

Effective asset management includes the planning, creation, operation, maintenance and review of assets over their whole life cycle to achieve the agreed Levels of Service at an affordable cost while satisfying corporate goals and statutory/regulatory requirements. Council acquires assets via purchase by contract, construction by Council staff and by handover of assets by developers.

The AMP delivers a range of benefits to the community as well as to the provider of the services, the main ones being:

- Maintain, replace and develop assets over the long term to meet required delivery standards and foreseeable future needs at minimal cost
- Continually improve asset management practices and service delivery to the customers
- Comply with strategic and regulatory requirements.

The NSW Government is currently reviewing the Water Industry Regulations and the Last Resort Provider Provisions for the Water Industry Competition (General) Regulation. As these reviews are ongoing this Asset Management Plan does not include any requirements, comments or recommendations which may impact on Shoalhaven Water as a result of being appointed as an “Operator of Last Resort”. When these reviews are finalised and a regulatory requirement become clear, a more detail response will be provided in future revisions of this document.

2.6 AMP Timeframes and Development

This AMP covers a 20 year timeframe from July 2021 until June 2040.

Version 1 of the Water Supply AMP was completed in June 2015 and is updated annually. It has been developed with collective input from Shoalhaven Water Staff and Consultants. Much of the content has been derived from discussions, existing plans, reports and research.

This AMP will be reviewed during annual budget preparation and amended to recognise any changes in service levels and/or resources available to provide those services as a result of the budget decision-making process. The AMP has a life of 4 years and is due for revision and updating within 12 months of each Council election.

2.7 Roles and Responsibilities

Shoalhaven Water has established an Asset Management Steering Committee (AMSC). The purpose of the AMSC is to ensure that there is an effective level of governance in place to drive the asset management improvements required within Shoalhaven Water. The AMSC has responsibility for the business enhancement project tasks associated with Shoalhaven Water’s Asset Management Capability – Progress Update (Sep 2014). These improvement tasks are given in the Plan Improvement (Section 12) in this AMP. The AMSC is responsible for providing and endorsing project rationale and objectives, making investment decisions, defining and realising benefits, and monitoring risks, quality and timeliness.

The AMSC consists of the following permanent members:

- Executive Manager Shoalhaven Water (Executive Sponsor)
- Water Asset Planning & Development Manager (Project Sponsor)
- Unit Manager Portfolio and Assets (Committee Chair)
- Executive Assistant
- Water Operations Manager
- Water Business Manager
- Finance Business Partner
- Unit Manager Water Capital Portfolio

The AMSC will invite other representatives to attend meetings as required, including but not limited to the Manager Operations, Manager Finance Division, Manager Customer Services and External Advisor (as required).

The AMSC meets monthly for approximately 1 – 2 hours, or at any point throughout the project where key information or a key decision is to be made and the timing of the next meeting would result in an untimely delay in the decision making process.

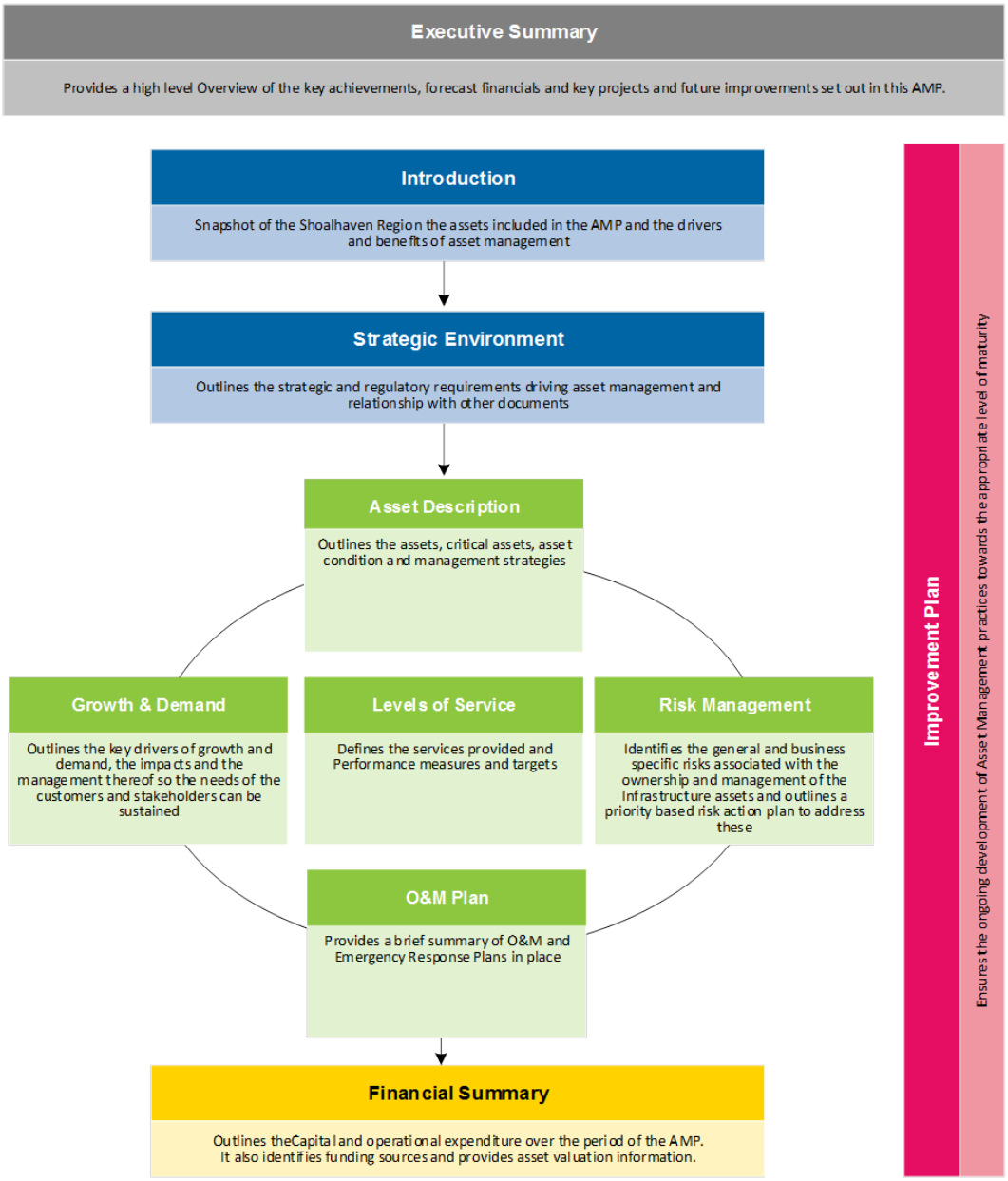
A Terms of Reference (April 2015) document provides overarching purpose and focus to the AMSC.

Minutes, agenda and other relevant information from the AMSC is located on Council's electronic filing system HPE Content Manager.

2.8 AMP Scope

The plan format shown below outlines the sections contained within this asset management plan (AMP), and how those sections link together.

Figure 2-1 AMP Scope

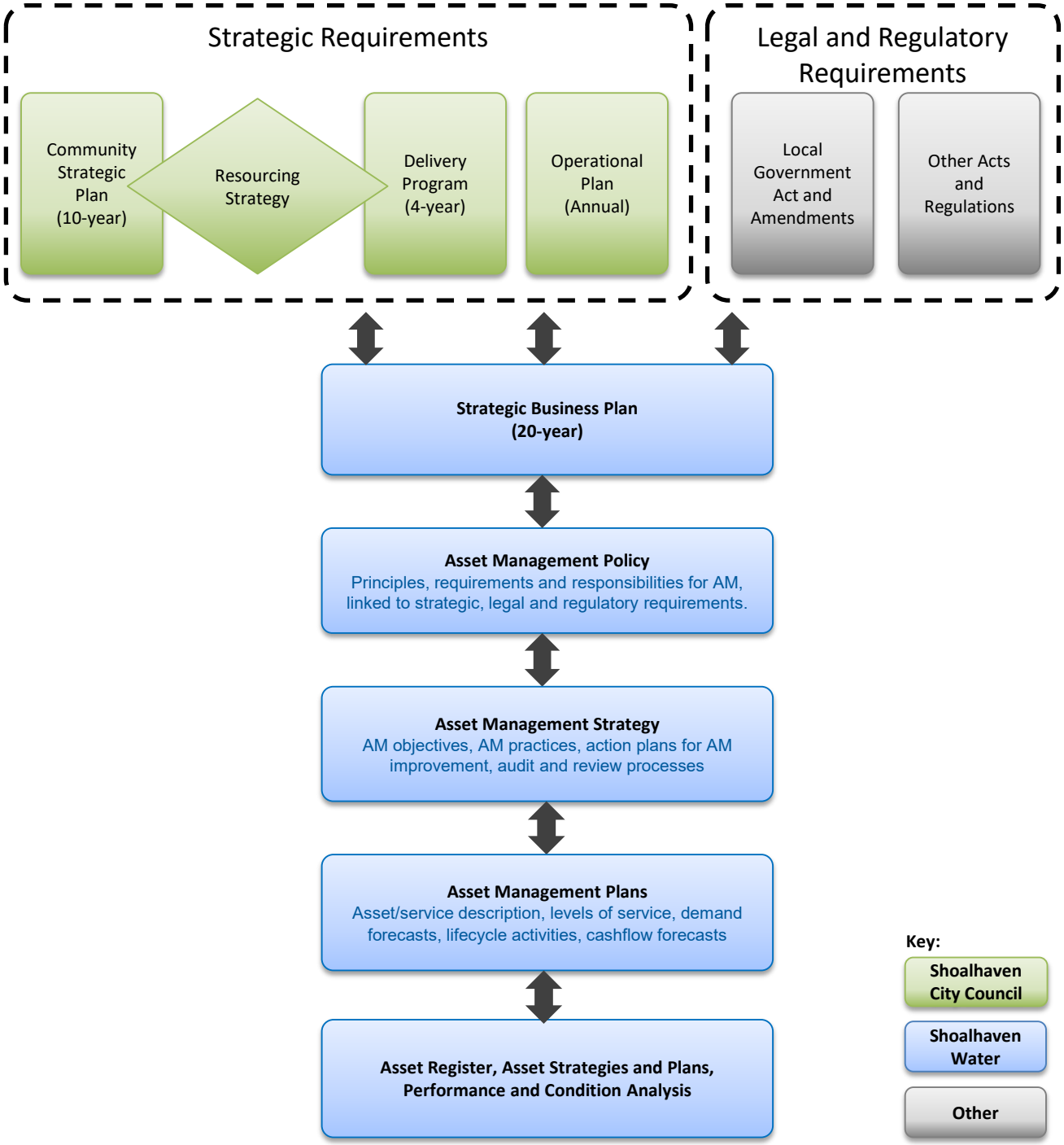


3 Strategic Environment

3.1 Strategic Overview

Council seeks to manage the water supply assets in a manner that meets the required level of service in the most cost effective manner for present and future consumers. The key documents are set out in Figure 3-1.

Figure 3-1 Key Document Linkages



3.2 Asset Management Policy Linkages

The Shoalhaven Water Asset Management Policy presents a full summary of the strategic, legal and regulatory requirements for asset management, as well as the policy statements which are necessary to facilitate and support achievement of these requirements.

The Shoalhaven Water Policy statements relating to Asset Management Plans are provided below:

The Asset Management Plans (AMPs) will document the plan to manage Shoalhaven Water's assets to support the delivery of our strategic direction and our contribution to the Governments priorities and outcomes.

The AM Strategy and AMPs will be developed and updated to meet the requirements of the IPR Guidelines and Best Practice Management.

AMPs will be developed for all infrastructure assets.

The AM Strategy and AMPs will be for a minimum time period of 20 years.

AMPs will include 20-year financial projections of capital expenditure (separated into renewals and replacements, asset enhancements and growth) and operational expenditure (separated into asset maintenance and operations).

Shoalhaven Water has established and maintain an Asset Management Steering Committee to guide the development, review and improvement of AM Strategy and AMPs.

The key business drivers are summarised below.

3.3 Shoalhaven City Council Strategic Requirements

3.3.1 Shoalhaven City Council Community Strategic Plan

The Community Strategic Plan sits at the top of the Council planning hierarchy and identifies the community's main priorities for the future and the ways to achieve these goals. Council's vision is set out in the Community Strategic Plan (CSP) as:

"We will work together in the Shoalhaven to foster a safe and attractive community for people to live, work, stay and play; where sustainable growth, development and environmental protection are managed to provide a unique and relaxed lifestyle"

In delivering Council's vision through a 20 year planning horizon for the provision of water supply and sewerage services, Shoalhaven Water's vision is set out in the Shoalhaven Water Community Strategic Business Plan 2020/21. The Shoalhaven Water Customer Service Plan also identifies that ***leading the way towards a bold future can sustain growth and economic development while retaining a lifestyle which is uniquely Shoalhaven, and describes our mission is to "Provide efficient, effective water and wastewater services to the Shoalhaven".***

3.4 Legal and Regulatory Requirements

As the Water Utility provider for the community, Shoalhaven Water operates as a Group within Shoalhaven City Council and subsequently there is a requirement to comply with the Local Government Integrated Planning & Reporting Guidelines. This includes a requirement to prepare;

- Community Strategic Plan (CSP),
- Resourcing Strategy,
- 4 year Delivery Program,
- Annual Operational Plan, and
- Annual Report

3.4.1 Local Government Act, Amendment Act and Amendment Regulation

The key legal and regulatory requirements for asset management are set out in the:

- Local Government Act 1993,
- Local Government Amendment (Planning and Reporting) Act 2009,
- Local Government (General) Amendment (Planning and Reporting) Regulation 2010.

The following key documents are used to guide asset management planning activities.

3.4.2 Integrated Planning and Reporting (IPR) Guidelines

The Integrated Planning and Reporting (IPR) Guidelines for local government in NSW list all the mandatory requirements from the Local Government Act and the Local Government Amendment Regulation 2013. Councils must comply with the Essential Elements set out in the IPR Guidelines *when planning and reporting to comply with the Local Government Act.*

3.4.3 New Regulatory Framework (previously Guidelines for Best Practice Management of Water Supply and Sewerage (August 2007))

From July 1, 2022, the Best Practice Management of Water Supply and Sewerage guidelines have been replaced with the new Regulatory Framework. This framework contributes to the implementation of relevant NSW Government commitments under the National Water Initiative, National Competition Policy, and the NSW Water Strategy. This regulatory and assurance framework applies to local water utilities in regional NSW from 1 July 2022. It covers:

- Local government councils exercising water supply and sewerage functions under Division 2 Part 3 Chapter 6 of the NSW Local Government Act 1993 (Local Government Act)
- Water supply authorities exercising water supply and sewerage functions under the NSW Water Management Act 2000 (Water Management Act)
- Guidelines for managing the provision of water supply and sewerage services by councils under section 409(6) of the Local Government Act National Water Initiative (NWI)

3.4.4 National Water Initiative (NWI)

The Australian Government established the National Water Commission (NWC) to implement the National Water Initiative (NWI). The NWI provides a national water performance reporting framework that requires annual reporting by Shoalhaven Water on a number of key indicators and subsequent benchmarking with the results tabled in a National Performance Report each year. This function is managed nationally through the Bureau of Meteorology. Council is also required to review and provide an action plan addressing any areas of under-performance identified in the NSW State Government Triple Bottom Line Summary each year.

3.4.5 Other Acts and Regulations

Table 3-1 Acts, Regulations, Guidelines and Standards

Type	Name
Acts and Regulations	Independent Pricing and Regulatory Tribunal (IPART) Act 1992
	Dams Safety Act 2015 & Regulations 2019
	Environmental Planning and Assessment Act 1979
	Catchment Management Authorities Act 2003
	Soil Conservation Act 1938

	Fluoridation of Public Water Supplies Act 1957
	Water Management Act 2000 & (General) Regulations 2011
	Protection of the Environment Operations Act 1997
	Water Industry Competition Act 2006
	Work Health & Safety Act 2011
	Water NSW Act 2014
	Trade Practices Act 1974
	Local Government Act 1993 & (General) Regulations 2005
	Public Health Act 2010 and Public Health Regulation 2012
Guidelines	Australian Drinking Water Guidelines 2011
	Developer Charges for Water Supply, Sewerage & Stormwater 2016
	Section 64 Determination of Equivalent Tenement Guidelines
	National Health & Medical Research Council (NHMRC) Guidelines (2004)
Standards & Policies	Australian Standard 4360: Risk Management 2008
	Australian Accounting Standards
	NSW Non-Urban Water Metering Policy

For a full description of the Acts and Regulations refer to the Shoalhaven Water Strategic Business Plan 2020-2021.

3.5 ISO Requirements

The three ISO Asset Management Standards that are now published will potentially impact all organisations that have asset management responsibilities. These Standards, while framed on the management of physical assets, can be utilised for any asset type and by any sized organisation. They address the requirements for a management system (not software) for the management of assets and comprise:

- ISO 55000 Asset Management – Overview, principles and terminology
- ISO 55001 Asset Management – Management systems – Requirements
- ISO 55002 Asset Management – Management systems – Guidelines for the application of ISO 55001
- ISO 55010 – Asset Management – Aligning Financial and Non-Financial Functions in Asset Management

ISO 55001 is the most critical Standard in that it details the things required to be done – some 70 requirements with several sub elements. It documents ‘What to do’, not ‘How to do it’, thus providing a systematic management specification while allowing organisations to structure their activities to suit their needs, resources, capabilities, and objectives.

ISO state that the main aim of Standards is to promote good practice, not to be there purely for compliance.

The Standards, per se, do not carry any force to require their application. In most cases, it will be up to the organisation itself to choose to apply them as part of good business practice. However, it is likely that in some highly regulated areas, involving significant asset values, the regulators, financiers and insurers may look to the comfort of requiring these Standards to be applied, to protect their interests.

Shoalhaven Water have analysed how the new ISO Standards are mapped to the sections proposed in the new AMP framework and the overall Shoalhaven Asset Management Framework.

3.6 Shoalhaven Water Strategies and Plans

3.6.1 Shoalhaven Water Strategic Business Plan (2020-2021)

Shoalhaven Water's vision, mission and values are presented in the Strategic Business Plan (SBP) 2020/21 (D21/197512) as follows:

Vision:

Defined by our spectacular beaches, surrounding natural forests and lakes, Shoalhaven Water connects distinct communities with water supply and sewerage services. Our Vision is "Through our Business Excellence, we will be a leader in the Water Industry".

Mission:

Leading the way towards a bold future that can sustain growth and economic development while retaining a lifestyle which is uniquely Shoalhaven, our Mission is to "Provide efficient, effective water and wastewater services to the Shoalhaven".

Values:

Our strategic decisions and day to day activities in achieving our Vision and Mission will be guided by the following organisational values;

Our Customer

Striving to understand and exceed customer expectation and satisfaction with an emphasis on quality service, consultation and continuous improvement.

Our Business

Provision of efficient and effective water and wastewater services, to an agreed "Levels of Customer Service" in an equitable and commercial manner.

Our Environment

Operating Shoalhaven Water in an environmentally responsible and sustainable manner for the betterment of present and future generations.

Our Community

Ensure quality of life and health to our community.

Our Team

Providing the Shoalhaven with efficient, dedicated and enthusiastic staff by working through trust, learning and communication.

3.6.2 Other Shoalhaven Water Policies, Strategies and Plans

Table 3-2 Shoalhaven Water Policies, Strategies and Plans

Type	Name
Policies	Asset Management Policy
	Risk Management Policy
	Asset Capitalisation Policy
	Community Engagement Policy
Key Management Plans	Demand Management Plan
	Drinking Water Quality Management Plan
	Drought Management Plan
	Emergency Response Plan
	Business Continuity Plan
	Risk Management Plans
	Integrated Water Cycle Management Strategy
	Operation Environment Management Plan
	Water Conservation Plan
Asset Management Strategies and Plans	Asset Management Improvement Plan
	Critical Assets Framework and Strategy
	Drinking Water Quality Management Improvement Plan
	Development Servicing Plan – Water
	Water Supply Transportation Strategy
	Treatment Plant Strategy
	Asset Management Strategy
	Shoalhaven Water Customer Service Plan

4 Asset Description

4.1 Asset Summary

Table 4-1 Water Supply Asset Summary (quantities as per Asset Valuation 30-6-2023)

Asset category	Gross Replacement Cost ($)
Water Storage Dams	$118,332,606.99
Water Treatment	$64,221,259.56
Service Reservoirs	$114,675,473.20

Pipe System	$590,536,125.48
Water Pump Stations	$24,654,874.56
Water Service Meters	$9,668,059.95
Buildings	$15,031,798.56
Microwave Network	$236,845.71
Total	$937,357,043.30

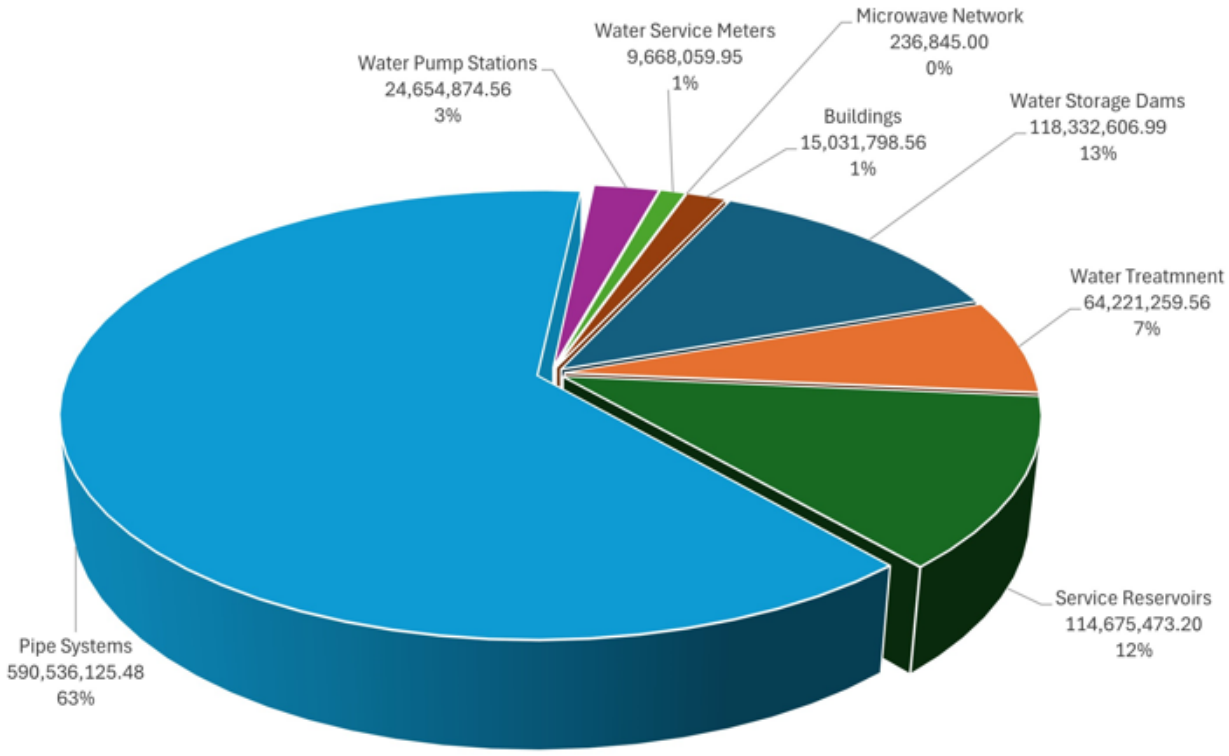
Gross Replacement Cost (GRC) is a methodology for measuring the estimated replacement cost of the water supply asset, adjusted for new technologies and the changing nature of the fit of the asset within the developing network.

Revaluation of Shoalhaven Water assets was previously undertaken using aggregated asset data (high level). Shoalhaven Water has completed a component level valuation as part of the implementation of the TechOne asset management system implementation. Ongoing valuations will be based on an rates and base lives that are regularly revised and consider the local context. Revaluation of the full data set (excluding building) was undertaken as part of the 21/22 asset accounting.

The value of hydrants, minor valves, and service connections are not currently valuation items in the asset register as they are generally valued below Shoalhaven Water's threshold of $5,000 as an individual asset item. The cost of these items is currently included in reference rates used to calculate the value of mains.

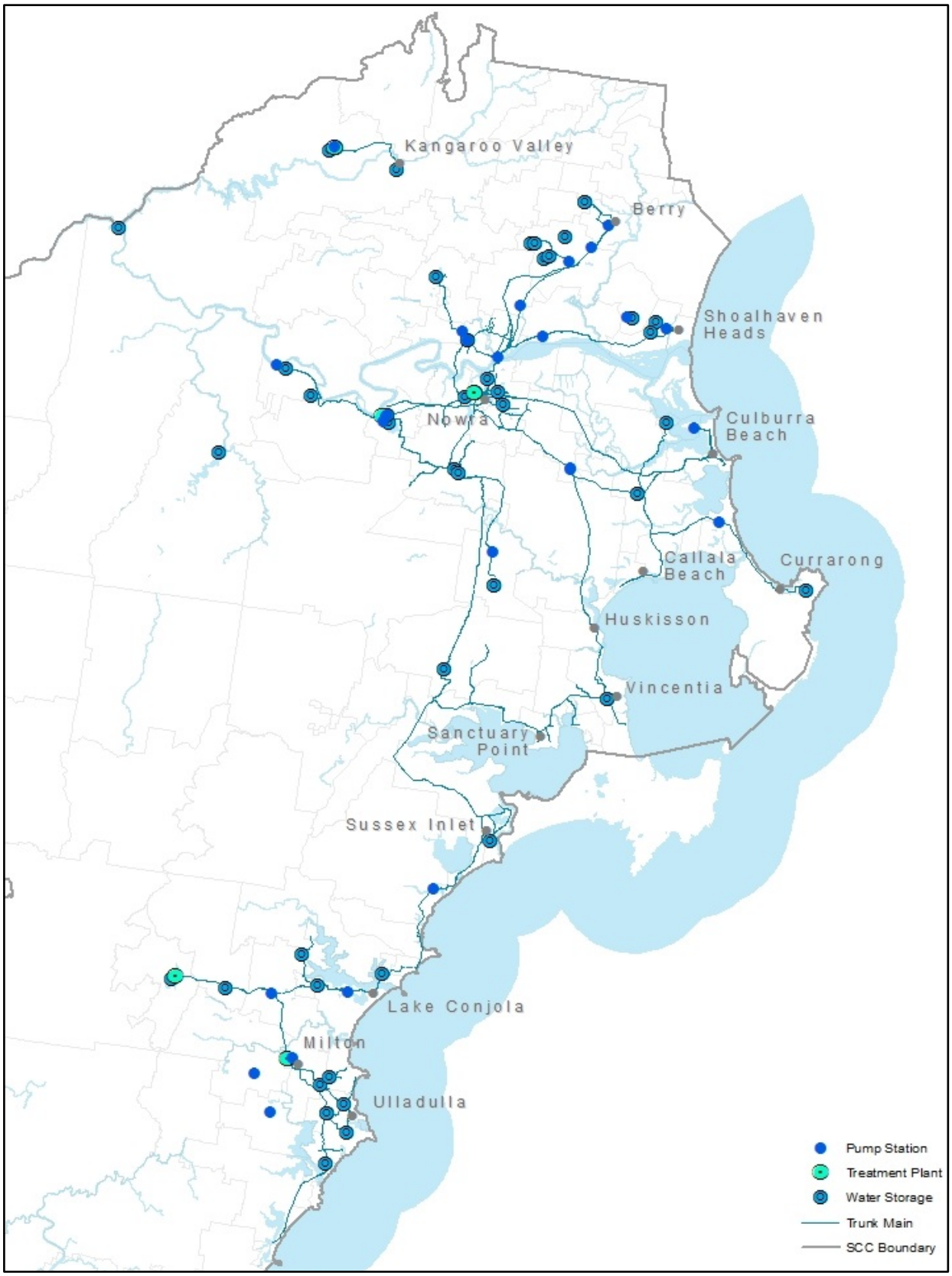
As part of the 2015/16 financial year reporting water meters have been added to the asset register as a network asset and are componentised into 5-year intervals for depreciation and valuation purposes. Large, high value valves are in the process of being added to the GIS and AMS to allow for maintenance management and reporting. Maintenance and management of these assets is identified in section *4.2.5.4 Master Flow Meters*

Figure 4-1 Proportion of GRC by Asset Group (as at 30/6/23)



The key features and locality of the Shoalhaven Water Supply Network is demonstrated on the following overview map and schematics.

Figure 4-2 Shoalhaven Water Supply Network



4.2 Asset Detailed Description

4.2.1 Overall System

Shoalhaven Water provides treated water to National Health and Medical Research Council (NHMRC) Guidelines (2004) to most towns and villages throughout the City of Shoalhaven. Unserviced towns are located south of Lake Tabourie.

The system's raw water is pumped from the Shoalhaven River at Burrier approximately 47 km upstream of the ocean estuary outlet. The water is pumped from Burrier to a 3,800 megalitre off river storage dam at Bamarang near Nowra West. The water is then pumped from the dam to Water Treatment Plants at Bamarang and Flatrock. The treated water is then transferred throughout the City.

The southern Shoalhaven is partly served by the Porters Creek Dam west of Milton and supplies the Milton Water Treatment Plant. The plant treats water for the towns/villages of Milton, Ulladulla, Narrawallee, Mollymook, Kings Point, Burrill Lake and Lake Tabourie. Bendalong, Manyana, Conjola & Fisherman's Paradise are supplied from the Northern System, which also supplements the area served by the Milton Water Treatment Plant over peak demand holiday periods.

A fourth treatment plant is located in Kangaroo Valley at Bendeela Pondage and supplies water to the Kangaroo Valley township. This plant is a microfiltration plant and operates using a membrane system for removing colour, sediment and algae.

A 7,600 megalitre storage dam at Danjera acts as an emergency backup supply feed for the Shoalhaven River in times of drought. The combination of Danjera's 7,600 megalitres and the off river Bamarang 3,800 megalitres storage acts to limit the effect of low flows in the Shoalhaven River to provide drought security for the Shoalhaven City water supply system. The average daily potable water demand for the 2015 calendar year was 32.8 ML/day, with a peak day of 66 ML. The system has the capacity to treat 114 megalitres per day.

The flow in the lower Shoalhaven River is controlled from Tallowa Dam, owned and operated by Water NSW. Release of water from Tallowa Dam for Shoalhaven use is controlled through a series of agreed protocols between SCA and SCC.

In 2013, properties along Strongs Rd were converted to treated water following the augmentation of the existing system which consisted of a new reservoir, pumping stations, reticulation main and trunk main. The existing raw water system has now been decommissioned and all existing connections are now provided with treated reticulated water.

In 2021 Shoalhaven Water will commence investigations into the North South Transfer Main. This project is to provide security of supply due to increasing demand in the southern region. The first stage of the project is to develop concept options reports to determine the size, alignment and cost estimates for the project.

Schematic representations of the various water supply systems are given in the following diagrams.

Figure 4-3 Northern Shoalhaven Water Supply System

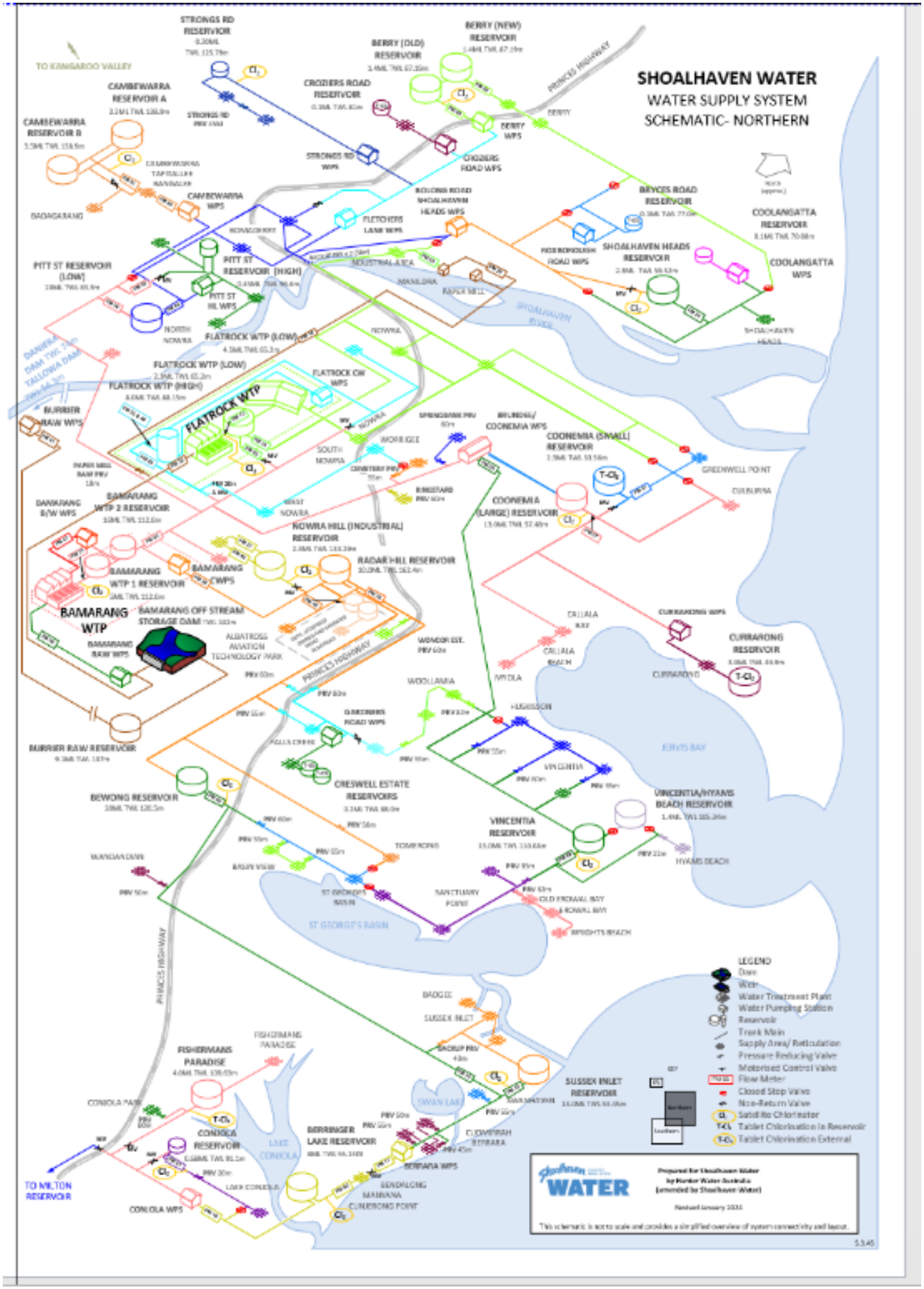
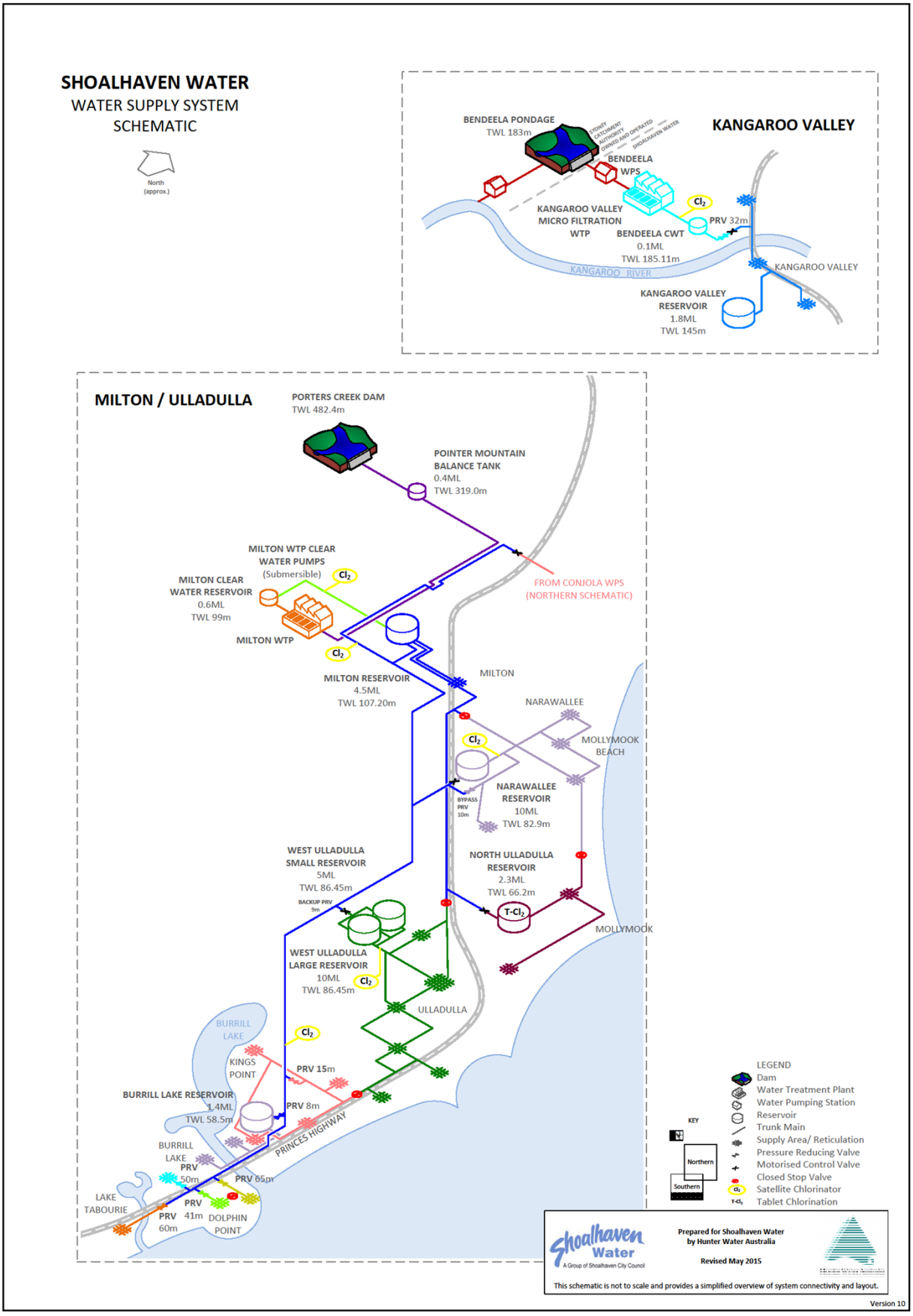


Figure 4-4 Milton/Ulladulla and Kangaroo Valley Water Supply System



4.2.2 Water Storage Dams

Water storage dams account for around 15% of the total value of the water supply assets. Shoalhaven Water has responsibility for five of the seven dams which supply water to the Northern, Southern, or Kangaroo Valley water supply schemes. Two of these dams are no longer used for water supply purposes but remain assets for which Shoalhaven Water has responsibility.

Table 4-2 Water Storage Dams (quantities as per Asset Valuation 30-6-2023)

Name	Capacity (ML)	Year of Construction	Scheme	Type	ANCOLD Hazard Rating	Prescribed Yes/No	Owned & Operated By	Comments	Value ($)
Bamarang	3,800	1982	Northern	Earth Fill	Significant	Yes	Shoalhaven Water	Main Northern storage	$23,480,028.24
Danjera	7,660	1968	Northern	Concrete diamond head buttress main wall.	Low	Yes	Shoalhaven Water	Emergency Storage	$42,253,243.36
Porters Creek	1,900	1968 Upgrade 2016	Southern	Post tensioned concrete gravity section &	Significant	Yes	Shoalhaven Water	Main Southern storage	$24,871,043.05
Flatrock	570	1933	Northern	Concrete Arch	Low	No	Shoalhaven Water (Disused)	Disused	$27,519,998.46
Cambewarra	28	1910 Raised 1927 Lower 2015	Northern	Concrete Gravity Earth fill embankment	High Consequence	No	Shoalhaven Water (Disused)	Disused	$208,293.88
Tallowa	85,500	1976	Northern	Concrete Gravity	Unknown	Yes	Water NSW	Unknown	N/A
Bendeela	1,200	Unknown	Kangaroo Valley	Unknown	Unknown	Yes	Water NSW	Unknown	N/A
TOTAL									$118,332,606.99

4.2.3 Planned Storage Dam Projects:

Decommissioning of Cambewarra Dam is currently in development with physical demolition expected to commence late 2024. This dam is out of service and presents an ongoing maintenance and operational cost to the organisation as well as being identified as a significant consequence dam by Dam Safety NSW.

Other dam projects include development of Shoalhaven Water's Dam Safety Management System which will include the development of a more integrated scheduled maintenance system utilising the TechOne Works Module.

4.2.4 Treatment Plants

Water is treated to the relevant potable standards for the Shoalhaven communities through four water treatment plants. Details of these plants are given in the table below.

Table 4-3 Treatment Plants (quantities as per Asset Valuation 30-6-2023)

Name	Capacity (ML/d)	Year of Construction	Processes	Value ($)
Bamarang	75	1982	Alum flocculation/clarification mixed media filtration Lime/CO_2 pH correction/stabilisation chlorine disinfection fluoridation	$36,144,881.59
Flatrock	28	1934	Alum flocculation/clarification sand filtration Lime/CO_2 pH correction/stabilisation chlorination fluoridation	$16,703,312.12
Milton	10.5	1998	Flocculation (rapid) mixed media filtration Chlorination lime/CO_2 pH Correction/stabilisation fluoridation	$9,284,262.24
Kangaroo Valley	1.5	1993	Activated carbon microfiltration chlorination fluoridation	$2,088,803.61
TOTAL				$64,221,259.56

Note. Porters Creek WTP has been removed as it is no longer a WTP and is instead an empty dam services building.

4.2.5 Planned Treatment Plant Projects:

The Bamarang water treatment plant will undergo major asset renewal/maintenance work over the next five years. The main improvement will be the upgrade to the electrical system refurbishment and upgrade, water clarifiers to increase efficiencies followed by sludge lagoons & drying beds. Projects completed since 2015 included access into the de-sludge pit, replacement of penstock rubbers, upgrade plant control to Citech, main relay panel upgrade, replacement of No.2 rapid mixer, replacement of the AC baffle boards on the filters, and new overhead rails for sludge rake bridges.

The Flatrock water treatment plant will undergo minor asset renewal/maintenance work over the next few years. Maintenance of the clarifiers, replacement of man proof fence, upgrade of plant control to Citech, PLC replacements, painting. Repainting both clarifier bridges and replacement of clarifier centre bearings are expected to be completed by the end of 2020 at a cost of $80,000.

The Kangaroo Valley water treatment plant will undergo asset renewal/maintenance work over including replacement of the membrane array. This is in addition to the recently completed reservoir at Bendeela. The new reservoir will increase storage, provide increase in head pressures and additional contact time

for disinfection. The cost of the new reservoir was $1M with work completed in2023.Renewal work and upgrading has recently been completed on the filter membranes at a cost of $100,000.

4.2.6 Service Reservoirs

The purpose of reservoirs is threefold:

- To provide sufficient reserves of treated water to ensure supply levels of service are maintained.
- To provide a head source to ensure pressure levels of service are maintained.
- To provide contact time for effective chlorination.

The table below provides details of all existing (excluding disused) reservoirs. There are a total of 41 service reservoirs making up around 10% of the total water supply asset value.

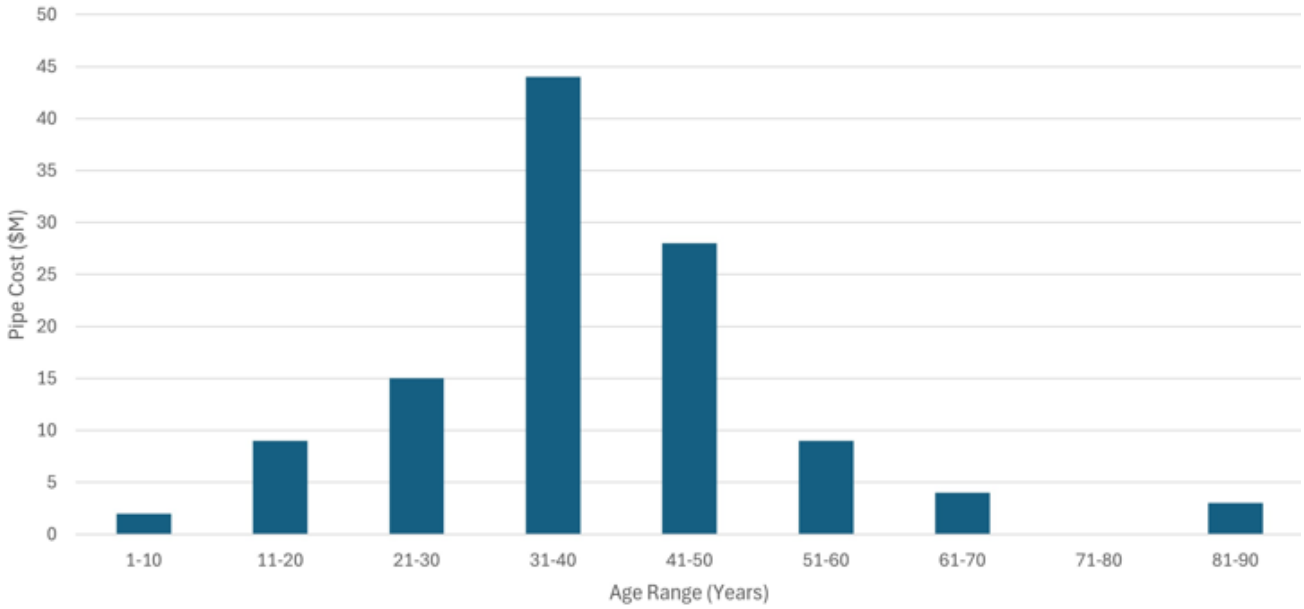
Table 4-4 Service Reservoirs (quantities as per Asset Valuation 30-06-2022)

Reservoir Identification	Capacity (ML)	Construction Material	Year of Construction	In Service Yes/No	Location
R47	0.3	Concrete	2014	Yes	Strongs Rd
R40	20	Concrete	2005	Yes	Bewong - Kells Rd, Tomerong
R39	10	Steel	2000	Yes	Radar Hill - BTU Rd, Nowra Hill
R33A	0.6	Concrete	2000	Yes	Corks Lane, Milton
R51	0.4	Concrete	1999	Yes	Porters Creek Rd, Pointer
R16B	1.4	Steel	1996	Yes	Kangaroo Valley Rd, Berry
R52	8.1	Steel	1996	Yes	Filter Rd, West Nowra
R48	0.1	Concrete	1995	Yes	Roxbrough Rd/Bryces Rd, Far Meadow
R49	0.1	Concrete	1995	Yes	Northview Cl, Coolangatta
R17	1.8	Steel	1993	Yes	Marshall St, Kangaroo Valley
R18	0.1	Concrete	1991	Yes	Jacks Corner Rd, Kangaroo Valley
R24A	0.1	Concrete	1990	Yes	McArthur Dr, Falls Creek
R24B	0.1	Concrete	1990	Yes	McArthur Dr, Falls Creek
R32	4	Steel	1988	Yes	Cornfield Rd, Fishermans Paradise
R34	10	Steel	1987	Yes	Narrawallee - Princes Hwy, Milton
R25	3	Steel	1986	Yes	Crookhaven Pde, Currarong
R30	8	Steel	1986	Yes	Berringer Lake - Cunjurong Point Rd,
R36	10	Steel	1986	Yes	West Ulladulla (Large) - White Gum Rd, Ulladulla

R29	13	Steel	1986	Yes	Pacificana Dr, Sussex Inlet
R21	13	Steel	1985	Yes	Coonemia Rd, Callala
R3	16	Concrete	1985	Yes	Yalwal Rd, Bamarang
R1.1	0.1	Concrete	1983	Yes	Grassy Gully Rd, Burrier
R27	13	Concrete	1982	Yes	Lively St, Vincentia
R5	20	Concrete	1982	Yes	Pitt St, North Nowra
R2	5	Concrete	1982	Yes	Yalwal Rd, Bamarang
R37	5	Concrete	1981	Yes	West Ulladulla Small - White Gum Rd, Ulladulla
R11	0.05	Concrete	1981	Yes	Croziers Rd, Jasper Brush
R9	2.3	Concrete	1980	Yes	Reservoir Lane, Cambewarra
R20	2.3	Concrete	1976	Yes	Edward Wollstonecraft Rd, Shoalhaven Heads
R4B	4.5	Earth	1976	Yes	Filter Rd, West Nowra
R33	4.54	Concrete	1975	Yes	Corks Lane, Milton
R35	2.27	Concrete	1975	Yes	Pengana Cres, Mollymook
R16A	1.4	Concrete	1974	Yes	Kangaroo Valley Rd, Berry
R7	2.3	Concrete	1973	Yes	BTU Rd, Nowra Hill
R38	1.36	Concrete	1973	Yes	Canberra Cres, Burrill Lake
R22	2.3	Concrete	1970	Yes	Coonemia Rd, Callala
R31	0.68	Concrete	1968	Yes	Lake Conjola Entrance Rd, Lake Conjola
R1	9.1	Concrete	1962	Yes	Burrier Rd, Burrier
R6	0.5	Concrete	1960	Yes	Pitt St, North Nowra
R4A	2.3	Concrete	1934	Yes	Filter Rd, West Nowra
R54		Concrete	1968	Yes	Flat Rock Clear Water tank
R19	0.5	Concrete	2023	Yes	Jacks Corner Rd, Kangaroo Valley
R10	3.5	Concrete	2024	Yes	Reservoir Lane, Cambewarra

The reservoirs have a total asset value of $71M. The value by asset age is represented in the graph below.

Figure 4-5 Reservoir Value by Age (data as per Asset Valuation 30-06-2023)



There is a spike in asset value in the 30-39 year old category, indicating that there may be a corresponding expenditure peak when these assets reach end-of-life.

4.2.7 Recently Completed Projects:

Shoalhaven Water has recently completed two new reservoirs, a 0.5mL reservoir at Bendeela to provide greater water security and a new 3.5mL reservoir at Cambewarra to support the new Moss Vale Rd urban release area. These projects cost $1M and $5.5M respectively with both projects completed in 2024.

4.2.8 Planned Reservoir Projects:

There are no planned reservoir projects in the short term however investigations into future growth areas and the Nowra to Ulladulla stage 2 project are still underway.

4.2.9 Pipe System

The function of the water supply pipes is to distribute water from the storage dams via treatment plants and service reservoirs to the supply connection for each customer, reliably, in sufficient quantity to meet peak demands and fire-fighting needs, and in a manner that protects water from contamination.

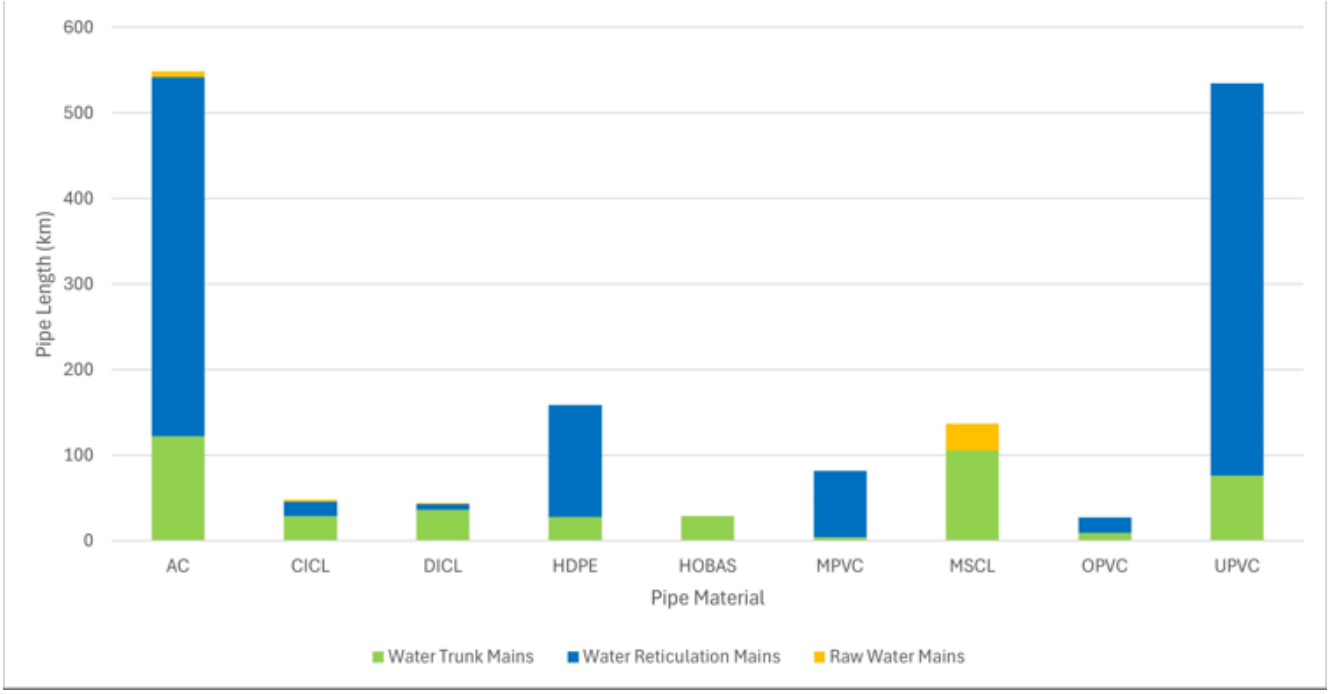
The pipe system makes up 51% of the total water supply asset value. The table below provides a summary of the water main assets.

Table 4-5 Water Pipe Assets (quantities as per Asset Valuation 30-06-2023)

Asset sub-category	Length (km)	Value ($)
Water trunk mains	439	$250,355,496.96
Water reticulation mains	1,131	$296,862,576.74
Raw water mains	40	$43,318,051.78
TOTAL	1,610	$590,536,125.48

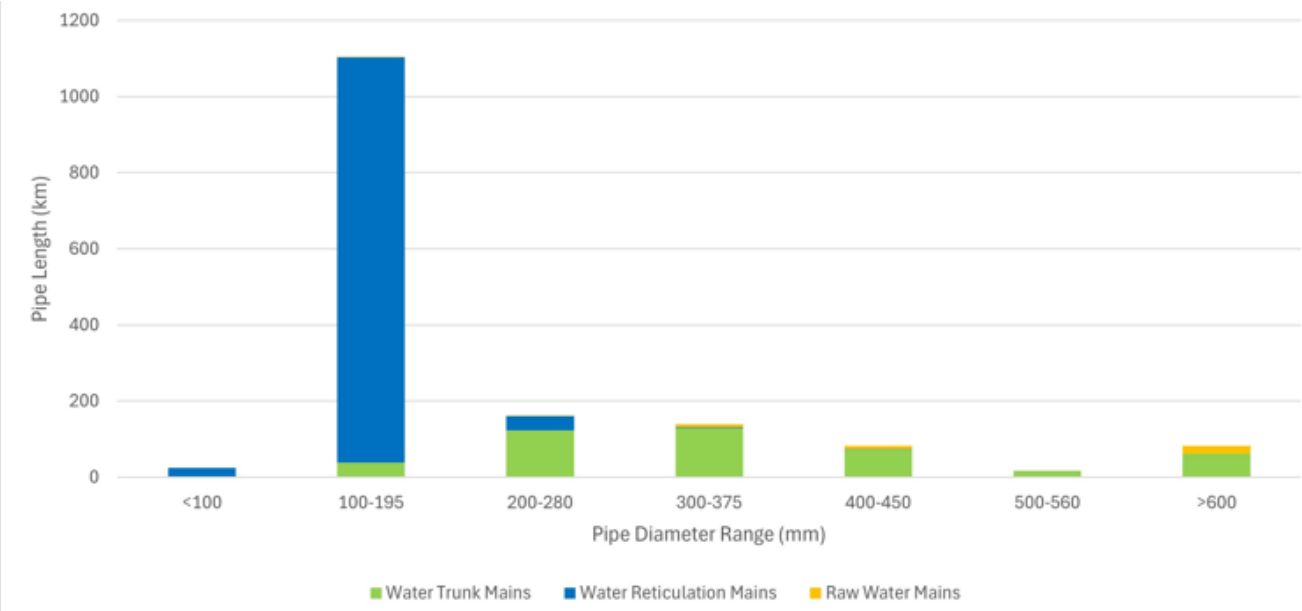
The pipe materials are predominantly Asbestos Cement (AC) and UPVC as demonstrated in the graph below.

Figure 4-6 Pipe Material by Length and Type (30/06/2023)



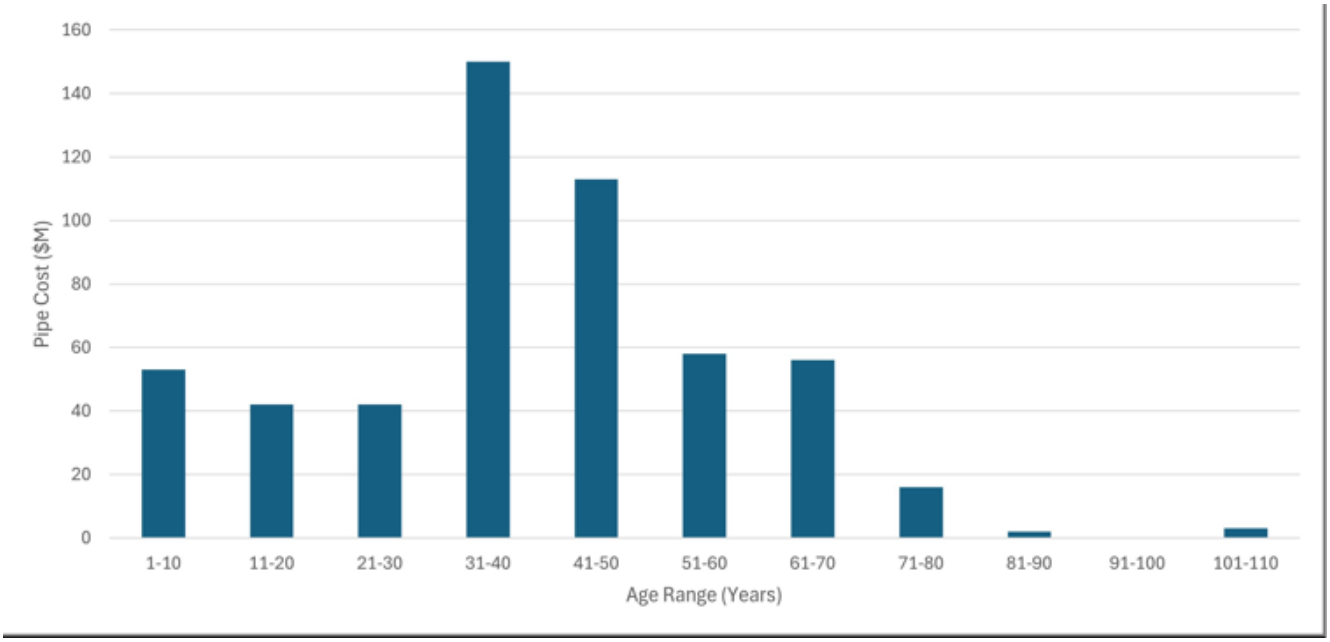
Many pipes are 100 mm diameter and 150 mm diameter reticulation mains. The largest pipe diameter is 900 mm with approximately 290 m length.

Figure 4-7 Pipe Diameter by Length and Type (30/06/2023)



The graph below provides an age profile of all water mains.

Figure 4-8 Age Profile of all Watermains (30/06/2023)



4.2.10 Recently Completed Water Supply Pipeline Projects

Shoalhaven Water, through its asset management system, identified the need to replace a section of 300 mm white uPVC water main throughout the network recent projects include in Currarong Rd stage 1 & 2, and Shoalhaven St as part of the Nowra Hospital upgrade. These pipelines were installed in the mid 1980's and have experienced failures due to the inherent failure of this type and age of pipe.

Other projects include the replacement of a failing main in Croobyar Rd, Burrier Raw Water Main Replacement, and a duplicate supply for Shoalhaven Heads. Both the Burrier and Shoalhaven Heads projects were instigated as a mitigation measure following a detailed risk assessment of Shoalhaven Water's asset risk profile.

4.2.11 Planned Water Supply Pipeline Projects

The Major Mains Project will focus on replacing critical 300 mm UPVC class 12 water mains and assets nearing the end of their useful life. These mains have been identified as having inherently high failure rates and have been deemed critical. The mains replacement project is ongoing with a total of 70 sites designed which will be progressed on a risk based prioritisation over the next 5 to 10 years. The next project to commence is the Bream Beach water main replacement project. This project will be completed in mid 2024

Work is also commencing on the Meadow Creek 900mm main replacement. This main is failing in a low lying area due to corrosion issues with the mild steel pipe. The Bamarang to Milton Stage 2 Water Main project is also in the early stage. This project is to provide security of supply and increased capacity for growth and demand with the project expected to be required by 2036. Initial investigations will consider options to the pipeline solution following the development of the preferred alignment which was completed in 2023.

Shoalhaven Water also work closely with other Council teams to identify opportunistic main replaces which are driven by road, drainage or other construction activities. Budget is set aside each year for this projects with the Culburra 300mm AC main replacement project currently in design. This project is expected to cost $700K and consists of 700m of 300mm AC main located in close proximity to the road upgrade.

4.2.12 Water Meters

Water meters serve two key functions within the water supply network:

To record flows delivered to residential and non-residential customers, as the basis for water charges and wastewater management.

To record flows in and out of treatment plants, reservoirs, or from supply zone to another, for management and compliance purposes.

Shoalhaven Water has a total of 51,075 metered services ranging in size from 15mm to 200mm with a value of $7,247,045 (June 22).

Water meter values have previously been included in the value of headworks assets, in 2016 these capitalised meters and relocations were included in the asset register as a network asset and will be capitalised in the future. The meters are not itemised for valuation purposes as the value is below Shoalhaven Water's threshold of $5,000.00 (as individual items).

The fleet of meters is relatively new and a water meter replacement program is in place the details of which considered in more depth in the asset renewals programs Section 10.4.1.

4.2.13 Master Flow Meters

Shoalhaven Water has 51 Master Flow Meters that are used at pumping stations and treatment plants to measure inflow and outflows into the system and plants. These meters are reportable to the Natural Resource Access Regulator (NRAR) and the Department of Climate Change, Energy, the Environment and Water (National Performance & Triple Bottom Line reporting). To ensure accurate and consistency of recording and reporting, the meters are to be inspected and validated 12 monthly in accordance with NSW Government Gazette No 27 Maintenance Specifications 29th March 2019. Test reports, maintenance data and specifications are then stored in Council document management system within the Flow Meter Verification file 63534E. Council's Asset Management System is used to manage the

maintenance and operation of these meters and all meters are to be mapped within Council's GIS system.

4.2.14 Valves and Hydrants

There are a total of 8,751 valves and 11,162 fire hydrants in the water supply system. The types of valves are summarised in the table below.

Table 4-6 Valve and Hydrants (as at June 2019 as used in the Criticality Assessment)

Valve Type	Number
PRVs	78
Zone Valves	188
Motorised Control Valves	12
Control Valves	7,827
Air Valves (includes reflux, relief and anti-vacuum valves)	939
Total Valves	9,044
Hydrants	11,499

Note: Valve and hydrant values are included in the asset register but are not itemised in the valuation as the value is below Shoalhaven Water's threshold of $5,000.00 and reference rates used to calculate value of mains include an amount for hydrants, valves, and service connections.

4.2.15 Pump Stations

Shoalhaven Water has 26 pump stations installed within the networks with ages ranging from 2 to 55 years 12 of these stations are identified as critical assets.

The table below provides details of Shoalhaven Water Pump Stations.

Table 4-7 Pump Stations (As at 1/01/2024)

External Asset Number	Pump Station ID	Capacity		Details	Year Constructed	In Service Yes/No	Critical Yes/ No	Location
		kW	L/s					
41057312	PS 15	1.1	6.1	3 x Grundfos CR5-8	2005	Yes	No	Park Row, Orient Point
41057302	PS13	37	45	2 x KSB Ajax (Omega Make)	1990	Yes	Yes	George St, Berry
41057306	PS29	2.2	1.6	2 x Grundfos CR8-60	1995	Yes	No	Bryces Rd, Far Meadow
41057304	PS30	4	5.7	2 x Grundfos CR16- 40	1995	Yes	No	Bolong Rd, Coolangatta
41057325	PS20	3	28	2 x Flight CP3102-180MT	1993	Yes	Yes	Jacks Corner Rd, Kangaroo Valley
41057305	PS19	7.5	10	Ajax 2000 80 x 50/150	1990	Yes	No	Jervis Bay Rd, Falls Creek
41057314	PS21	150	75	2 x Weir DRC 150/150	1987	Yes	Yes	Lake Conjola Entrance Rd, Lake Conjola
41057313	PS12	45	34.1	2 x Thompson/ Byron/ Jackson	1986	Yes	No	Fletchers Lane, Meroo Meadow
41057319	PS6	55	44	2 x Thompson/ Byron/ Jackson	1986	Yes	No	Currarong Rd, Kinghorne
41057320	PS7A	55	77	2 x Thompson/ Byron/ Jackson	1986	Yes	No	Bolong Rd, Bolong
41057318	PS5	95	92	2 x Worthington	1984	Yes	No	Lakeland Ave, Berrara
41057316	PS4	110	350	1 x Worthington 10LR15B	1984	Yes	Yes	Springbank Rd (Priv), Worrigee
41057301	PS1	1950	925	2 x Thompson/ Byron/ Jackson	1983	Yes	Yes	Grassy Gully Rd, Burrier
41057315	PS2	2 x 250 1 x 320	2 x 770 1 x 950	2 x Thompson/ Byron/ Jackson CLW 500/500	1982	Yes	Yes	Yalwal Rd, Bamarang

				1 x Thompsons Kelly & lewis Super Titan 500 x 500 - 550				
41057307	PS14	2.2	4.1	2 x Grundfos CR5-14	1981	Yes	No	Mullers Lane, Jaspers Brush
41057310	PS22	4	5.7	4 x Grundfos CRIE15-3	?	Yes	No	Corks Lane, Milton
41057308	PS24	5.5	5.7	2 x Grundfos CRIE 15-04	?	Yes	No	Croobyar Rd, Croobyar
41057309	PS23	1.5	1.7	2 x Grundfos CRE4-80	?	Yes	Yes	Woodstock Rd, Woodstock
41057323	PS27	75	220	2 x Thompson Kelly & Lewis – Super Titan 250 x 300 - 335	1970	Yes	No	Filter Rd, West Nowra
41057303	PS10	45	125	2 x Thompson/ Byron/ Jackson	1980	Yes	Yes	Illaroo Rd, North Nowra
41057317	PS3	900	325	2 x Kelly & Lewis KL GME HORZ. 10/12	1980	Yes	No	Springbank Rd (Priv), Worrigee
41057311	PS32	3	2.6	2 x Grundfos CRE8-80	1964	Yes	Yes	Pointer Rd, Yatte Yattah
41057321	PS9	110	88	2 x Xylem NSCC 80-316/1100W/ W25VCC4	2024	Yes	Yes	Illaroo Rd, North Nowra
41057465	Bamarang -Backwash	110	??	2 x Indeng 384-3T	1982	Yes	Yes	Bamarang WTP
41057322	Bamarang - Clear water	300	380	2 x Thompson Kelly & Lewis – V.S. Super Titan 350 x 400 - 500	1999	Yes	Yes	Bamarang WTP
41057324	PS33	4	3 4.2	2 x Xylem Multistage Lowara 15SV05F040 T	2014	Yes	No	Strongs Rd, Jaspers Brush
	PS47	1.1 1.1	0.7 0.3	2 x Lowara 5SV06F011T 2 x Lowara 3SV11F011 M	2014	Yes	No	Reservoir, Strongs Rd, Jaspers Brush

4.2.16 Recently Completed Pump Station Projects

The Burrier and Brundee Pump Station, high voltage switch yard and associated infrastructure were renewal in 2024, with the HV infrastructure replaced at Burrier. Brundee Pump Station was modified to low voltage to reduce the whole of life costs of the asset. The cost of this project was over $2,5M.

Other projects include the replacement of the Illaroo Rd pumpstation which was completely replaced to accommodate the Moss Vale Rd urban release area. This project was completed in 2024 at a cost of $1.4M

4.2.17 Planned Pump Station Projects

A major review of all water pumpstations is proposed for 24/25 & 25/26 with the project looking at the capacity, utilisation, and condition of the existing assets along with the requirements from the Water Servicing Strategy. This project will result in upgrades and replacement of aging infrastructure to ensure these critical assets can provide the levels of service required in the most cost effective manner now and into the future.

4.2.18 Buildings

The quantity of buildings associated with the water supply activity is given below. The value of Flinders Depot and Plant Building is represented separately in the valuation information (50/50 shared between water supply and wastewater).

Table 4-8 Building Types and Quantities (quantities as per Asset Valuation 30-6-2023)

Asset sub-category	Quantity
Admin	5
Pumping	24
Reservoir	3
Treatment	21
Grand Total	53

4.2.19 Recently Completed Building Projects

Shoalhaven Water recently commissioned a new depot amenities building and associated facilities to house mechanical and electrical operations staff. The building is located at south collocated with the existing depot at Norfolk Ave The Project was completed in 2023 at a cost of $10M.

4.2.20 Planned Building Projects

Current planned new works will include new storage sheds at Ulladulla Depot and Bamarang. This facilities will provide storage and work shop facilities for operational teams. Renewal projects will focus on the condition of existing structures with Culburra STP Roof Replacement Project in the prioritisation stage. Critical Assets

4.3 Criticality

This section of the AMP summarises the framework in place to identify critical assets, the process followed to develop this framework, the critical assets identified and general strategies in place for their management. Improvement tasks are identified to further improve the criticality assessment.

It is important that Shoalhaven Water has a clear understanding of which assets within these systems are critical and why they are critical. Identifying critical assets allows Shoalhaven Water to develop appropriate management strategies that minimise the risk of catastrophic events and achieve an optimum balance between the risk of asset failure and the lifecycle costs of inspecting, maintaining, repairing, and renewing assets.

4.3.1 Criticality framework development and assessment

In 2012-2013 Shoalhaven Water developed a criticality assessment framework and general management strategies for critical assets, and subsequently utilised the framework to identify critical water assets. A series of workshops were conducted involving relevant staff across the organisation to agree upon the criticality criteria for each asset type. Analysis was carried out to identify which assets are critical and datasets were produced for use in management systems planning.

4.3.2 The definitions of critical assets

Asset criticality is defined in terms of the consequences of asset failure. Three criticality grades have been defined as follows:

Extremely Critical: Assets where the consequences of failure are unacceptable and must therefore be reduced.

Critical: Assets where the consequences of failure are sufficiently serious that it is desirable to avoid the failure of these assets to the extent that it is practicable to do so.

Non-critical: Assets where the consequences of failure are not significant enough that Shoalhaven Water should actively commit resources to preventing their failure.

4.3.3 Critical asset identification criteria

Assets are potentially critical if their failure would have significant detrimental impacts on service delivery or compliance, on the local community, or on the financial performance of Shoalhaven Water.

The water assets considered for the criticality test included dams, treatment plants, reservoirs, balance tanks, pump stations, pipes (raw water, reticulation and trunk mains), pressure reducing valves (PRVs), zone valves, motorised control valves, control valves, air valves (reflux, relief and anti-vacuum valves), and fire hydrants.

Generally, the following attributes discussed in this section apply to potentially critical assets. Assets which fall under the categories explained below were assessed based on the significance of the consequences of asset failure which include both operational and social impacts.

Operational impacts of the asset failure are the effects on Shoalhaven Water's ability to operate, measured by the cost and time required to repair the asset, and the effect on Shoalhaven Water's ability to maintain compliance with legislative requirements.

Social impacts of the asset failure are the effects on customers and the community, measured by the severity of the effects, their magnitude or scale, and their duration.

Table 4-9 Critical Asset Identification Criteria

Criteria	Description
Assets serving large populations	The failure of assets serving large populations may result in a critical disruption of service or may cause significant health risk. They are also typically larger, more expensive to repair and take longer to repair, and can cause significant damage or disruption at the point of failure (eg flooding). The population and pipe size thresholds for critical water assets are ≥ 500 and ≥ 300mm, respectively. These thresholds are indicative based on previous experience with comparable water service providers.
Assets serving extremely critical customers	Extremely critical customers are those for which the disruption of water supply may present a serious threat to human life (eg notified dialysis patients, hospitals and surgical facilities). Assets serving extremely critical customers shall be considered potentially critical if failure of the asset would impact service delivery to the customer.
Assets likely to disrupt critical infrastructure or services	Critical infrastructure or services include heavily trafficked roads or rail lines, access to emergency services (such as hospitals, fire stations, police station, or ambulance stations), and access to key facilities (such as airports and ports). The failure of assets in these locations can result in significant disruption to the local community or other infrastructure services. Disruption may occur as a direct result of damage caused by failure of the water asset.
Assets required for compliance with legislative requirements	Some levels of service and monitoring requirements are mandated by legislation. Failure of assets which provide those levels of service or monitoring functions would cause Shoalhaven Water to be non-compliant with legislative requirements. Water assets which fall under

	this category include fire hydrants, turbidity or residual monitoring equipment, and SCADA or Telemetry systems.
Critical Valves (Water Trunk and Distribution Networks)	Since water valves on trunk and distribution networks provide a range of critical functions within the water supply network, they should be considered critical although they may not necessarily qualify as critical based on the previously presented criteria. Valves which should be considered critical include: Valves which operate in emergencies – fire hydrants, zone valves, and isolation valves on reservoir inlets and outlets, connections to extremely critical customers, and on critical water mains. Valves which operate continuously - pressure reducing valves (PRVs) / pressure sustaining valves (PSVs) / water hammer arresting valves (WHAVs), non-return valves, and backflow prevention devices.

4.3.4 Critical assets

A summary of critical water assets is provided in the table below. All treatment plants, zone valves, motorised control valves and fire hydrants are considered critical.

Table 4-10 Water Supply Critical Assets (as at 30/06/2022)

Asset		Quantity	Percentage critical
Water Storage Dams		3 of 5	60%
Treatment Plants		4	100%
Service Reservoirs	Service Reservoirs	17 of 39	43%
	Balance Tanks	1 of 2	50%
Pipe System	Raw Water Mains	28 km of 29 km	96.5%
	Reticulation Mains	136 km of 1,151 km	12%
	Trunk Main	304 km of 449 km	68%
	Total Pipes	468 km of 1,629 km	29%
	PRVs	3 of 80	3.7%
	Zone Valves	188	100%
	Motorised Control Valves	12	100%
	Control Valves	699 of 8,043	8.6%
	Air Valves (includes reflux, relief and anti-vacuum valves)	4529 of 939	56%
	Fire Hydrants	11,499	100%
Pump Stations		11 of 25	44%

The total quantities in the table above are reliant on GIS data and only include in-service Shoalhaven Water owned assets. Note that above ground or facility assets were assessed at facility level only, and not to the component level.

In addition to the above, additional assets that have been identified as critical are:

- Large meters (on mains or connections > 100mm in diameter)
- Meters serving extremely critical customers (eg dialysis patients, hospitals).

- Backflow prevention devices are also critical for high risk industries / installations and need to be considered as part of the Backflow Prevention Programme. This should cover location, type of device, risk, serial numbers (where applicable), testing frequency, test results, emergency response, etc. These need to be clearly identified as BPD's in the asset database / GIS. This may be a legal requirement for meeting drinking water standards. Need to also consider marking of these valves.
- The knowledge of critical assets can be used to enhance various operation and maintenance regimes such as the following:
- To develop, assign and implement appropriate management strategies for critical assets.
- To develop an accurate renewals program that programs critical assets for replacement before their anticipated failure date.
- To inform shutdown procedures for planned and unplanned shutdowns involving critical assets.
- To flag incidents involving critical assets for rapid response or escalation.

To achieve operational efficiencies by targeting more frequent inspections to critical assets, and potentially reducing frequency of inspection, maintenance or replacement of assets whose consequence of failure is not critical.

The tables in Appendix 1 list the water supply reservoirs, dams and pump stations determined to be critical, including the rationale for the criticality grading.

4.4 Asset Management Strategies

This section identifies the management strategies for the following asset types:

- Pipe system
- Water meters
- Service reservoirs
- Storage dams
- Valves

The management strategies are focussed on critical assets.

4.4.1 Management Strategies – Pipe System

While the specific structural failure modes for water mains are many and varied, there are two general categories:

Catastrophic failure: Complete rupture of the main resulting in rapid loss of hydraulic capacity (ie mains break). Mains breaks occur because the combined internal and external loading on the pipe exceeds the tensile strength of the pipe wall. Breaks become increasingly likely toward the end of an asset's useful life due to the loss of tensile strength resulting from corrosion of the pipe wall and joints over time.

Non-catastrophic failure: Minor leaks which result in some water loss but which do not detrimentally affect operation of the main. Leaks occur as a result of materials or manufacturing defects, repair defects, or as a result of pipe wall or joint deterioration. While leaks are common in water supply networks, where water loss due to leaks is significant or trending upwards overtime, this is an indication that network condition is deteriorating. Leaks which go undetected for a long time can lead to a full main break due to, for instance, crack propagation, scour of bedding material, or increased corrosion.

Ultimately the accuracy of predictions about when water main assets are likely to fail as a result of deterioration depends on what data is available, the reliability of that data, and the reliability of the analyses which are applied to it.

Four general sources of data for predicting likelihood of failure are:

- Asset age
- Environmental condition data
- Network performance data
- Physical condition data

Each source represents an increasing burden and therefore cost of data collection and analysis. The benefit is more accurate knowledge of asset condition and therefore more accurate prediction of failure likelihoods.

Critical water mains should be renewed before a failure becomes likely as a result of condition deterioration. The management strategy for critical water mains is therefore determined by:

The need to detect and repair non-catastrophic failures – In most water utilities this is achieved through (a) prioritised repair of leaks reported on critical mains, and (b) a prioritised leak detection program

The need to determine the optimum time to replace a water main before catastrophic failure occurs – Critical water mains present challenges with respect to predictive condition modelling. These assets do not require preventive maintenance; inspection is typically difficult and costly because these assets are both buried and pressurised; and critical mains will generally not have failure histories.

4.4.2 Environmental Condition Data (Water Mains)

The principal mode of deterioration for water mains is reduction of pipe wall thickness and/or strength due to corrosion (both internal and external) or other factors (eg leaching of cement from AC pipes). The rate of deterioration and the likelihood of failure are influenced by a wide range of factors, as shown below.

Table 4-11 Factors influencing the rate of deterioration and/or the likelihood of failure

Factors Influencing the Rate of Deterioration	Factors Influencing the Likelihood of Failure for a Deteriorated Pipe
Pipe and lining material **Manufacturing quality (joint type, dissimilar metals)** **Water quality** **Bedding and backfill material** **Soil type and moisture** **Temperature** **Stray electrical currents**	External loading due to traffic Earth movements Freeze-thaw movement Internal loading due to operating pressure, hydraulic transients, and flow velocity and tuberculation

For any given pipe, the particular combination of factors at play may produce a life expectancy dramatically lower or higher than the average life expectancy for that type of pipe.

4.4.3 Network Performance Data (Water Mains)

Collection and analysis of network performance data can also inform renewals predictions:

Leakage: Leak detection programs allow Shoalhaven to identify water losses through network leakage. Leak statistics are an indicator of failure likelihood, ie mains with higher leak rates or with rates which are trending upwards over time may indicate mains which are at higher risk of failure due to deterioration, materials or construction defections, or adverse environmental or operating conditions.

To improve response time and reduce water losses, Shoalhaven Water is trialling IOT (internet of things) devices at PRV's and sewer pump stations. These devices will give real time monitoring and identify leaks through out the network. The project is expected to be completed

Network Pressure: Pressure modelling is used to identify those sections of the network which operate under constant high pressure or which are subject to high transient pressures. These mains represent a higher likelihood of failure due to the excess loading which is applied to them. Increasing complaints about low pressure may indicate that hydraulic capacity is being affected by pipe deterioration (eg tuberculation). Shoalhaven Water has invested in Innovize Water Modelling software and engaged is developing hydraulic models which will be used to monitor network pressures and model changes in the network which will feed into our strategic planning and development assessment projects.

Failure History: Recorded failure frequency is a key input to predictive models. Reliable failure history data is not likely to be available for critical mains. However, failure histories for non-critical mains of a similar type provide a source of data for estimating failure probabilities for critical mains and pipe renewals. Failure history is difficult to estimate due to the differing operating environmental and operating factors.

Water Quality: Increasing water quality complaints, changes to pH, high iron concentrations in water samples, or low chlorine values may indicate that water mains are deteriorating.

4.4.4 Physical Condition Data (Water Mains)

Physically inspecting water main assets and assessing their condition provides the most reliable source of data for predicting likelihood of failure. Accurate condition information can be combined with environmental and operating condition data, and network performance data to identify those mains most at risk of failure.

Physical condition assessment can be achieved in a number of ways:

Opportunistic inspection: Undertaken when opportunities arise, eg when mains are repaired or replaced, or when cut-ins are carried out. At the minimum, utilities should be collecting condition data on their water mains every time a main is exposed. Shoalhaven Water is implementing ArcGIS Collector application for mobile asset data collection. This is an ongoing project that will allow for external adhoc/coarse condition assessment.

Out-of-service inspection: Deliberately taking a main out of service and carrying out an inspection. This may involve internal inspection of the main (eg by CCTV or more advanced scanning techniques), removal of a section of main for analysis (destructive testing), or removal of samples from the pipe wall (non-destructive testing). Given the costs of taking a main out of service and the physical works involved in uncovering the main for testing, these sorts of inspections may only be viable for the most critical mains.

Destructive testing of water mains should only be considered as a last resort when other modes of inspection are non-viable. This is because the removal and replacement of a section of water main creates a localised weakness, which significantly increases the likelihood of a break occurring in that location.

In-service inspections: Recently developed technologies now allow the condition of water mains to be assessed without taking the main out of service. These include CCTV inspection under pressure and flow, and condition assessment based on acoustic or electromagnetic analysis. The latter provide an assessment of the pipe condition based on the acoustic or electromagnetic signature of the pipe as compared with a database of comparable pipes. Physical works are not required as the testing rigs are attached to accessible nodes within the network (ie valves, hydrants). These new technologies may

present methods for condition data collection for critical mains when taking them out of service is problematic.

Key condition information for pipelines which should be collected during condition inspections include:

Pipe Wall Thickness: Wall thickness reduces over time due to internal and external corrosion. Since the degree of reduction in wall thickness represents loss of tensile strength, measurements of wall thickness can be combined with other variables (ie internal and external loadings) to assess the current likelihood of failure of specific mains. For mains of a similar type, measurements of pipe wall thickness over time can be used to estimate average rates of decay and hence life expectancy.

Pit Depth: Internal and external corrosion is not necessarily uniform over the length of a water main. Localised pitting of the pipeline wall can occur, for instance, due to galvanic corrosion resulting from connection of dissimilar materials. The number and depth of pits in a section of pipeline wall, and the rate of pitting increase can be used to assess likelihood of failure and life expectancy for pipelines.

Lining Thickness: Where pipelines have an internal lining, the condition of this is also important. Lining thickness should be included in the condition assessment.

Residual Tensile Strength: For asbestos cement pipes in contact with soft water, loss of strength is mainly attributable to leaching of the cement matrix resulting in increased porosity, but no significant reduction in wall thickness. The condition of asbestos cement pipes can only be reliably assessed by chemical analysis and/or residual strength testing of wall samples. Wall samples can be obtained by non-destructive techniques or using pipe sections that have been removed.

The following table summarises the review of current critical asset management practice for water mains and identifies specific strategies and recommendations requiring further action.

Table 4-12 Summary of Management Strategy Practice for Water Mains

Management Strategies			Current Practice	Recommendations	Status	Responsibility
Category		Description	Description			
Resilience Strategies	Isolation	Standard 2 isolation valves per main. Valve locations determined based on network modelling	Isolation valves on critical mains at sufficient spacing to allow easy isolation for valve maintenance, cleaning, etc. Can shut down manually. Approximately 1km apart.	Maintain current practice, and review incidents to ensure no further change required. Cost prohibitive to increase number of valves as already optimised.	In progress maintain current practices	Mark Jennings
	Redundancy	Need for duplication based on failure risk analysis	Trunk Main 11 doesn't have redundancy. Can fix within 24 hours. Have got storage at reservoir +36 hours. Risk that Porters Creek dam tunnel may collapse. No gap in practice. Note that the recent Water Supply System Strategy determined adequate supply.	Confirm critical assets requiring redundancy and existing measures in place. Determine any areas that need further investigation. including: Confirm condition of tunnel and potential alternatives.	Investigations underway – New PRVs installed in Basin and Sanctuary Point. OIT devices being fitted to PRVs Tunnel to be inspected for condition	Mark Jennings Coordinator to arrange condition inspection program
	Spares Holding	Spares held for all critical mains	Shoalhaven currently hold approximately $1M of stock. Gibault, pipe, tapping banks, PRV's considerable stores. Actuators not in stores but can operate manually. Have got separate electrical stores.	Use critical asset list to review spares holding. Review lead time vs spares / redundancy. Consider supplier arrangements and / or spares holding.	Stores system to be reviewed and upgraded to manage stock	Mark Jennings

			Lead time for some assets could be an issue. Currently reviewing – take into consideration critical assets. Enough for all breaks.		Ongoing	
	Emergency Supplier Arrangements	Contract with emergency supplier in place with agreed levels of service (ie response times)	Don't have formal contractual arrangements in place with key suppliers. To date key suppliers have responded quickly in emergency situations.		Industry contact with Sydney water and Wingecarribee Council in emergency	
	Emergency Response Plan	Emergency Response Plan addresses critical mains failure	Plan is to move to event based planning. Doesn't relate to critical mains. Reliance on people.	Could workshop specific critical mains for action required to reduce reliance on key people and process.	Emergency response and O & M manual to be updated	
Operations & Maintenance Practices	Asset Location	All critical mains are located in GIS	Mains in GIS are identified as critical.	Need to review all incoming works to assess criticality in accordance with the current critical asset register. Need to document the date the asset is recorded as critical and why.	Complete	MK
		Operators have critical assets maps	Critical assets are identified in GIS viewer and map base.	Need to advise all staff of new asset field and update PDF sheets to identify critical assets. Critical asset review to be undertaken for all new assets constructed or accepted into	Completed using mobile devices Completed. Part of ¼ updates	MK

				system. Asset section to develop risk assessment and consequence for failure matrix for all incoming assets. Several options: ~~Published PDF maps.~~ Handheld electronic devices. Note that need to resolve accuracy issues and cell coverage. Working through confidence levels in data.	Completed N/A Complete Ongoing	
	Routine Inspection & Maintenance	Programmed walk-overs of all critical mains	Walkover patrols are carried out at routine intervals (annually for distribution mains, two-yearly for trunk mains). Visible maintenance issues (eg leaks, vegetation slashing, painting) are addressed during these patrols. Scheduled maintenance programme is in place for all valves, hydrants and stop valves however data from these inspections is not incorporated into asset register.	Review frequency of inspections on critical assets. Review current inspection process and procedures to incorporate inspection data into asset register. Implement scheduled maintenance programs in T1	Procedure to be drafted – Dec Asset unit to risk assess based on isolation Ongoing using collector App In development Completed	Mark Jennings MK Matt Crowe

	Detecting Failure	Leak detection programme	Visual leaks are observed during programmed walk-overs. There is no annual reporting requirement, but the leakage is low, so not so critical. Reviewed 3 times, but not major issue.	Note that PVC >300mm diameter has issues with breakage.	PRV IOT Project is currently in development which will identify main breaks using IOT devices on trunk mains and water meters at SPS's	Alan Gilkes & Matt Kidd
		SCADA monitoring of meters on critical mains	All bulk meters on SCADA. Most reservoir have meters. All res have SCADA		Complete	Mark Jennings
	Walk-over process	Specific walk - over process for critical mains	No definition between critical mains and non-critical mains.	Develop changes to walk-over process to address this.	Noted above	Mark Jennings
Age & Condition Data	Age	Ages for all mains are recorded in AMIS.	Age data is recorded. Largely confident of age data.	Schedule replacement date into renewals programme.		MK/CS
	Environmental Condition Data	Environmental condition data is recorded for input into life expectancy calculations	eg: Sulphate soils, contaminated land - considered for useful life.	Map acid soils, contaminated land, etc. into GIS layer for analysis. Target condition inspection program	NYS Use of Drone and desktop assessment	MK Mark Jennings/MK
	Performance Data	Leakage	Visual leaks are observed during programmed walk-overs.	Record location and review leakage data annually. Refer failure history below.	To be reviewed as part of draft procedures Improve leak detection in SCADA	MJ AG

		Network pressure	Very little modelling. System model well calibrated but only been in operation 12 months. Don't get pressure complaints.	Review model to ensure critical mains are included. Extend model if necessary. Installation of pressure loggers on PRV zones to pick up pressure within system and chlorine residual	Models currently in development Project also includes monitoring of meters at SPS sites.	CS –AG currently under way
		Failure history (all mains)	Mains break history/frequency is recorded in new CRM system Failures will be recorded against the asset in the works order system. PVC >300mm diameter has been recognised as an issue because of the number of breaks.	Once works order system in place, set up process to analyse common failures. Implement progressive replacement programme for PVC >300mm in diameter, prioritising critical mains.	In progress – Mapping Merits. CRM Project to include main break dashboard In progress	BL MK
	Physical Condition Data	Data collected from programmed in-service or out-of-service inspections	Walkover patrols are carried out at routine intervals (annually for distribution mains, two-yearly for trunk mains). Visible maintenance issues (eg leaks, vegetation slashing, and painting) are addressed during these patrols.	Assess age and condition of critical valves. Update database with asset information. Feed into long-term renewals programme. Review current inspection process and procedures to incorporate inspection data into asset register.	In progress In process	MK MK/CS
Renewals forecasting	Risk-based forecast, with likelihood of	Age + Standard Useful Life	Age data is used as an input for renewals decisions making.	Improve current renewal planning by considering the criticality of assets along with age and failure rates.	Complete	MK

	failure determined	Environmental condition data Network performance data Physical condition data Advanced deterioration modelling	Mains break history/frequency is used as an input to renewals decision making. Yes – PVC.			

Table 3.1 Summary of Recommendations for Water Mains

Management Strategies	Recommendations
Isolation	Maintain current practice, and review incidents to ensure no further change required. Cost prohibitive to increase number of valves as already optimised.
Redundancy	Investigate feasibility of Trunk Main 11 redundancy. Confirm condition of tunnel and potential alternatives.
Spares Holding	Use critical asset list to review spares holding.
Emergency Response Plan	Workshop specific critical mains for action required to reduce reliance on key people and processes.
Asset Location	Need to mark the critical assets in GIS as a first step. Need to make the criticality of assets known to operations staff. Several options: Published PDF maps. Handheld electronic devices Note that need to resolve accuracy issues and cell coverage.

Routine Inspection & Maintenance	Review frequency of inspections on critical assets. Review current inspection process and procedures to incorporate inspection data into asset register. Implement scheduled maintenance program in Tech One.
Detecting Failure	Check whether have meters on all critical mains.
Works-over Process	Develop changes to works-over process to address this.
Performance Data	Review model to ensure critical mains are included. Extend model if necessary. Record location of leaks found and review data annually. Identify areas of the network requiring replacement and include in renewals programme. Once works order system in place, set up process to analyse common failures. Implement progressive replacement programme for PVC >300mm in diameter, prioritising critical mains.
Physical Condition Data	Assess age and condition of critical valves. Update database with asset information. Feed into long-term renewals programme.
Renewals forecasting	Improve current renewal planning by considering the criticality of assets along with age and failure rates.

Table 4-13 Summary of Recommendations for Water Mains

Management Strategies	Recommendations
Isolation	Maintain current practice, and review incidents to ensure no further change required. Cost prohibitive to increase number of valves as already optimised.
Redundancy	Investigate feasibility of Trunk Main 11 redundancy. Confirm condition of tunnel and potential alternatives.
Spares Holding	Use critical asset list to review spares holding.
Emergency Response Plan	Workshop specific critical mains for action required to reduce reliance on key people and processes.
Asset Location	Need to mark the critical assets in GIS as a first step. Need to make the criticality of assets known to operations staff. Several options:

	Published PDF maps. Handheld electronic devices Note that need to resolve accuracy issues and cell coverage.
Routine Inspection & Maintenance	Review frequency of inspections on critical assets. Review current inspection process and procedures to incorporate inspection data into asset register.
Detecting Failure	Check whether have meters on all critical mains.
Works-over Process	Develop changes to works-over process to address this.
Performance Data	Review model to ensure critical mains are included. Extend model if necessary. Record location of leaks found and review data annually. Identify areas of the network requiring replacement and include in renewals programme. Once works order system in place, set up process to analyse common failures. Implement progressive replacement programme for PVC >300mm in diameter, prioritising critical mains.
Physical Condition Data	Assess age and condition of critical valves. Update database with asset information. Feed into long-term renewals programme.
Renewals forecasting	Improve current renewal planning by considering the criticality of assets along with age and failure rates.

4.4.5 Management Strategies – Water Meters

The key failure modes for water meters are:

- Catastrophic damage or blockage caused by foreign objects in the water supply
- Loss of accuracy due to wear of meter components.
- The management strategy for critical water meters is therefore determined by the need to:
- Protect meters from damage due to foreign objects in the water supply
- Ensure meter accuracy.

Current and target practices regarding critical water meters are summarised below. The current practice was considered to be reasonable, and as such no further recommendations were made.

Table 4-14 Summary of Management Strategy Practice for Water Meters

Target Practice			Current Practice	Status	Responsibility
Category		**Description**	**Description**		
Resilience Strategies	Redundancy	Not applicable.	Can bypass meter at Manildra.		
	Spares Holding	Spares held for all critical meters (or can be sourced from supplier on agreed lead times if required).	Hold spares for large critical customer meters. Can't hold spares on bulk meters. Have got meter replacement programme in place.		
	Emergency Supplier Arrangements	Contract with emergency supplier in place with agreed levels of service (ie response times).	Not deemed to be required.		N/A
	Emergency Response Plan	Emergency Response Plan addresses critical water meter failure.	See water mains.		
Operations & Maintenance Practices	Routine Inspection & Maintenance	Routine meter calibration.	Identified critical bulk meters and auditing those. Replacement based on performance and criticality.	Procedure set up Map reportable meters Create asset AMS	Complete In progress In progress
	Detecting Failure	Critical meters monitored via SCADA. Failure detected during meter reading, routine inspection or calibration.	On bulk meters. Consideration of smart metering	Review smart metering	Andrew McVey
Age & Condition Data	Age	Ages for all meters are recorded in AMIS.	Assess age and condition of critical meters. Update database with asset information. Feed into long-term renewals programme.	In progress	MK

			O&M contract for immediate works. O&M contract should allow for immediate repair / replacement and programming. Replacement will be an ongoing programme. Higher quality meters.		
	Physical Condition Data	Condition updated following routine inspection and testing of critical meters.	Painted different colours and/or tags for critical meters / customers and valve direction. Tags for lock off. Meters to critical consumers for dialysis painted different colour		
Renewals forecasting	Based on Condition	Based on recommendations of the trained service personnel who routinely inspect, test, and maintain the meters.	Meter replacement within 20 years. Ongoing calibration by manufacturer annually.		

4.4.6 Management Strategies – Service Reservoirs

The key modes of structural failure for reservoirs are:

Leakage: Leakage occurs through cracks in the floor and walls of a reservoir. Cracks are inevitable in concrete structures and their presence does not necessarily indicate imminent structural failure. Many reservoirs provide an adequate level of service for many years after leakage is initially detected. However, leakage can accelerate structural deterioration as water comes into contact with reinforcing steel causing active corrosion

Structural failure: Total collapse of concrete structures due to deterioration is rare. Rather, structural failure usually occurs as a large deflection or excessive displacement of beams, columns, or walls, or the development of cracks beyond the limit of tolerability. These modes of failure typically occur over a significant period of time with clear warning signs

Drain down: A further mode of failure is ‘drain down’ which occurs due to failure of the rising and falling mains to which, the reservoir is connected.

The management strategy for critical reservoirs is therefore determined by the following requirements:

The need to protect the reservoir from drain down. All reservoirs should have inlet and outlet control valves which automatically shut off flow in the event of a loss of downstream pressure to prevent reservoir drain down. These valves also enable the reservoir to be isolated in a water quality event. Valves on reservoirs should be managed as critical valves.

The need to identify, monitor and repair leakage. Identification and monitoring of leaks should be undertaken during routine reservoir cleaning activities.

The need to determine the optimum time to renew the reservoir before structural failure becomes likely.

The following table summarises the review of current critical asset management practice for reservoirs and tanks and identifies specific strategies and recommendations requiring further action.

Table 4-15 Summary of Management Strategy Practice for Reservoirs and Tanks

Target Practice			Current Practice	Recommendations	Status	Responsibility
Category		**Description**	**Description**			
Resilience Strategies	Isolation	Auto- or remote operated isolation valves on rising and falling mains to prevent drain down.	Nothing to stop reservoir being drained if leak downstream. Haven't lost one but have been close. Each has low level alarm, overflow alarms. Have got some high flow rates monitors.	Only required for Porters Creek. Data pickup with SCADA To be further developed as part of leak detection system	Ongoing	Mark Jennings
	Redundancy	Need for reservoir bypass loop considered within overall network resilience strategy.	Some redundant reservoirs also back fed from others. Look at the 17 to check redundancy.	• Pitt St Res (Low) bypass PRV required • Pitt St Res (High) pressure pump required • Nowra Hill Res (Ind) bypass PRV required • Cambewarra Res – 2nd reservoir required • Bendeela Res – 2nd Reservoir required • Shoalhaven Heads Res – PRV required and redundancy supply via Berry	In progress as part of Res Contingency Plan Contingency Plan now complete	Mark Jennings

				• Bewong Res – PRV required • Radar Res – pressure pump as backup? Pointer Rd Balance tank – PRV required		
	Emergency Supplier Arrangements	Use of preferred suppliers list and trade services panel in place with agreed levels of service (ie response times)	Suppliers respond quickly. Required Procurement procedures which limit supplier arrangements	Supplies available at plants to cover in case of emergency		
	Emergency Response Plan	Emergency Response Plan addresses critical reservoir failure	Set at 25-30%. Some more critical at 50%.			
Operations & Maintenance Practices	Asset Location	All critical reservoirs are located in GIS	All reservoirs are critical.		Complete	MK
	Routine Inspection & Maintenance	Routine security inspections	All reservoirs are inspected monthly (or quarterly?), including associated pumps and valve assemblies.	Review current inspection process and procedures to incorporate inspection data into asset register.	Ongoing	MJ
		Routine cleaning as per drinking water quality requirements.	All reservoirs are cleaned on a 5-yearly cycle.			
	Detecting Failure	Access hatches are alarmed and	No but should do.	Alarm or monitor all access hatches	Ongoing	MJ

		monitored via SCADA				
		Water level monitoring via SCADA.	Have low level alarms in place.		Complete	MJ
Age & Condition Data	Performance Data	Maintenance / works history recorded in AMIS	Data collected in WorXonline into TechOne System		Complete	MJ
	Physical Condition Data	Visible condition assessment carried out during routine cleaning and recorded in AMIS.	Diving programme. Have database. Monthly inspection. 10 yearly paint condition assessment Cathodic inspection on steel structures 6 monthly Condition inspection will also be undertaken as part of asset revaluation project.	Need to incorporate into Shoalhaven System	Ongoing Ongoing Ongoing In progress	 MJ MJ MK
Renewals forecasting	Recommended renewal	Renewal as recommended from detailed structural condition assessment.	If visible issue, then drain and test and programme painting.		In progress	MJ

4.4.7 Management Strategies – Treatment Plants & Pump Stations

Water treatment plants will require generally require upgrading either through insufficient capacity due to growth in the catchment or due to changing licence conditions by the regulator. Mechanical Equipment

Mechanical equipment includes pumps, motors, aerators, screens, etc. These assets typically have multiple moving components which wear at different rates (eg for a pump: bearings, drive shafts, impeller). The principal deterioration-related mode of failure applicable to these assets is loss of operational function due to component failure. It is desirable to prevent loss of operational function due to component failure through preventive or predictive maintenance. As components wear out, they must be replaced to sustain the function of the asset.

Individual components of mechanical assets may be replaced multiple times over the useful life of the asset. At some point, however, performance and reliability of the asset will decline, the life cycle costs of continuing to preventively maintain the asset will increase, or key structural components of the asset will reach the end of their useful lives (eg pump casing). At this point, the whole asset should be renewed.

4.4.8 Master Flow Meters

Shoalhaven Water has Master Flow Meters that are used within the system to measure flows. These meters are reportable to the Department of Climate Change, Energy, the Environment and Water (National Performance & Triple Bottom Line reporting) and the Natural Resource Access Regulator (NRAR). To ensure accurate and consistency of reporting, the meters are to be inspected and validated 12 monthly in accordance with NSW Government Gazette No 27 Maintenance Specifications 29th March 2019. Test reports, maintenance data and specifications are then stored in Council document management system within the Flow Meter Verification file 63534E. Council's Asset Management System is used to manage the maintenance and operation of these meters and all meters are mapped within the GIS system.

4.4.9 Electrical & Electronic Systems / Equipment

Common components of electrical and electronic systems include

- Cabling
- Connections
- Circuit boards
- Programmable Logic Controllers
- Digital Storage Mediums
- Switches
- Indicators
- Displays
- Transmitters/Receivers/ Antennae
- Rotors / Windings
- Lights
- Batteries
- Detectors
- Solar Panels
- Keypads

For any of the above components, at least one of the following failure modes applies:

- **Complete failure:** The device or component suddenly stops working, does not switch on, or cannot be switched off. The fault may be permanent or intermittent. This failure mode is applicable to all electrical devices/components.
- **Performance drift:** The device or component continues to function but is either unable to maintain normal operational parameters or the range of function becomes limited. This could mean inaccurate measurement, operating temperature too high or too low, speed too high or too low, etc. This failure mode applies to some kinds of electrical devices/components.

For critical assets, occurrence of either of the above failure modes would likely result in loss of service. It is therefore desirable to replace critical electrical or electronic equipment before either of the above failure modes occurs. The management strategy for critical electrical and electronic equipment is determined by the following requirements:

- For all electrical/electronic equipment, the need to replace components before failure occurs or becomes likely
- For equipment which only operates in emergencies (and is normally “off”), the need to ensure that the equipment has not failed while sitting idle.

The following table summarises the review of current critical asset management practice for treatment plants and pump stations and identifies specific strategies and recommendations requiring further action.

Table 4-16 Summary of Management Strategy Practice for Treatment Plants and Pump Stations

Target Practice			Current Practice	Recommendations	Status	Responsibility
Category		Description				
Resilience Strategies	Redundancy	Need for stand-by assets based on failure risk analysis	Currently at least two pumps at each WPS & each treatment plant function. Pump replacement program undertaken to ensure pumps have 100% redundancy due to duty/standby. Treatment plants designed well above current peak loading. All treatment plants have redundancy in systems. Bamarang WTP can supply Flatrock WTP zone as well as SSWS ie. Milton and Flatrock WTPs can be turned left off and supplied from Bamarang WTP.	Review ongoing pump replacement program. Water modelling Maintain alternate supplies wherever possible	Ongoing 2021 Ongoing	Andrew Truran and Craig Singleton MJ
	Spares Holding	Dual electrical feeds or back-up generator	Some pumps stations have dual feeds. Backup generators are located at strategic sites and can be relocated at short notice. Maintain some critical spares on shelf – such as VSDs, refluxes and actuators – otherwise interchange components as necessary. Maintain contact list of critical suppliers of materials and resources.	Burrier WPS – No issue due to Bamarang Dam capacity Bamarang WTP – Generator on order Bamarang RW & CW PSs – generator on order Brundee WPS – going to low voltage transformer which will enable a generator connection/operation Other WPS – Conjola WPS generator on order Milton WTP – Can currently be operated via generator	Ongoing Tech one dependent	MJ Fleet
		Spares held for all critical equipment	Different brands of pump currently being used, but being replaced with standard types, so that spares can be held.	Spares held by supplier. Ongoing pump replacement program being considered	Ongoing	MJ
	Emergency Supplier Arrangements	Contract with emergency supplier in place with agreed	Supplier has pumps for hire. Hold enough spares but could shift to suppliers. Suppliers won't hold specific pump as not interchangeable. Some	Internal maintenance crew to maintain and managed. Condition data recorded for	Ongoing Ongoing	MJ

		levels of service (ie response times) Reservoir Contingency Plan – under Water ERP (Intranet)	pump stations will have place for a 3rd pump Follow contingencies as laid out in plan	replacement program using WorXonline. Goodwin and Sykes pumps available for emergency using bypass. Investigate recommendations as laid out in the reservoir contingency plan	Ongoing	
Operations & Maintenance Practices	Routine Inspection & Maintenance	Regular cleaning and basic preventative maintenance as per manufacturers' instructions or accept industry practice	All mechanical equipment is routinely inspected and basic preventive maintenance undertaken on fixed six-monthly, annual, or 1000-hr schedules. Daily flow checks and data telemetry checks. Each week all pump stations are visually checked. With preventative maintenance, 6 monthly on bigger pump stations and 12 monthly on smaller ones.	Internal crews used for programmed maintenance Develop scheduled maintenance program for all WTPs & WPS Data recorded using mobile applications in Tech One & WorXonline.	Ongoing 2019 Ongoing	MJ AG MK
	Detecting Failure	All critical equipment monitored via SCADA	SCADA is used to identify issues with a web based system.	SCADA system upgrade in progress to improve data	Complete	MJ/AG
Age & Condition Data	Age	Ages for all critical equipment are recorded in AMIS	Age information accurate	Improvements asset data in AMS as part of componentisation project. Ongoing data cleansing and data acquisition using One Council WO system.	Complete Ongoing	MK
	Performance Data	Failure history recorded	Failures are recorded but there is no loop back to a central system. Works order and CRM systems will enable failure analysis.	Breakdown maintenance recording as part of TechOne solution	Ongoing	MK
	Physical Condition Data	Observations of physical condition during routine inspections and maintenance activities	Proactive pump replacement programme. Replace electrical and mechanical systems at the same time if required.	Development of condition assessment rating system as part of TechOne Solution.	In progress	MK

		Advanced condition inspection/analysis techniques (eg vibration analysis) carried out on a programmed basis	Vibration analysis is also carried out on key pumps on annual schedules.	Develop advanced condition inspection analysis based on best practice for critical pump station Use of power meters to fault detect electrical issues	2020 Ongoing	MJ
Renewals forecasting	For Assets with Redundancy	Renewal based on lifecycle costs		TechOne dependant	2022	MK
	For Assets without Redundancy	Renewal based on lifecycle costs and reliability/operational difficulty		TechOne dependant	2022	MK

Table 4-17 Summary of Recommendations for Treatment Plants and Pump Stations

Management Strategies	Recommendations
Redundancy	Review pump configuration and operation for redundancy.
Spares Holding	Review spares held based on criticality.
Emergency Supplier Arrangements	Suppliers have available spares and hire equipment
Condition Assessment	Development of condition assessment system that can be integrated with asset register and mobile solutions.

4.4.10 Management Strategies – Storage Dams

Shoalhaven Water has responsibility for five of the seven dams which supply water to the Northern, Southern, or Kangaroo Valley water supply schemes. Two of these dams are no longer used for water supply purposes but remain assets for which Shoalhaven Water has responsibility.

Table 4-18 Shoalhaven Water Dams

Dam	Owned & Operated By	Declared	Inspection Frequency[1]
Bamarang	Shoalhaven Water	Yes – Significant	Bi Weekly
Danjera	Shoalhaven Water	Yes - Significant	Bi Weekly
Flatrock	Shoalhaven Water (Disused)	No	Monthly
Cambewarra	Shoalhaven Water (Disused)	Yes - Significant	Weekly
Tallowa	Water NSW	Yes	N/A
Bendeela	Water NSW	Yes	N/A
Porters Creek	Shoalhaven Water	Yes - Significant	Bi Weekly

The Dams Safety NSW (DS NSW) is charged with ensuring the safety of those dams which are Declared under the new NSW Dams Safety Act 2015, because their failure would have serious community consequences. Four of Shoalhaven Water's dams were identified as Delared under the DSA 20158 and assessment and management of these dams is undertaken in accordance with the Dam Safety Act and the Dam Safety Regulation 2019.

As an owner of declared (prescribed) dams, Shoalhaven Water is required to comply with the DS NSW requirements (refer http://www.damsafety.nsw.gov.au) for the construction, management, operation, maintenance, surveillance, modification, and decommissioning of dam structures. During the life of a dam, these requirements include:

The regulation specifies that:

(1) An operations and maintenance plan under section 16(1) of the Act for a dam must set out the following—

(a) the operating procedures for the dam with a concise description of the procedures and limits (operator controls) of plant and equipment used in the operation of the dam,

(b) details of each circumstance in which an alarm will be triggered in respect of the dam and the response and reporting protocols that will occur when that alarm is triggered,

(c) the maintenance (comprising corrective and preventive) that will be carried out on the dam, the times at which that maintenance will be carried out and who is responsible for the maintenance,

(d) the procedures for reporting incidents in respect of the dam,

[1] Source: Shoalhaven Water and Wastewater O&M Schedule Manual – Revised 2005

(e) the procedures to ensure public safety in respect of the dam during its day to day operation,

(f) the security measures that are in place in respect of the dam.

(2) The operations and maintenance plan must—

(a) set out how the matters in subclause (1) will apply in normal, abnormal and extreme loading operation conditions, and

(b) be appropriate to the size and complexity of the dam and its associated structures and systems.

(3) The operations and maintenance plan may include any other matter that the dam owner considers to be relevant to the operation and maintenance of the dam.

(4) The operations and maintenance plan for a dam categorised as significant consequence, low consequence or very low consequence must be updated at least once every 5 years.

Note. Section 16 (3) of the Act requires all other operations and maintenance plans to be updated on an annual basis.

(5) The owner of a declared dam must, if required by notice in writing to do so by Dams Safety NSW, provide Dams Safety NSW with a copy of the operations and maintenance plan within the time, and in the form, specified in that notice. The following table summarises the review of current critical asset management practice for dams. The current practice was reasonable, and as such no further recommendations were made.

Table 4-19 Summary of Management Strategy Practice for Dams

Target Practice			Current Practice	Status	Responsibility
Category		**Description**	**Description**		
Resilience Strategies	Redundancy	Need for additional raw water storage considered within overall network resilience strategy.	Little issue even in drought conditions. Good drought management plan. Tallowa Dam not Shoalhaven owned, but important Water NSW agreement in place.	Ongoing	MJ
	Emergency Response Plan	Dam Safety Emergency Plan (DSEP) in place and updated annually as per DSC requirements (DSC2G).	Catchment protection plans – locations ok.	Ongoing	MJ
Operations & Maintenance Practices	Routine Inspection & Maintenance	O&M manual in place as per DSC requirements (DSC2F), and routine inspections and maintenance in accordance with the manual.	All part of schedule of maintenance. Dam O & M manuals completed	Ongoing	MJ
	Detecting Failure	Appropriate instrumentation in place and monitored via SCADA (storage level and seepage).	SCADA for Bamarang Danjera flood system. Buttress dam, early 70's. Emergency supply upgraded 2017 Dam Monitoring system with alarms set inline with the respective DSEP included in Scada	Complete	MJ
Age & Condition Data	Age	Ages for all dams are recorded in AMIS	Dam life dates in AMIS.	Complete	MK
	Environmental Condition Data	Rainfall and flow monitoring.	Test for algae/water quality. Agreement in progress with BOM to integrate live data into SCADA system. Develop flood network	Ongoing/ In progress	MJ

	Physical Condition Data	Dam Surveillance Reports at 5 yearly intervals (DSC2C) Dam Safety Reviews as required (DSC2D)	Regular audits in place. Already have categories, already determines frequency of inspection. Condition assessment is to be undertaken as part of re-valuation process.	Ongoing Completed	MJ MK

4.4.11 Management Strategies – Valves

Different types of valves provide a range of functions within the water supply network. All valves have the following general failure modes:

Catastrophic: Failure of the valve casing, equivalent to a main break.

Non-catastrophic: Leakage through seals or diaphragms, or seizure/failure of the internal mechanism. Failure of seals or diaphragms will result in leakage from one side of the valve to the other when in the closed position, or leakage to the external environment. Seizure of the valve mechanism will mean that the valve cannot be opened or closed when required. Failure of the mechanism can cause spontaneous opening of closed valves. It may be possible to remotely detect non-catastrophic failures via system telemetry (eg pressure or flow abnormalities), depending on the valve type and function. However, for other valve types, these types of failures cannot be detected unless the valve is inspected and/or operated.

For all critical valves it is desirable to prevent both catastrophic and non-catastrophic failures before they occur. The management strategies for critical valves are therefore determined by:

- The need to routinely inspect valves to assess condition, ensure correct operation, and repair or replace leaking or seized valves.
- The need to determine the optimum time to replace a valve before catastrophic failure occurs.

Table 4-20 Shoalhaven Water's Current Inspection and Maintenance Strategies for Valves & Hydrants

Category	Critical infrastructure on Trunk Mains	Critical Infrastructure on Distribution Mains
Operations & Maintenance Practices	**All valves on trunk mains are inspected on a 5 -year cycle using ArcGIS Collector.** **Stop valves, scour valves, and hydrants have painted covers**	All valves & hydrants on trunk mains are inspected on a risk based assessment basis using ArcGIS Collector application. The results of these inspections are available to coordinators through ArcGis Collector. Maintenance

		issues or defects are recorded using WorXonline and TechOne Works Management System. Fire hydrant locations are indicated by road markings, cat's eyes, and painted marker posts Some valves have painted covers to indicate that they are left-hand valves (Red), closed valves (Green), or valves on connections to dialysis patients (blue). At 12 monthly intervals, the property owners and/or occupiers of properties must ensure that testable backflow prevention devices are tested and are maintained if required.
	Hydrants on Trunk Mains are to be inspected on a risk management based using ArcGIS Collector	All valves & hydrants on trunk mains are inspected on a risk based assessment basis using ArcGIS Collector application. The results of these inspections are available to coordinators through ArcGis Collector. Maintenance issues or defects are recorded using WorXonline and TechOne Works Management System.

Table 4-21 Recommendations for Critical Valves

Management Strategies	Recommendations	Status	Responsibility
Spares holding	Spares and/or parts holding for large critical valves if necessary.	Ongoing	
Valve operation / testing	Ensure critical valves are operated on an as needs basis Redundancy within system to isolate (dependent on type of valve). Include in O&M procedures.		
Valve direction / lock off	Symbol, tag or paint for valve direction if not indicated. Tag, paint or lock off valves that are closed.		
Valve marking	Paint different valve types. Review valve markings at frequent interval ie whether they have been removed, are visible, are damaged or need painting (including road and marker posts where applicable).		
Asset condition assessments / renewals	Assess age and condition of critical valves. Update database with asset information. Feed into long-term renewals programme. O&M contract for immediate works. O&M contract should allow for immediate repair / replacement and programming.	In progress	MK
Specifications for new valves	Engineering standards should state reputable, proven valve types and markings.		
Testing	Testing for PRV's, PSVs at routine interval. Serviceability testing of critical hydrants is undertaken at a minimum annually. Recording of information in asset database using the ArcGIS Collector application. Local Government Regulation 2005 – REG 142 does not specify minimum flow or testing requirement for hydrants. The Legislation requires "(b) must maintain the hydrants in effective working order" therefor testing is performed based on serviceability and maintaining in working order.		
Isolation	Review ability to isolate critical valves if replacement is needed. Consider isolation valves or redundancy / bypass.		

Critical assets identified in Critical Asset Report has been identified in asset management system/GIS and will become the focus for future asset condition assessment programs.

4.5 Asset Condition

4.5.1 Condition Reporting and Assessment

Condition assessment and reporting is undertaken by Shoalhaven Water using the following codes and documents

- IPWEA Condition Assessment & Asset Performance Guidelines - Practice Note 7 Water Supply & Sewerage
- WSAA Condition Assessment Guidelines for Civil Structures 2017
- WSAA Tank Inspection Reporting Code 2017
- WSAA Conduit Inspection Reporting Code of Australia WSA 05-2006 Second Addition V 2.1
- WSAA Condition Assessment Guidelines for Mechanical and Electrical Assets

4.5.2 Regulatory Reporting of Asset Condition

Council is required to include the condition of its water assets as part of Special Schedule 7 in its annual financial statements. The asset condition for each asset category (water supply is one asset category) is defined using a "key" as per the NSW Local Government Asset Accounting Manual. This "key" is as follows:

The water supply information in the 2022 Special Schedule 7 is as follows:

Table 4-22 Asset Condition Reported in Annual Financial Statements (SCC Annual Financial Statements 30 June 2018)

Level	Condition	Description	GRC	Percent
1	Very Good	No work required (normal maintenance)	$42,897,828	5%
2	Good	Only minor maintenance work required	$223,068,704	26%
3	Satisfactory	Maintenance work required	$489,035,236	57%
4	Poor	Renewal required	$94,375,221	11%
5	Very Poor	Urgent renewal/upgrading required	$8,579,566	1%
		Total	$857,956,555	100%

*Assets in Condition as a % of Gross Replacement Cost.

This information only provides an overall "snapshot" of the water supply asset condition.

As part of the 2022 revaluation Shoalhaven Water undertook a project to inspect, condition assess and componentise all above ground headworks assets. The results of this project are noted below.

Table 4-23 Results Inspection Condition of Assets Componentisation

Condition Rating	Pump Station Components	%	Treatment Plant Components	%	Reservoirs	%	Dams	%	Mains	%	Overall %
1	2	1%	7	2%	2	1%	0	0%	1078	3%	3%
2	53	24%	61	18%	32	12%	4	22%	13827	44%	44%
3	108	49%	231	68%	188	70%	9	50%	13069	42%	43%
4	59	27%	39	12%	45	17%	4	22%	2633	8%	9%
5	0	0%	0	0%	3	1%	1	6%	536	2%	2%
Total Components	222		338		270		18		31143		

4.6 Asset Systems

Shoalhaven City Council has completed the the implementation of the TechOne One Council Asset Management System (T1-AMS). Stage 1 consisted of the integration of the finance system, new asset register and works management modules.

The migration to the new system presented an opportunity to establish a new asset register, which is as up-to-date as possible. Shoalhaven Water utilised the GIS database as well as Conquest (the current asset information system), as the master source of asset data. This information was migrated by the project team and reviewed by Shoalhaven Water staff for completeness, accuracy, and functionality. The Asset Data Migration Program addresses several data fixes and improvements required to prepare for the migration to a new system, including fixing known data issues and implementing recommended improvements in GIS. This data was then transferred into the new TechOne system in July and October 2020. From 6th October 2020 the TechOne, One Council program will be the system used for asset transaction and accounting within Shoalhaven Water

Following the migration, a component-level valuation was undertaken on all assets as part of the 2021/22 revaluation project. This project entailed the engagement of an external consultant, internal staff and multiple sources of information to value, componentise and determine the condition of all above ground assets. Further projects included the establishment of the asset hierarchy and data dictionary within the TechOne System. Information from these projects was then used as the basis to drive further componentisation in the AMS and to design the asset data base within the TechOne One Council program.

Development of the new asset system will continue as more data is made available by the Works Management Module and the future implementation of the TechOne Strategic Asset Management Module.

Critical assets identified in Critical Asset Report have been identified in the asset management system/GIS. For more information on the above projects refer to the Improvement Program in this AMP.

4.7 Data Confidence and Completeness

In April 2013 Shoalhaven Water developed an Asset Information Framework that included recommendations for the establishment of data confidence ratings in the Conquest database.

Table 4-23 provides a summary of the asset data confidence by asset group with 4-23 providing an explanation of the asset information rating framework.

Table 4-24 Asset Data Confidence

Water Supply Asset Group	Creation Date	Type & Dimension	Condition Rating	Unit Rates & Base Lives
Water Storage Dams				
Treatment Plants				
Service Reservoirs				
Pipe System				
Pump Stations				
Buildings				

Key: Highly Reliable | Reliable | Uncertain | Very Uncertain | Unknown

Table 4-25 Asset Information Confidence Rating Framework

Confidence Rating		Meaning	Basis of Confidence Rating for Different Data Attributes			
			Asset Creation Date	**Asset Type and Dimensions**	**Asset Condition Rating**	**Standard Unit Rates & Base Lives**
Highly Reliable	1	96-100% certain the correct asset data is captured in Conquest	The asset creation date is based on: As-built plans and construction records.	The asset type and dimensions are based on: Documented asset information collected during planned/unplanned maintenance, site investigation, survey or measurement using accepted industry practice; or As-built plans and construction records.	The condition rating is based on: Documented condition inspection and assessment by qualified personnel consistent with industry best practice not more than 3 years old.	Unit rate and base life data is based on: Independently peer reviewed and benchmarked rates/lives prepared for valuation purposes and not more than 3 years old. Unit rates are correctly escalated to current year rates based on accepted indices.
Reliable	2	76-95% certain the correct asset data is captured in Conquest	The asset creation date is based on: Documented extrapolation from highly reliable contextual data.	The asset type and dimensions are based on: Documented extrapolation from very reliable contextual data.	The condition rating is based on: Actual condition data 3-5 years old; or Documented extrapolation from highly reliable contextual data not more than 3 years old; or Output from an industry-standard deterioration model based on very reliable data sources not more than 5 years old.	Unit rate and base life data is based on: Documented extrapolation of highly reliable rates/lives for comparable asset types and not more than 3 years old. Base life data may be based on industry standard lives confirmed by consensus of experienced personnel with local knowledge. Unit rates are correctly escalated to current year rates based on accepted indices.

Uncertain	3	51-75% certain the correct asset data is captured in Conquest	The asset creation date is based on: "Best guess" based on consensus of experienced personnel but not verified by field investigation or as-built records.	The asset type and dimensions are based on: "Best guess" based on consensus of experienced personnel but not verified by field investigation or as-built records.	The condition rating is based on: Actual condition data 5-10 years old; or "Best guess" based on consensus of experienced personnel but not verified by field investigation or other analysis techniques; or	Unit rate and base life data is based on: Documented local contract rates/standard base lives, not independently peer reviewed or benchmarked. Unit rates are between 5-10 years old and are correctly escalated to current year rates based on accepted indices.
Very Uncertain	4	0-50% certain the correct asset data is captured in Conquest	The asset creation date is based on: Unconfirmed verbal reports.	The asset type and dimensions are based on: Unconfirmed verbal reports.	The condition rating is based on: Actual condition data more than 10 years old; Unconfirmed verbal reports;	Unit rate and base life data is based on: Industry standard unit rates/base lives, not independently peer reviewed or benchmarked. Unit rates are more than 10 years old and are no escalated to current year rates based on accepted indices.
Unknown	5	The source of data in Conquest has not been verified or default values have been entered.	The asset creation date has not been verified or a default date has been entered.	The asset type and/or dimensions have not been verified or default values have been entered.	The asset condition rating has not been verified or a default rating has been entered (this includes where the Condition Rating is based solely on the consumed useful life of the asset).	The unit rate and/or base life data has not been verified.

Table 4-26 Overall Data Completeness

Asset Type	0-50%	50%	60%	70%	80%	90%	100%
Water Storage Dams						✓	
Treatment Plants						✓	
Service Reservoirs						✓	
Pipe System				✓			
Pump Stations					✓		
Buildings						✓	

5 Levels of Service

5.1 Introduction

One of the basic cornerstones of sound asset management is:

"To provide Levels of Service in the most cost effective manner, through the management of assets that the present and future community expect and are prepared to pay for".

Asset management planning enables balance to be determined between the cost of the service and the level of the service delivered (ie the price/quality relationship).

Well defined levels of service (LOS) can be used to:

- Inform customers of the current level of service provided and any proposed changes to level of service and the associated costs
- Measure performance against these defined levels of service
- Develop AM strategies to deliver the required level of service
- Identify the costs and benefits of the services, and
- Enable customers to assess suitability, affordability and equity of the services offered.

5.2 Drivers for Levels of Service

There are three main drivers of LOS:

External Environment – legislative and other external requirements that impose minimum standards

Internal Environment – strategic goals and objectives, availability of resources, financial constraints

Customer Environment – customer expectations of the quality of service, balanced against the price they are willing and able to pay for that service

These drivers influence the decisions that Shoalhaven Water makes regarding the range, quality and quantity of services provided.

5.3 Engaging the Community in Developing Levels of Service

Shoalhaven Water has reviewed its LOS documentation d a new Customer Service Plan (CSP) and an updated Strategic Business Plan. The CSP is modelled on the requirements of the NSW Office of Water's Water & Sewer Strategic Business Guidelines. Council has adopted both the CSP and the Strategic Business Plans in 2024/25.

The Community Strategic Plan sits at the top of the Council planning hierarchy and identifies the community's main priorities for the future and the ways to achieve these goals. Council has adopted a

Community Engagement Policy which is a planned process whereby Council will work with the whole of the community to address issues affecting their well-being.

Shoalhaven Water conducts Stakeholder Engagement and Project Delivery Plans for major capital works and seeks comment, feedback and opinion on a continual basis via website, telephone or mail.

As a proactive measure to engage the community, Shoalhaven Water attends sponsors and takes an active role in a range of Community Events where the services and capital works projects are publicly displayed.

5.4 Critical Customers

Shoalhaven Water has identified and prioritised a range of critical water customers:

- Dialysis patients
- High consumption customers (eg Nowra Correctional Centre, Shoalhaven Zoo, Manildra)
- Critical water customers, which identifies schools, tertiary education institutes, nursing homes, hospitals, medical centres, and emergency facilities and other high consumption

These customers are shown on Council's GIS system and are viewable on mobile applications to assist in the identification and management of these customers.

A list of key communications and actions which are required in response to incidents, emergencies, and disasters is provided in Appendix A of Shoalhaven Water's Emergency Management Plan July 2012. The second item on this list is to notify critical users. The ERP also directs specific communications in relation to certain customers or stakeholders for some events (eg notifying residents within vicinity of a sewer overflow of the public health hazard, or notifying NSW Fisheries if an overflow results in a fish kill).

Shoalhaven Waters Customer Service Plan also addresses the management and operations in relation to critical customers.

5.5 Water Supply Levels of Service

Shoalhaven Water has developed LOS statements for the wastewater assets with the CSP. The review was conducted in accordance with SMART (Specific, Measurable, Achievable, Relevant and Time bound) principal to ensure they are achievable, useful and relevant.

Shoalhaven Water has several historical performance measures and targets relating to managing the wastewater assets. Performance measures and targets are used for:

- development of the resourcing strategy
- identifying capital works requirements
- reporting progress to Council and the community
- state and national performance reporting

The existing performance measures are as follows:

Table 5-1 Performance Measures and Targets

A full list of performance measures and targets is available in Shoalhaven Waters Customer Service Plan (D18/152811)

Performance Measure		2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
Operating Cost – Water ($/property) (medium Average for >10,0000)	Statewide Median	252	245	233	256	334	257	310	297	268
	Shoalhaven	142	146	137	163	218	195	218	235	188
Percent of Population with E. coli Compliance	Statewide Median	100	100	100	100	100	100	100	100	100
	Shoalhaven	100	100	100	100	100	100	100	100	100
Percent of Population with Chemical Compliance	Statewide Median	100	100	100	100	100	100	100	0	100
	Shoalhaven	100	100	100	100	100	100	100	100	100
Real Losses (Leakage) (Litres/day/connection)	Statewide Median	80	60	70	56	57	71	58	64	61
	Shoalhaven	60	90	70	107	64	71	74	52	90
Main Breaks per 100 Km - Water Service	Statewide Median	11	9	9	11	9	10	12	10	11
	Shoalhaven	10	8	8	6	6	6	11	6	6

**Source – NSW Government – Department of Planning and Environment - Water – accessed 07 February 2024 https://water.dpie.nsw.gov.au/local-water-utilities/local-water-utility-performance*

Table 5-2 Customer Service Standards

Standards	Description	Target	Priority*	Comments	Benchmark
Minimum drinking water pressure to boundary.	Provide between 15 metres and 90 metres head of water in the reticulation system.	95% of all residential properties during summer whilst conveying a minimum of 9 litres per minute.	2	Section 2 Our Water Services.	Industry standard
Extent of unplanned drinking water interruptions (water interruptions frequency)	An unplanned water supply interruption occurs when a property is without a service due to any cause. This excludes the following: • Property service connection interruptions (unless the burst or leak requires the main to be shut down for repairs which affect multiple customers) • Interruptions that cause some reduction to the service but where normal activities are still possible • Planned interruptions except where the customer has not received notification.	< the median average.	1	Section 2 our Water Services and Section 5 Your rights and responsibilities.	National Performance Benchmarking Report (C15 – Average Duration of unplanned interruptions water in minutes) (C10 – Water Service complaints # per 1000 properties) (A8 – Water main breaks # per 100 km of water main)
Time for restoration of water service – unplanned interruptions.	Restoration occurs where all interrupted connections are restored to normal service.	< the median average.	1	Section 2 Our Water Services and Section 5 Your rights and responsibilities.	National Performance Benchmarking Report (A8 - Water main breaks # per 100 km of water main) (C15 – Average Duration of unplanned interruptions water in minutes)
Drinking water quality and/or complaints.**	Supply drinking water in the reticulated system which meet the Australian Drinking Water Guidelines and minimise the number of water quality complaints resulting from Operational practices.	• 100% of the service population for which microbiological compliance is achieved. • < the median average for water quality complaints.	2	Section 2 Our Water Services and Section 4 Our rights and responsibilities.	National Performance Benchmarking Report (H1 – Water quality guidelines) (H3 - % of population where microbiological compliance was achieved. H7 – Public disclosure of drinking water performance) National Performance Benchmarking Report (C9 – Water quality complaints per 1,000 properties)

* See Response time to system failure table under.
** Exception – Raw Water Supply customers.

5.5.1 Actions to Close the Gaps.

It is noted that the current performance is within the target level and hence no actions are required to close the gaps.

5.5.2 Service Standards.

In addition to the performance measures and targets, Shoalhaven Water has the following service standards. These have been considered as part of the CSP preparation, and where possible incorporated into the development of SMART LOS statements.

Table 5-3 Service Standards

Service area	Standard
Water Pressure to boundary of property	Provide between 15 metres and 90 metres head of water in the reticulation system to 95% of all residential connections under normal operating conditions during summer whilst conveying a minimum of 9 litres per minute
Consumption Restrictions	The water supply system has been designed so that restrictions on supply should not be necessary more than once every 10 years on average and should not last, in total, for more than 5% of the time. The system should be able to supply 80% of the unrestricted demand through a repeat of the worst recorded drought starting at the time restrictions are first applied. (The 5:10:20 rule) Restrictions are only applied when severe water shortages are evident. There are four categories of restrictions, each with an increasing impact on consumption, in accordance with the current Drought Management Plan Restrictions will be widely advertised to ensure total awareness by all customers
Potable Water Supply	Water supplied in the reticulated system should meet the Australian Drinking Water Guidelines, as published by the National Health and Medical Research Council
Exceptions	Burrier and Porters Creek untreated systems
Interruptions to Supply	Planned Individual domestic and commercial customers will receive 24 hours' notice and industrial customers, 7 days or by agreement. For large areas, radio and newspaper notice will be given. If interruption will be less than four hours, notice will only be given to those customers who are put at extreme inconvenience. Dialysis patients All patients reliant on a dialysis machine will be advised of planned or unplanned interruptions to supply.
Water for fire-fighting	Water will be available from reticulated hydrants in urban areas for fire-fighting

5.6 Performance Monitoring and Reporting

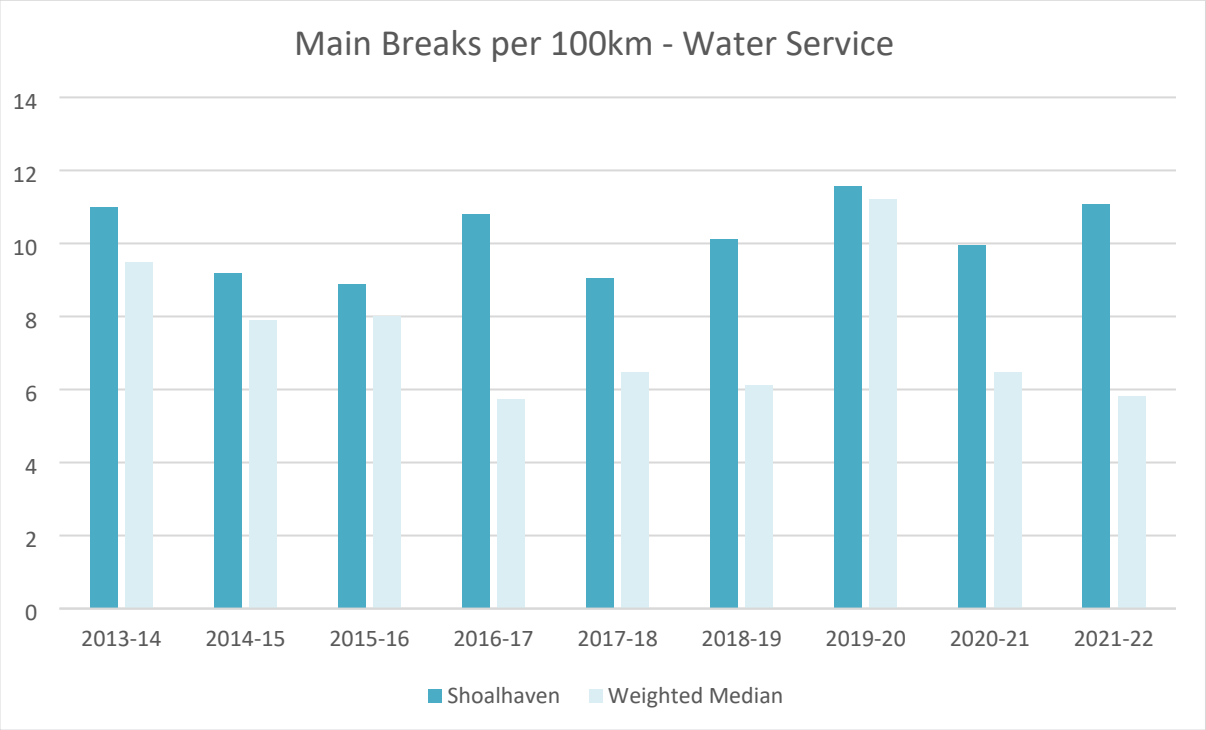
Actual performance is reported to the DPI Water, NSW Department of Health and EPA for information stipulated as 'reportable items'. Internally, performance is reported in half-yearly reports for non-

reportable and reportable items to drive process improvement and to support process audits and process monitoring.

Operational data relating to performance (eg number of leaks and breaks) is held in a separate system (CRM) and cannot be automatically linked to individual assets identified in Conquest at the current time.

The graph below provides an example of the information from the CRM system on water main bursts and leaks notified by customers. This information can be drilled down to suburb or street level only.

Figure 5-1 Customer Request Quantities for Mains Breaks and Leaks 2013 to 2022



*Source – NSW Government – Department of Planning and Environment - Water – accessed 07 February 2024 https://water.dpie.nsw.gov.au/local-water-utilities/local-water-utility-performance

Shoalhaven Water has maintained the number of breaks and leaks per annum below the target of 15 per 100 km of water supply pipe.

This performance data is used to support or confirm submissions from field staff for various renewal or replacements of assets in the short/immediate term. Other data for input into the longer term renewal/replacement program is based on the age and type of the pipes.

6 Growth and Demand

6.1 Introduction

Planning for future growth and demand is imperative to provide economically sustained services to meet the future needs of the region and its visitors.

This section describes the key growth and demand trends in the Shoalhaven Region, the demand forecast for water services, and the strategies that Shoalhaven Water will adopt to manage growth and demand related to this business unit.

6.1.1 Growth and Demand Definitions

Growth and demand planning allows for the identification and quantification of areas within the region that are likely to experience significant pressures. Although growth and demand are considered together in this section, it is worth noting that they do have different implications regarding the on-going function/delivery of the Shoalhaven Water services.

Growth in relation to the water activity mainly refers to the growth/changes in population or areas that are growing due to new residential developments. These changes increase the demand for water and essentially lead to an increase in the volume of water that needs to be collected, treated and distributed. Growth can also relate to increases in commercial/industrial activities, particularly if they are reliant on water.

Demand for water supply can be influenced by growth, climate change, type of developments (eg commercial development will generally have greater requirements) and customer expectations and trends (eg wasteful water usage versus environmental awareness, seasonal demand and household technologies).

6.1.2 Key Demand Drivers for Shoalhaven Water

A number of factors affect the demand for sewerage services including:

- Population and demographic patterns
- Residential growth and development
- Commercial/industrial growth and development
- Climate change
- Technological changes
- Changing regulations, government policy or priorities
- Seasonal factors

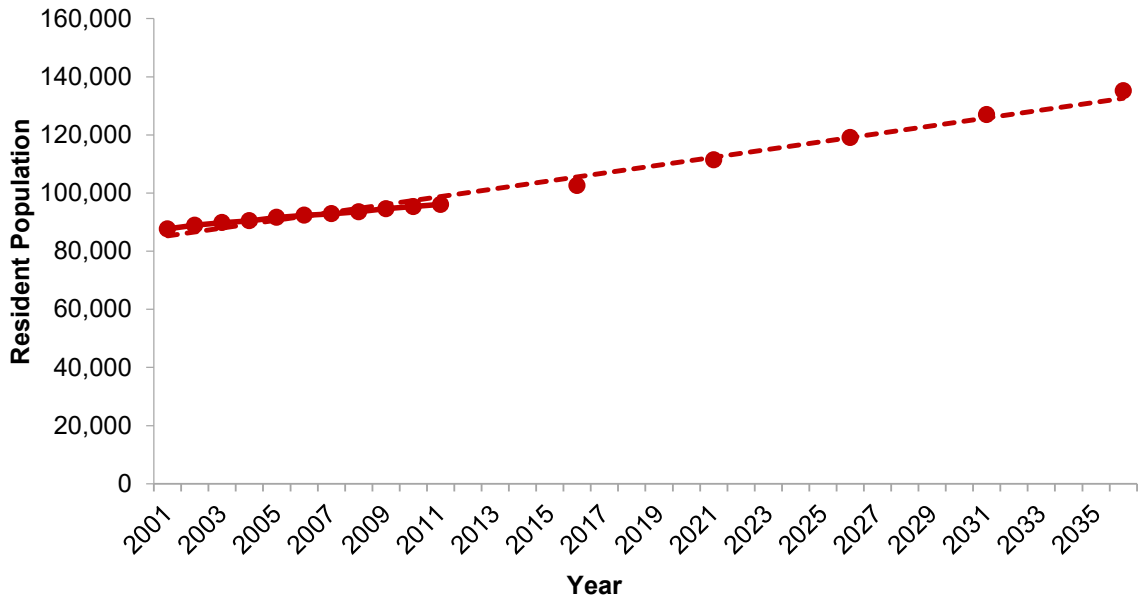
6.1.3 Growth and Demand Trends and Forecasts

The growth and demand trends and forecasts are described in this section.

6.1.4 Population Growth

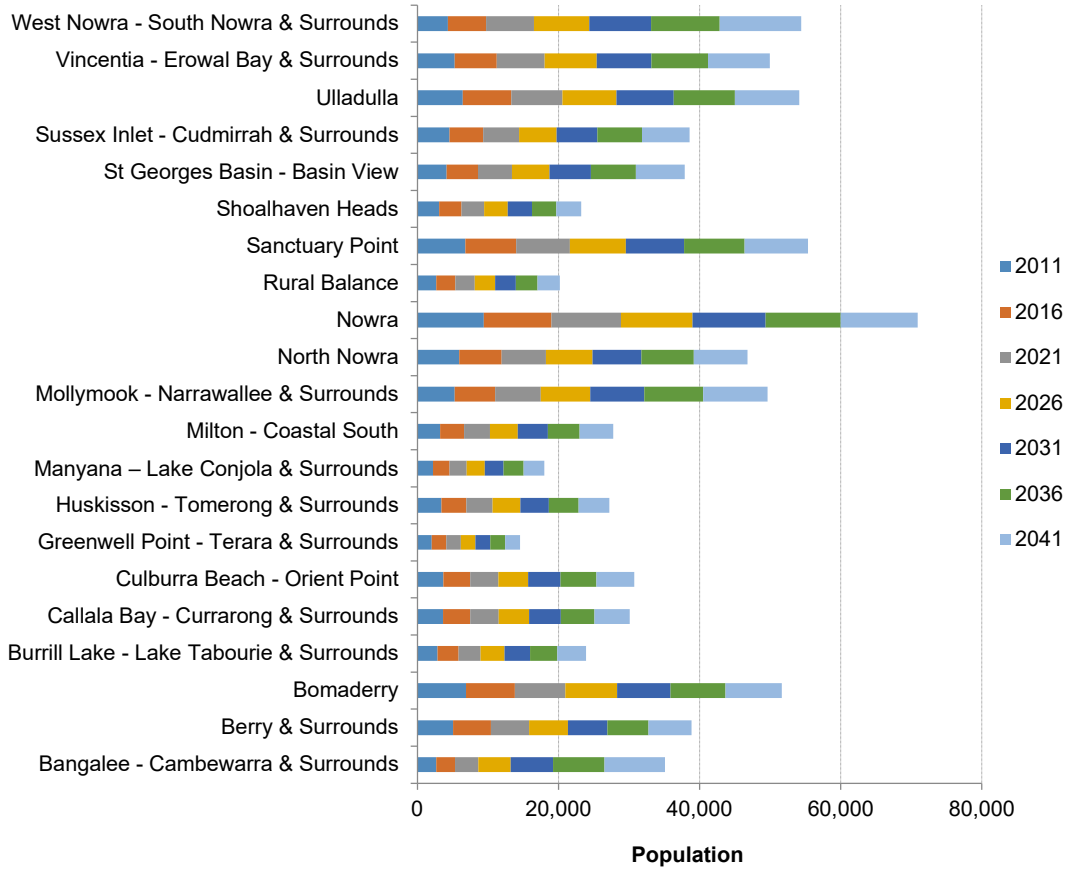
The Shoalhaven population forecast for 2022 is 107,857 and is predicted to grow to 137,673 by 2051(.Id).This information is used to develop the Growth Management Strategy for the Council. The extent of natural growth (the difference between birth and deaths) and the net migration are the two main factors that affect population. For Shoalhaven, rate of natural growth is considerably small compared to the rate of net immigration. Figure 6.2 below indicates the population growth distribution within the Shoalhaven City Council area.

Figure 6-1 Resident Population Growth of the Shoalhaven – Historical and Future Projection.



Source: Growth Management Strategy Version 1, adopted 14th December 2012

Figure 6-2 Population Distribution by Area



Source: Water & Wastewater Servicing Strategy Part A (June 2013)

Key demographic features of Shoalhaven City are summarised below.

- Population Distribution by Area: Within Shoalhaven, Nowra/Bomaderry area has the highest population. However, most of the growth within last 20 years has been within the South Nowra/Worrigee area.

- Population Distribution by Age: Shoalhaven has a higher average age compared to other cities in NSW. The number of people aged over 65 is expected to increase by 43.9% and represent 24.6% of the population by 2021. The number of people aged under 15 is forecasted to increase by 10.3% representing 17.6% of the population by 2021.
- Household Structure: In 2006 the dominant household type in Shoalhaven was couples without dependants, which accounted for 35.5% of all households. This is forecasted to be increased, comprising 39.8% of all households by 2021.

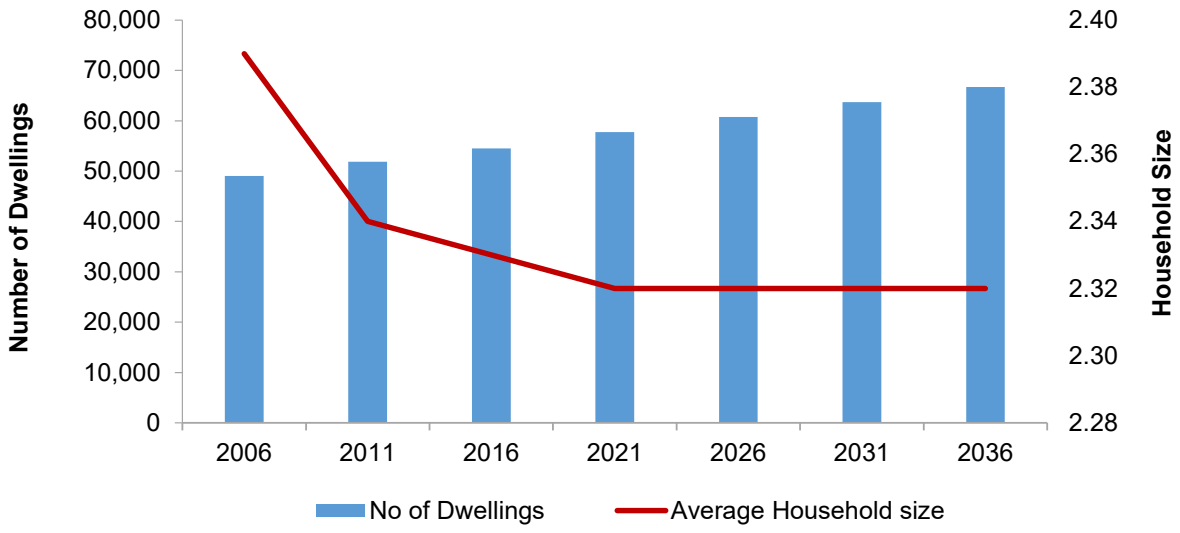
- Tourist Population: During the peak summer holiday period, total population of Shoalhaven grows up to three to five times of the residential population, increasing the demand for services and facilities.

6.1.5 Residential Growth

The forecast for number of dwellings in Shoalhaven up to 2036 is shown in figure 6-3 below. The factors that contribute to the residential growth are:

- Population growth
- Decrease in household size (as shown in 6-3)
- Relative housing affordability which encourages migration from the Sydney great metropolitan and Canberra areas
- A large proportion of older residents requiring accommodation that is adaptable to their particular needs
- A demand for temporary accommodation from tourists

Figure 6-3 Number of Dwellings and Household Size



Source: Growth Management Strategy Version 1, adopted 14th December 2012

About 88% of the dwellings in Shoalhaven are single houses. The number of people living in caravans as permanent accommodation is higher than the state average.

Shoalhaven has a high rate of 'not permanently occupied' dwellings due to high tourist population. It is expected that, as the population ages and retirees start to move from Sydney and Canberra into their holiday homes, the vacancy rate will reduce. The figure below illustrates the expected change in dwelling occupancy rate.

Figure 6-4 Change in Dwelling Occupancy Rate

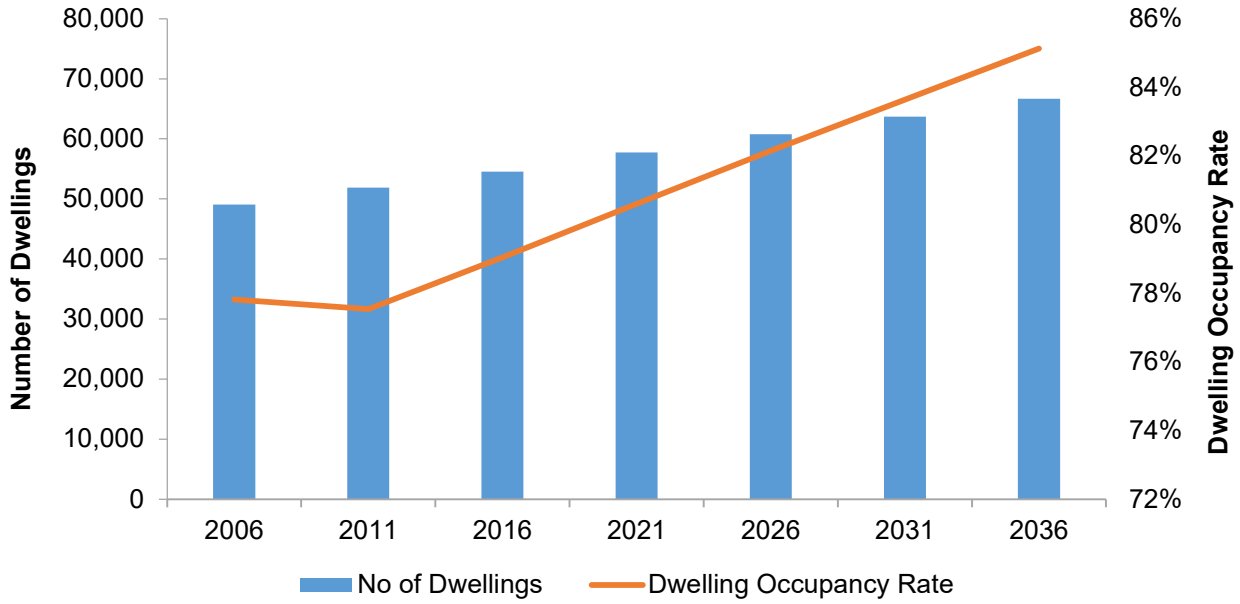
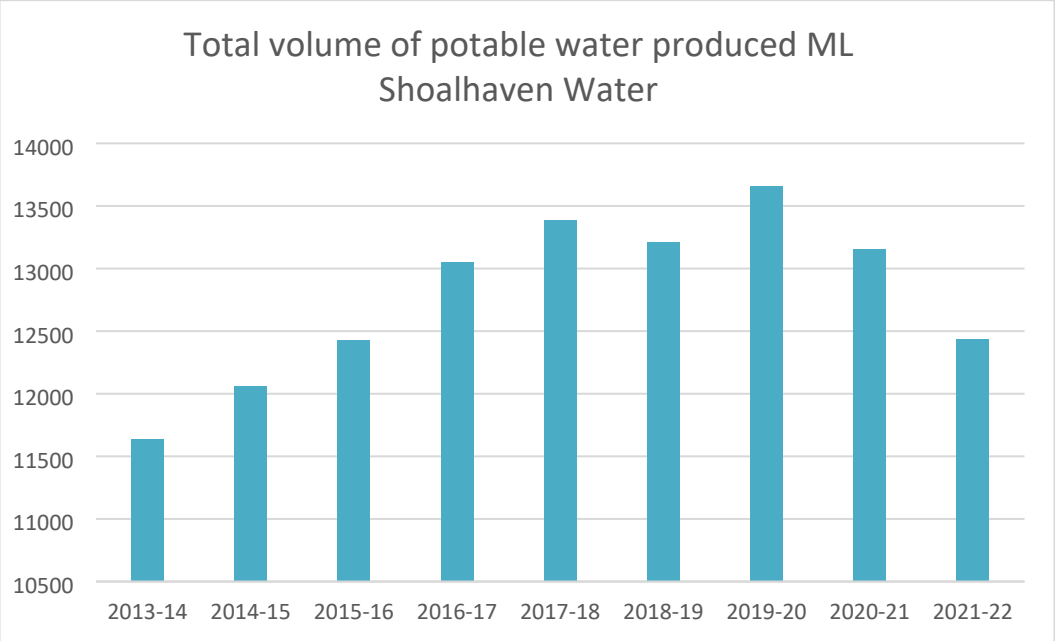


Figure 6-5 Treated Water Volume



**Source – NSW Government – Department of Planning and Environment - Water – accessed 07 February 2024*
https://water.dpie.nsw.gov.au/local-water-utilities/local-water-utility-performance

A Demand Management Plan developed in conjunction with extensive consultation, resulted in a significant decrease in water supply demand until 2011/12. Since that time demand has increased because of drought and increasing population.

Note that the 'number of assessments' refers to the number of properties that have an entitlement to water supply and are assessed under the Local Government Act.

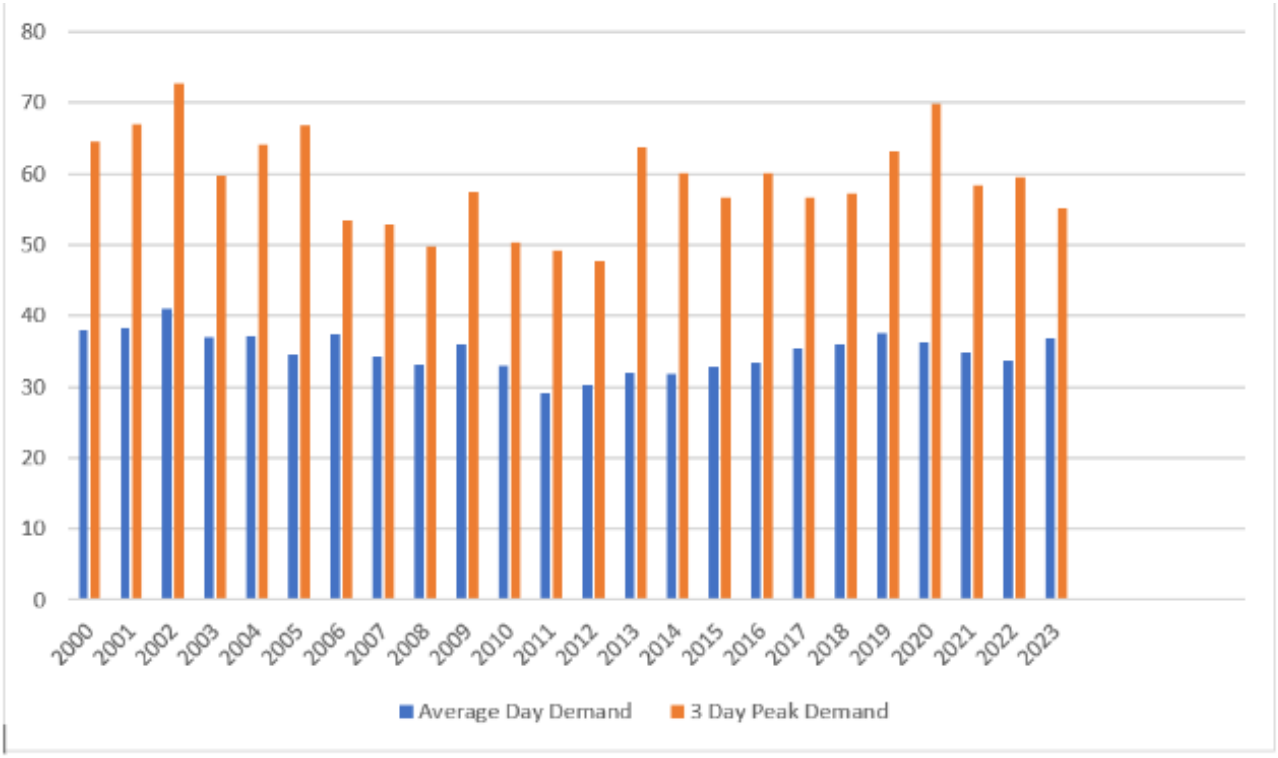
6.2 Growth and Demand Impacts and Strategic Response

Shoalhaven Water has developed Water and Wastewater Servicing Strategies (June 2013) however because of the release of the Final 2016 Developer Charges Guidelines for Water Supply, Sewerage and Stormwater a review of the Strategies and Development Servicing Plans is being undertaken. The review will be used to understand the demand for water and wastewater services over the period from 2016 – 2046 and to identify the capital works requirements to accommodate this. The Part A of this strategy estimates the water demand over the period of 2016 – 2046 by analysing the historical demand and demand affecting factors.

Figure 6.6 below indicates the annual demand (average day and peak day) from 2000 – 2011. This indicates a minor average demand reduction in the past 12 years even though the population has increased. This may result from combination of climate change, water efficiency programs such as BASICs & WELS, cost of water increases including a change to usage based billing and previous water restrictions within the area.

Figure 6.7 indicates the predicted water demand up to 2041. This is based on the historical trends including climate changes and water efficiency impacts; and provides allowance for contingency.

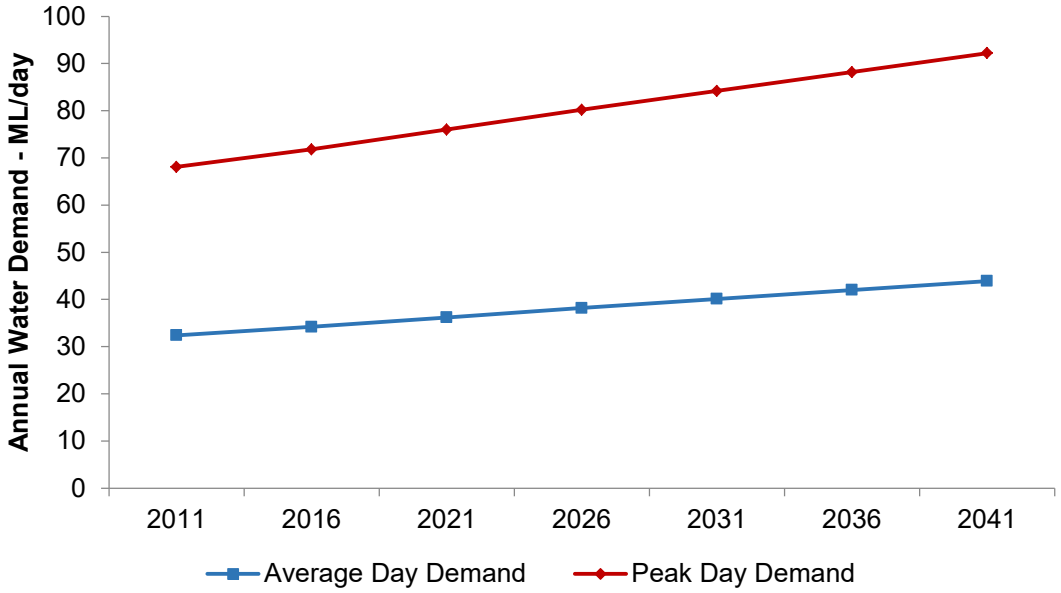
Figure 6-6 Annual Water Demand – Historical



Source: Water and Wastewater Servicing Strategy Part A (June 2013) – Updated demand figures & demand per capita.

Note – Serviced population data has decreased since 2013 due to more accurate data collection methodology.

Figure 6-7 Predicted Annual Water Demand 2011-2041



Source: Water and Wastewater Servicing Strategy Part A (June 2013)

6.2.1 Asset Solutions

Growth in population and other demand trends can result in capital works being required to increase capacity of the network and expand the network footprint in certain areas. The Shoalhaven Water strategic response to these trends is explained below.

The Water and Wastewater Servicing Strategy has assessed the capacity and performance of existing infrastructure. It concludes that the existing water supply network has sufficient capacity to meet the Peak Day Demand within the planning horizon. However, some capital works are required to meet the demand of specific new developments and new service areas as summarised in the table below.

Table 6-1 Capital Work Requirements 2016-2046

Name	Supply Zone	Year	Type	Quantity
Moss Vale Road North	Cambewarra	2021-24	Trunk Main Res Pump Station	6.8km
Cabbage Tree Lane Urban Release Area	Bamarang	2030	Trunk Main	1.2km
Shaolin Temple and Academy	Vincentia	unknown	Trunk Main	3.4km
Bayswood Estate & Village Centre	Jervis Bay Rd. PRV	Completed		
Worrigee Urban Release Area	Bamarang	2025		
Culburra Beach Future Residential	Coonemia Large	2022	Trunk Main	

South Nowra Future Residential	South Nowra (Hi.)	2024		
Mundamia Urban Release Area	Bamarang	2025	Trunk Main	0.05km
Moss Vale Road South	Cambewarra	2021/22		
North Nowra Future Residential	Pitt St. (high)	2025		
Ulladulla Future Residential	Narrawallee	2020		
Mollymook Beach Future Residential	Narrawallee	2020		
Badgee Lagoon	Sussex Inlet	2019/20	Trunk Main	0.95km
Claydon Park Development	Milton	2022		
Basin View Future Residential	Basin View	2021		
Manyana Future Residential	Berringer	2021		

Source: Water and Wastewater Servicing Strategy Part A (June 2013). Year - updated based on recent data SEP 2016

The following key growth projects have been identified by Shoalhaven Water:

Table 6-2 Identified Growth Projects

Name	Year	Budget
Bamarang WTP Clarifier Upgrade	2024	$2M
Berry Distribution Augmentation	2016	$200k
Milton WTP Augmentation	2019 - 2020	$2.1M
Mundamia Feeder Main	2021	$50k
Cabbage Tree Lane Trunk Main	2021	$170k
North/South Transfer System Improvements	2021	$100k
North Nowra Moss Vale Rd Trunk Main	2022	$1.3M
Sussex Badgee Lagoon Trunk Main	2028	$340k
Vincentia Shaolin Temple Trunk Main	NYK	$480k
Various Minor Development Works	2015 to 2036	$50k per annum
Various Water Supply DSP	2021	$100k/5 yearly
Various Water Supply Strategy	2015 to 2036	$500k

Source: 2015 – 2016 Capital Expenditure Budgets – Water & Wastewater

(The full list of capital projects is available in an appendix to this report)

Shoalhaven Water's current key growth projects include:

- Growth areas within the Shoalhaven region have now switched to the Moss Vale Rd URA, West Nowra and Ulladulla with a number of key projects in the planning and delivery phase. Moss Vale Rd will require trunk mains, a pump station and reservoir, to support the development and these projects are currently in the construction phase with works expected to be completed 2024/25. Development of the Mundamia and Cabbage Tree Lane area will require minor extension to the existing trunk network. The Mundamia project ready for construction subject to

the developer moving forward with the project. Cabbage Tree Lane is yet to commence with no movement from the developers.

- Growth works in Milton Ulladulla area consist of the pump station and transfer system upgrades. These projects were highlighted in the Shoalhaven Water – Water Servicing Strategy (Feb 2013). The strategy provided augmentation options to support current and future growth based on the predicted growth within the catchment.

The full list of capital projects is available in Shoalhaven Water's Portfolio Management System.

6.2.2 Non-Asset Solutions

Non-asset solutions provide an alternative to the creation of new or improved assets in order to meet demand changes. They address ways of modifying customer needs in order that the utilisation of existing assets is maximised and the need for new assets is deferred or reduced.

The non-asset solutions planned by Shoalhaven Water over the next period are:

- Shoalhaven Water's funds and supports an education program "Tapstar" which visits schools and agricultural shows promoting water wise programs and water efficiency and explains the water cycle processes. Educational packs are also available to a teacher which promotes water conservation and education of water cycles. This is an ongoing program.

- Shoalhaven Water's website also details water saving initiatives, water wise gardening and grey water reuse information. A rebate program also exists for rainwater tanks and a re-washer service for eligible households. Ongoing program.

- Shoalhaven Water has a Water Supply Demand Management Strategy to assist in the establishment and implementation of effective water demand management procedures. The Demand Management Strategy is classified as Demand Reduction Strategies and Supply Rationalisation Strategies. Demand Reduction uses pricing policy, education, water efficient appliance promotion, water tank installation and water restrictions to implement effective water demand management. Supply Rationalisation uses water loss reduction, leak detection/repair, pressure reduction, system metering and effluent/greywater reuse. The Demand Management Plan is dated July 2008.

- The aim of the Drought Management Plan (DMP, 2014) is to ensure the water utility business of Shoalhaven Water in the Shoalhaven region, has an appropriate mechanism in place to allow it to carry out its responsibility to soundly manage Shoalhaven Water use during droughts. A DMP details the demand and supply issues to be addressed during drought to ensure that town water supplies with a significant storage, such as the Shoalhaven, minimise the risk of failure in times of drought. The purpose of the DMP is to:
  - Identify what Shoalhaven Water does before, during and after a drought;
  - Describe the staged approach Shoalhaven Water takes to drought management; and
  - Provide a clear, publicly available statement of Shoalhaven Water's role and responsibilities during a drought.

- Other non-asset solutions include the pricing strategy which is structured in such a way to encourage water conservation for domestic and commercial customers.

6.2.3 Assumptions

Population and residential growth in Shoalhaven area will happen as per the predictions developed by Forecast id.

7 Operations and Maintenance Plan and Environmental Stewardship

7.1 Introduction

Operations and Maintenance Plans aim to maintain the current levels of service (achieve the performance targets), mitigate risk and minimise cost by implementing a balanced programme of planned and reactive works.

The operations of Shoalhaven Water facilities are undertaken in accordance with:

- Operating Environment Management Plans (OEMPs),
- Operations manuals that are produced during asset commission or upgrading and/or
- Operations manuals that have been prepared for each Water Treatment Plant.
- Shoalhaven Water Emergency Response Plan

The key acts and regulations that set out the statutory requirements relating to environmental stewardship are summarised in Section 3 of this plan.

Specific operations and maintenance practices for individual asset groups are set out within the Management Strategies in Section 4.4 of this plan. Monthly reports are prepared by each operational area.

7.2 Operational Environment Management Plans (OEMPs)

OEMPs are in place for:

- Northern OEMP
- Kangaroo Valley OEMP
- Southern OEMP

The aim of the OEMPs is to provide a practical management tool for the personnel responsible for the operation of the water supply schemes. Specifically, the objectives of the OEMPs are to:

- Meet the requirements identified in the Review of Environmental Factors for the Water Trunk Main Maintenance Reports.
- Identify potential environmental risks due to the operation of the water supply schemes.
- Ensure the effective management of the water supply schemes to prevent or mitigate potential environmental impacts associated with their operation in accordance with best practice management; and
- Assign responsibility, monitoring requirements and define reporting requirements.

The OEMP provides environmental protection objectives for Shoalhaven Water in regard to the management of the water supply schemes to achieve ecologically sustainable development. The OEMP sets out the actions required to avoid or minimise identified environmental risks and to fulfil all conditions set by development approvals.

7.3 Emergency Response Plan

The Emergency Response Plan (ERP) for the water supply system for the Shoalhaven was prepared by the Department of Commerce and includes the following documents:

- Drought Management Action Plan
- Giardia and Cryptosporidium in Water Supplies
- Contingency Plan for Blue – Green Algae
- Dam Emergency Response Plan

The ERP provides Shoalhaven Water staff with instructions for responding to a potable water related emergency and provides a register of contact details and responsibilities. The ERP coordinates the requirements of existing policies and procedures, including the Local Disaster Plan (DISPLAN) and its Support Plan.

8 Disposal Plan

Disposal of an asset includes any activity associated with the disposal of a decommissioned asset including sale, demolition or relocation. Shoalhaven Water has a number of decommissioned water supply assets that will require further examination for future disposal or ongoing maintenance options. The main projects currently in progress are the Cambewarra Dam decommissioning and the Illaroo Pump Station and The both sites are expected to be decommissioned in 2024/25 with Illaroo Rd replace with the a new pump station and Cambewarra Dam handed back to Shoalhaven City Council at the conclusion of the project.

Previous projects included the completion of the Strongs Rd project in 2014 has resulted in the decommissioning of the raw water mains, reservoirs and break tanks that served the residence of Strongs Rd. These assets have been replaced with new reticulation mains, reservoirs and pump station to provide chlorinated water to the residence.

9 Risk Assessment and Management

9.1 Overview

This section covers the risk management implemented by Shoalhaven Water and how it applies to current and future water supply activities.

Risk management is a process used to identify the specific business risks, together with any possible risks associated with the ownership and management of the water supply assets. This can be used to determine the direct and indirect costs associated with these risks and form a priority-based action plan to address them.

The outcome of this evaluation is to be used to:

- Emphasize the importance of continuing to provide Council's water supply services and manage inherent risks.
- Continually identify improvements required to Council water supply services to avoid risk events or minimise their impact or to realise identified opportunities.

A ***Risk*** is defined in AS/NZS ISO 31000:2009 – Risk management – Principles and guidelines, as:

"Effect of Uncertainty on Objectives"

Effect: Deviation from the expected – positive or negative.

Objectives: Can have different aspects (see Risk Types) and can apply at different levels (see Risk Hierarchy Levels).

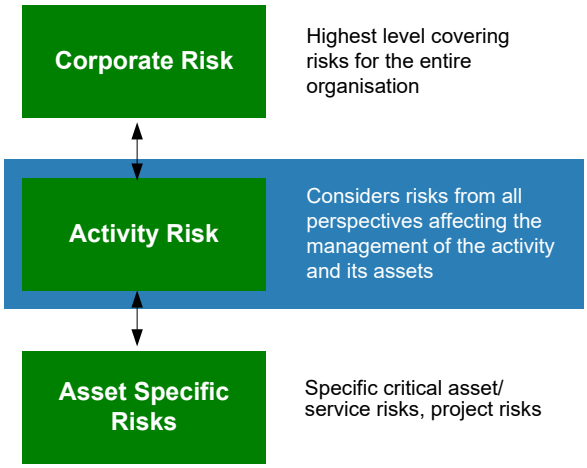
Risks: Often characterized by reference to potential events and consequences and is often expressed in terms of a combination of the consequences of an event and the associated likelihood.

Uncertainty: The state, even partial, of deficiency of information related to, understanding or knowledge of an event, its consequence, or likelihood.

9.1.1 Level of Risk

The purpose of this risk plan is to identify the risks associated with the water supply activity and assets. This requires approaching the risks from many perspectives including financial, operational, reputational, public health and safety. These risks are pertinent to both a higher, corporate level, and to a more detailed asset –specific level, but do not substitute for more specific risk analysis at those levels (see Figure 9-1). The next step beyond this risk analysis is to develop more detailed risk plans where the criticality of specific assets is assessed and an action plan developed as appropriate.

Figure 9-1 Risk Hierarchy Levels



9.2 Current Situation

A risk register is currently maintained at a Shoalhaven City Council level, site level and at an individual project level. Shoalhaven Water has identified that there is a need to develop a risk register at an activity level specific to the water supply activity and this is a key task identified in the Improvement Plan.

9.2.1 Risk Types

Risks events will derive from, or impact in one or more of the following ways. These risk types are considered when populating the risk register.

Table 9-1 Risk Types Considered for the Risk Register

Operational	Risks that affect the efficient operation of the service or facility and its' ability to function effectively.
Financial / Economic	Risks related to the financial management of Shoalhaven Water and its' ability to fund Council services now, and into the future Risks resulting from the external economic environment.
Health and Safety	A risk event with adverse impacts on the health and safety of the community and Council staff.
Reputation / Image	Risks that affect the way Council and staff are perceived: By the community By staff Nationwide and internationally By stakeholders By the media
Legislative	A risk event that results in Shoalhaven Water either unknowingly or knowingly breaching statutes and regulations, or being exposed to liability

9.2.2 Risk Assessment Methodology

The overall risk exposure an asset represents to Shoalhaven Water is a combination of Condition (likelihood of failure) and Criticality (consequences of failure). The procedure for identifying and assessing risks is summarised below.

9.2.3 Identify Possible Activity Risks

All possible risks affecting the asset activity need to be identified. Once identified, risks are entered into the risk register (see Table 9-5). The register is used to record and summarise each risk and to outline current mitigation measures and potential future management options.

9.2.4 Determine Likelihood and Consequence for Initial Risk Factor

Table 9-1 and Table 9-2 demonstrate the scales used to determine the likelihood and consequence levels, which are used to evaluate a risk event.

The likelihood of occurrence and severity of consequences should be based on as much real data as possible; for example, local knowledge or recorded events such as maintenance records and weather events.

The likelihood scales identify how likely, or often, a particular event is expected to occur, these are shown in the table below.

Table 9-2 Likelihood Rating Scale

Likelihood	Level	Description
Almost Certain	5	Is expected to occur nearly every year eg 80% chance within the next 12 months
Likely	4	Will probably occur often eg 25% chance within the next 12 months or once in 4 years
Possible	3	Might occur from time to time eg 10% chance within the next 12 months or once in 10 years
Unlikely	2	Could occur only very occasionally eg 4% chance within the next 12 months or once in 25 years
Rare	1	May occur in exceptional circumstances eg 1-2% chance within the next 12 months or once in 50+ years

Table 9-3 Consequence Rating Scale

Consequence	Level	Description
Catastrophic	5	Disaster with extensive loss and long term consequences; Threat to viability of service or operation
Major	4	Critical loss or event requiring replacement of property or infrastructure; Long term impact on organisation
Moderate	3	Significant loss with temporary disruption of services; Medium term impact on organisation
Minor	2	Minor loss with limited downtime; Short term impact; Mostly repairable through normal operations
Very Minor	1	Isolated or minimal loss; short term impact; repairable through normal operations

After the likelihood and consequence factors have been determined, the level of risk is calculated by multiplying the likelihood of occurrence and consequence rating together.

Risk = the likelihood of an event occurring X the consequence of such an event.

The final outcome is a risk rating. The risk rating enables definition between those risks that are significant and those that are of a lesser nature. Having established the comparative risk level applicable to individual risks, it is possible to rank those risks. Four risk categories have been used: Extreme, High, Medium, and Low.

Table 9-4 Risk Factor Assessment Matrix

Likelihood	Consequence				
	Very Minor (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Almost Certain (5)	Medium	Medium	High	Extreme	Extreme
Likely (4)	Medium	Medium	Medium	High	Extreme
Possible (3)	Low	Medium	Medium	High	Extreme
Unlikely (2)	Low	Low	Medium	Medium	High
Rare (1)	Low	Low	Low	Medium	Medium

Table 9-5 Risk Level

Overall Risk Level	Actions
Extreme	Immediate action required to reduce risk
High	Senior management attention to manage risk
Medium	Management responsibility must be specified and risk controls revised
Low	Managed by routine procedures

The initial risk is calculated based on considering the likelihood and consequences as if there are no measures in place to prevent or mitigate the risk occurrence. Essentially, initial risk is an exercise to determine “What is the worst that could happen?” Once the initial risk is determined it is necessary to evaluate the effectiveness of current systems and processes to identify the revised risk and then formulate an action plan to further reduce the likelihood or consequences of identified risks occurring.

9.3 Risk Register and Action Plan

Critical events relating to water supply assets have been identified as part of a preliminary risk assessment and the controls and risk treatment are summarised in the table below.

Table 9-6 Risk Register and Action Plan

Risk / Consequence	Type / Category	Controls	Rating	Responsible Officer
R000268 - Contamination of water supply or sewer system - trade waste discharges, cross connection in to REMs system/pressure sewer mains, illegal connection to water main. **Open** **Consequences - increased damage to the sewerage network lead to increased maintenance and replacement costs; breaches of EPA license; lead to environmental overflow; illegal discharge to sewer**	Operational Environment	C001464 Backflow prevention (Inspections, policies, Australian Standards, installation of devices) C001465 Separate Water & Sewer maintenance crews C001466 Water and Sewer pipes are different types and colour C001467 Management system, including sample testing C000598 trade waste approval policy & system for discharges C000599 Regulate known sources C000600 Implementation of testing equipment C000601 Trade Waste policy C000602 Inspection/ audit program and random monitoring water & sewer system C000603 Enforcement procedure C000604 Education as part of approval process C000605 Increased monitoring via Regulatory team	Residual **Medium** Inherent **High**	Executive Manager - Shoalhaven Water
	Task		Due	Task Responsible
	Nil			
R000278 - Illegal use/ tamper to gain access to water supply system, which could impact other properties ability to access water during critical times e.g. natural disaster. **Open**	Operational People	C001469 Awareness program for the Public regarding regarding bushfire seasons and illegally installed stand pipes C000629 Regular monitoring by rangers and SW staff	Residual **Medium** Inherent **Extreme**	Manager Water Business Services

Consequences - Financial impact and community safety issues during natural event e.g. lack of access to water during bushfires due to illegal connections to water infrastructure		C000898 Regular scheduled meter readings C000900 Asset Management plan		
	Task		Due	Task Responsible
	T00000759 - Public Education Program to remove illegally installed connections to the water infrastructure, which caused issues during the bushfire re water pressure down the line		31/10/25	Manager - Water Asset Planning & Development
R000279 - Fraud and corruption resulting in loss, or damage to reputation **Open** **Consequences - Financial loss and reputational damage**	Operational Financial	C000901 Fraud prevention measure currently being implemented by SCC. E.g Tender process C000889 Separation of duties, meter readers, monitoring of usage over time and invoicing C000890 Code of conduct training by staff C000891 IT back up system in place C000892 Multistep approvals for all high value transactions	Residual **Medium** Inherent **Medium**	Executive Manager - Shoalhaven Water
	No outstanding tasks			
R000280 - Major gas or chemical leakage at Shoalhaven Water sites **Open** **Consequences - potential to injure or kill people; will require evacuation; impact of plant functioning**	Operational People	C000630 Emergency Response Procedures C000631 Regular training C000632 Proactive Maintenance C000633 Sensor alarm networks C000634 Automatic chlorine shut off valves C000635 PPE, SCBA Self Contained Breathing Apparatus	Residual **Medium** Inherent **Extreme**	Manager - Water Operations & Maintenance
	No outstanding tasks			
R000281 - Power Failure causing major water, sewer and communications infrastructure outages **Open** **Consequences - Loss of sewerage services; loss of water supply; leads to environmental impact; health issues**	Operational Property & Infrastructure	C000636 Fleet of generators C000637 24/7 on call, telemetry monitoring C000638 Emergency Response plan C000639 BCP C000640 Training of staff C000874 Emergency generators connection points on all critical facilities C000875 All pump stations have adequate emergency storage. C000876 Additional onsite storage for greater retention capacity on critical sites	Residual **Medium** Inherent **Medium**	Manager - Water Operations & Maintenance
	Task		Due	Task Responsible

	RT000116 - Capital program for onsite storage for greater retention capacity		01/02/26	Manager - Water Operations & Maintenance
R000282 - Critical Infrastructure - Potential damage, failure or disruption of services related to water, wastewater and communication infrastructure, due to natural events, vandalism, cyber attack, third party damage or supply chain issues **Open** **Consequences - Result in major disruption of a critical infrastructure service; financial impact; major community impact**	Operational Property & Infrastructure	C000877 CIRMP - physical security - Security (man proof) fencing for critical sites C000878 CIRMP - physical hazard - Dial before you dig (DBYD) C000897 CIRMP - natural hazard - Drought management plans for dam storages C000641 CIRMP - natural hazard - Emergency Response Plan C000642 CIRMP - physical hazard - Proactive maintenance on critical equipment/assets C000643 CIRMP - Physical hazard - Capital upgrade program (ongoing program) C000644 CIRMP - supply chain - Redundancy, additional stock of critical chemicals C000645 CIRMP - supply chain - Major spares; fleet of generators; use of Council emergency tankers C000646 CIRMP - physical security - Security systems & CCTV C000647 CIRMP - natural hazard - Emergency Operational Centre support C000648 CIRMP - natural hazard - Asset protection zone C001477 CIRMP - personnel hazard - Recruitment process & reference checking C001478 CIRMP - personnel hazard - monitoring of staff access and use of critical system C001479 CIRMP - Supply chain - Alternative treatment methods pending availability of critical chemicals C001480 CIRMP - natural hazards - resilience upgrade to broadcasting towers e.g. generators, deluge system s	Residual **Medium** Inherent **Medium**	Executive Manager - Shoalhaven Water
	Task		Due	Task Responsible

R000284 - Significant injury to staff member from undertaking high risk activities, e.g. working from heights, confined spaces, working near water, etc. **Open** **Consequences - employee injuries potential death; LTI**	Operational People	C000652 Appropriate staff training in required disciplines C000653 WHS Mgt system C000654 permit to work system - high risk tasks C000879 Safety Committees C000880 Safety in design e.g engineering solutions for working at heights or confined spaces C000881 Adequate supervision of staff	Residual **Medium** Inherent **Extreme**	Director - Shoalhaven Water
	Task		Due	Task Responsible
	RT000122 - Regular training		28/02/25	Manager - Water Operations & Maintenance
	RT000123 - Use of improved technology to minimise safety risk		28/02/25	Manager - Water Operations & Maintenance
	RT000124 - Regular review of SWMS		28/02/25	Manager - Water Operations & Maintenance
	RT000125 - WHS Quality Officer position		28/02/24	Manager - Water Operations & Maintenance
	RT000126 - Engineering solutions to minimise the needs for working at heights or confined spaces		28/02/25	Manager - Water Operations & Maintenance
R000293 - Inappropriate use of raw water provided to customers **Open** **Consequences - health issues potential; potential litigation**	Operational People	C000703 Yearly advice on appropriate use of raw water sent to RW users C000704 Capital works program to reduce number of customers using raw water	Residual **Medium** Inherent **Extreme**	Manager - Water Operations & Maintenance
	No outstanding tasks			
R000429 - DSMS - Environmental (bushfire/storm) or seismic event damage to critical dam infrastructure **Open** **Consequences - Loss of life, Loss of access, Reputation Loss, Financial loss, Service interruption, Water quality risk & Environmental damage**	Operational Property & Infrastructure	C000908 Dam condition monitoring (SCADA & visual) C000909 Dam safety management system (DSMS) C000910 Capital works program to ensure dam remains in condition state 3 or above C000911 Regular site inspections and condition inspections C000912 Epoch Surveys C000913 Training C000914 Instrumentation & Telemetry	Residual **Medium** Inherent **Medium**	Manager - Water Asset Planning & Development

	No outstanding tasks			
R000430 - DSMS - Mechanical, electrical failure or automated system failure of critical dam infrastructure **Open** **Consequences - Loss of life, Loss of access, Reputation Loss, Financial loss, Service interruption, Water quality risk, Environmental damage**	Operational Property & Infrastructure	C000915 Dam condition monitoring (SCADA & visual) C000916 Dam safety management system (DSMS) C000917 Capital works program to ensure dam remains in condition state 3 or above C000918 Regular site inspections and condition inspections C000919 Double redundancy on critical outlet valves C000920 Training C000921 Instrumentation/telemetry C001482 Regular schedule of maintenance via OneCouncil system	Residual **Medium** Inherent **Medium**	Manager - Water Asset Planning & Development
	No outstanding tasks			
R000431 - DSMS - Uncontrolled erosion, seepage or loss of stability of dam due to water **Open** **Consequences - Loss of life, Loss of access, Reputation Loss, Financial loss, Service interruption, Water quality risk, Environmental damage**	Operational Property & Infrastructure	C000922 Dam condition monitoring (SCADA & visual) C000923 Dam safety management system (DSMS) C000924 Capital works program to ensure dam remains in condition state 3 or above C000925 Regular site inspections and condition inspections C000926 Training C000927 Dam Surveys	Residual **Medium** Inherent **Medium**	Executive Manager - Shoalhaven Water
	No outstanding tasks			
R000482 - Climate change ref AP-R14 - Infrastructure & service impacts from heat & Fire - There is a risk that as a result of an increase in the number of hot days within the LGA, combined with ageing electricity supply infrastructure, power outages and brown outs **Open** **Consequences - Environmental, property and assets**	Operational Property & Infrastructure	C001483 Power purchase agreement for Shoalhaven Water sites C001484 Use of solar power at some sites C001264 Asset Management Plans C001265 Recovery into resilience project C001266 Sustainable Energy Policy C001267 Regularly liase with Endeavour Energy to minimise risks	Residual **Medium** Inherent **Not Rated**	Manager - Water Operations & Maintenance
	Task		Due	Task Responsible

	Nil			
R000483 - Climate change ref AP-R17 - Reduced rainfall and water quality - As a result of an increase in the number of hot days annually there could be reduced stream flow into the catchment, greater evaporation at water storage areas. **Open** **Consequences - Environment, asset management, community**	Operational Environment	C001267 REMS C001268 Water supply integration program C001485 Drought management plan reduces the reliance on Shoalhaven Water dams C001486 Yield analysis identified robust water supply with limited medium term impact from drought C001487 Water conservation education program	Residual **Medium** Inherent **Medium**	Manager - Water Asset Planning & Development
	Task		Due	Task Responsible
	T00001056 - Review drought management plan		30/06/24	Manager - Water Operations & Maintenance
R000498 - Climate change ref AP-R16 - Reduced rainfall and water quality -Decreased levels of rainfall may cause severe drought, resulting in impacts on the natural environment economy and liveability of urban areas **Open** **Consequences - Community, financial, environmental**	Operational Environment	C001299 REMS C001300 Drought management Plan C001391 Demand Management Plan	Residual **Medium** Inherent **High**	Manager - Water Asset Planning & Development
	Task		Due	Task Responsible
	T00000815 - Review REMS program and recycled water supply and capacity to meet needs in times of drought.		30/06/22	Manager - Water Operations & Maintenance
R000271 - Potential change to legislation requiring the removal of asbestos pipes from our infrastructure **Open** **Consequences - Potential for significant cost if required to replace ACM pipes if legislation changes or land owners require removal.**	Operational Financial	C000886 Monitor relevant legislation C000887 Process undertaken to remove asbestos pipes on private property when works are required C000616 Remove ACM pipes by opportunity- no new asbestos pipes used C001468 Asbestos/Cement Water & Sewer Pipe Management Guidelines ASEA	Residual **Low** Inherent **Medium**	Executive Manager - Shoalhaven Water
	Task		Due	Task Responsible
	Nil tasks outstanding			
R000285 - Dry weather sewerage overflows that have an environmental impact to third parties causing potential health impacts to members of the public e.g. aquaculture or recreational areas **Open** **Consequences - Health and environmental issues; Property damage; litigation; reputation**	Operational People	C000882 New technologies e.g IOT devices to monitor sewerage systems C000655 Emergency Response Procedures C000657 Telemetry monitoring system C000658 Proactive maintenance and capital program C000659 Specialist staff; 24hr on call staff	Residual **Low** Inherent **Extreme**	Manager - Water Operations & Maintenance

	Task		Due	Task Responsible
	RT000127 - Major SCADA telemetry upgrade incl implementation of report monitoring system to alert to problems within the system sooner		28/02/19	Manager - Water Operations & Maintenance
R000286 - Use of unfit for purpose re-claimed water **Open** **Consequences - Potential health issues; litigation, environmental breaches and reputational damage**	Operational People	C000661 High level of treatment at STP C000662 Upgrading existing STP's to UV C000663 Guidelines for water recycling and quality monitoring C000664 Agreement with end users C000665 RPZ critical control point monitoring at sewer treatment plants	Residual **Low** Inherent **High**	Manager - Water Operations & Maintenance
	No outstanding tasks			
R000290 - Storage water supply falls to critical levels in major (dam) storages **Open** **Consequences - Impact on community; possible restrictions.**	Operational People	C000855 Drought Management Plan C000687 BCP C000689 Agreement with Water NSW C000690 Water licensing C000691 REMS - reclaimed water management scheme C000692 Demand Management Plan	Residual **Low** Inherent **Medium**	Manager - Water Asset Planning & Development
	No outstanding tasks			
R000292 - Critical chemical supply chain failure **Open** **Consequences - incorrect treatment of water; non compliance with ADWG; potential for unfit water; reputation impact; community health impact**	Operational People	C000699 Formal agreement with supplier; number of alternative suppliers available C000700 Regular monitoring of stock levels C000701 Regular deliveries C000702 Multiple storage locations/ large number of stock points C001396 Purchasing Procedure to clearly identify specific chemical names for purchasing officer C001397 Chemical supplier to provide email confirmation of order with chemical type C001398 All chemical deliveries to contact Water Treatment Operator prior to plant entry C001399 Correct signage on all chemical delivery points and storage facilities C001400 Delivery Driver and Operator to check delivery docket and chemical type before transfer of chemical	Residual **Low** Inherent **Medium**	Manager - Water Operations & Maintenance

	No outstanding tasks			
R000424 - Asset Renewal Funding **Open** **Consequences - failure to deliver capital works programs**	Operational Financial	C000872 Forecast scheduling of maintenance against upcoming budget C000873 Implementing scheduled maintenance of all assets C000862 Asset Management System upgraded to integrated system C000863 Up to date Asset Management Plans & strategies C000864 Implement T1 SAM module	Residual **Low** Inherent **Low**	Executive Manager - Shoalhaven Water
	Task		Due	Task Responsible
	T00000551 - Implement Control C000864 - Implement T1 SAM module		02/03/25	Manager - Water Asset Planning & Development
R000428 - Project or Contractual Disputes **Open** **Consequences - Financial Loss, Reputational loss & Legal proceedings**	Operational Financial	C000893 Contract & Project Management training for staff managing contracts and projects C000894 Use of standard contracts for project and contract management C000895 Contract management framework C000896 Development of project management system	Residual **Low** Inherent **Medium**	Manager - Water Asset Planning & Development
	No outstanding tasks			
R000463 - DSMS - Partial or full dam failure (wall or other critical components) **Open** **Consequences - Loss of critical water infrastructure.**	Operational Property & Infrastructure	C001114 Dam condition monitoring (SCADA & visual) C001115 Dam safety management system C001116 Capital works program to ensure dam remains in condition state 3 or above C001117 Regular site and condition inspections C001118 Epoch surveys C001119 Staff training C001120 Instrumentation & telemetry	Residual **Low** Inherent **Medium**	Manager - Water Operations & Maintenance
	No outstanding tasks			
R000464 - DSMS - flood damage to critical dam infrastucture **Open** **Consequences - Consequences** **Loss of critical water infrastructure.**	Operational Property & Infrastructure	C001133 Dam condition monitoring (SCADA & visual) C001134 Dam safety management system C001135 Capital works program to ensure dam remains in condition state 3 or above C001136 Regular site and condition inspections	Residual **Low** Inherent **High**	Manager - Water Operations & Maintenance

		C001137 Epoch surveys C001138 Staff training C001139 Instrumentation & telemetry		
	No outstanding tasks			
R000504 - DSMS - Damage to dam as a result of modification, construction or decommissioning **Open** **Consequences - Loss of life, Loss of access, Reputation Loss,** **Financial loss, Service interruption, Water quality risk, Environmental damage**	Operational Property & Infrastructure	C001320 QA certified contractors C001321 Use of qualified consultants C001322 Quality management system C001323 Procurement process, includes tender evaluation and specifications	Residual **Low** Inherent **High**	Manager - Water Asset Planning & Development
	No outstanding tasks			
R000505 - DSMS - Human error resulting in damage to dam or unplanned large volume release of water **Open** **Consequences - Loss of life, Loss of access, Reputation Loss,** **Financial loss, Service interruption, Water quality risk, Environmental damage**	Operational Property & Infrastructure	C001324 Training and development of staff C001325 System process documentation in DSEP and O&M plans	Residual **Low** Inherent **Medium**	Manager - Water Operations & Maintenance
	No outstanding tasks			

9.3.1 Future Improvements

- Risk workshops are regularly under quarterly or in the event of an incident to identify all risks at a tactical level. Work is currently underway to analyse the level of risk and identify controls to reduce the level of risk to an acceptable level. Develop and implement a risk action plan.
- Develop risk action plan format, including person responsible, target date to be monitored and reported against and method and frequency of monitoring.
- Populate and complete risk action plan within the TechOne Risk Module.

9.3.2 Climate Change Resilience Planning

Shoalhaven Water's asset portfolio is valued more than $1.9B and due to the geographical location, these assets they are highly susceptible to environmental change. A changing environment with higher sea levels, increase in temperature and increased frequency of extreme weather events may provide significant risk to the assets under the control of Shoalhaven Water therefore it has been identified by Shoalhaven Water's management that these risks need to be identified quantified, assessed with a risk management approach implemented to manage the ongoing risk of asset failure or reduced asset useful life due to these changes in the environment.

From an asset management perspective there are two important dimensions of resilience that are particularly relevant. These are technical or asset resilience and organisational resilience. Consideration of risk and resilience outcomes for new and upgraded infrastructure needs to be embedded in project business case guidelines, capital asset planning and assurance processes as a matter of course.

The International Infrastructure Management Manual provides a risk management approach to resilience planning - Section 3.2.8 – Assessing Infrastructure Resilience.

The NSW State Infrastructure Plan also recommended that -

To ensure whole-of-life assessment of infrastructure risk and resilience issues and to ensure Shoalhaven Water's assets are managed in a sustainable way, Shoalhaven Water needs to:

- consider of risk and resilience outcomes for new and upgraded infrastructure be embedded in project business case guidelines, capital asset planning and assurance processes as a matter of course.
- as part of the new asset management processes Shoalhaven Water undertake periodic assessments of the vulnerability of assets to the impacts of climate change (such as sea level rise), natural disasters (such as floods, bushfires, heatwaves, and storms) and human-related threats (such as cyberattacks).

9.3.2.1 Resilience Planning Steps

1. Identification of asset to determine hazards and vulnerability. Short term/long term impacts.
2. Risk assessment to determine likelihood and consequence – short term/long term impact.
3. Lifecycle cost analysis of high risk assets (maintenance costs, remaining useful life, rehab - replace or renewal options, cost benefit analysis of options, other issues).
4. Determine resilience approach, Accommodate, Protect/defend or Retreat based on cost benefit/business cases.
5. Consult with stakeholders.

6. Priorities and implementation of mitigation measures, or resilience approach.

7. Imbed asset resilience planning in asset planning processes.

9.3.2.2 Other Options

- Financial resilience – Having funds available to deal with unplanned events
- Links to the emergency management
- Designing for resilience at the planning and concept stage of asset development.
- Resilience in supply chain.

9.3.2.3 Adaptation

To improve resilience, Shoalhaven Water will need to consider how to adapt to these risks. The IPWEA Practice Note 12 identifies climate change adaption as a range of response that are implemented with the expectation of reducing the impact of climate change.

Adaptation measures include –

- Accommodate;
- Protect/defend; or
- Retreat.

Accommodate is described as accommodating the affects in a harmonious way without resisting or retreating. This involve modifying existing infrastructure in situ without any addition protection methods. An example of this would be to utilising pressure sewer system in the same location to provide an alternative approach to the management of wastewater services.

Protect/defend is described as placing a physical barrier between the asset and the impact zone to reduce the expose. This option would include the construction of retaining structures or sea walls however if these measures are implemented then the measure themselves should become assets which would require management into the future and adequate budgeting would need to be allocated for the whole of life costs of these protection assets.

Retreat from climate changes is self-explanatory. This option is identified as the most difficult particularly with high value long life assets such as WPS and WTP's.

To determine the most effective and cost-effective approach Shoalhaven Water will need to undertake a cost benefit analysis considering the whole of life costs of options to determine the most cost-effective approach which is consistent with Shoalhaven Water's/Council's levels of service.

The effects of natural disasters and climatic change has the potential to significantly affect Shoalhaven Water's assets and the operation of those assets and affords a significant risk to the organisation if not managed effectively. As part of the new asset management processes Shoalhaven undertake periodic (5 yearly) assessments of the vulnerability of assets to the impacts of climate change on these assets.

10 Financial Summary

10.1 Introduction

10.1.1 Expenditure Definitions

Expenditure and revenue projections within this plan have been classified as capital (new and renewal) or operating, in accordance with generally accepted accounting practice.

Shoalhaven Water has developed an asset management policy that reflects accounting treatment of activities for infrastructure asset components. It has approved the use of this policy, and these definitions have been applied during the development of this asset management plan.

Expenditure on infrastructure assets can be categorised into five main areas:

- Operations and Maintenance (Sustaining Assets)
- New Works - Growth
- New Works – Asset Enhancement
- Renewals/Replacement
- Disposals

These are discussed below.

10.1.1.1 Operations and Maintenance (Sustaining Assets)

Operations and maintenance expenditure that is required for the day-to-day operation of the network whilst maintaining the current levels of service. Examples of this type of expenditure are:

10.1.1.1.1 Routine maintenance

This includes day to day maintenance which is required on an ongoing basis and is budgeted for, and reactive maintenance is unexpected and necessary to attend to immediately to continue operation of the service.

10.1.1.1.2 Major periodic replacements

This includes non-day-to-day maintenance which is identified in advance and is incorporated into a maintenance budget for a certain time period.

10.1.1.1.3 Other operating costs

These include energy consumption costs, cleaning costs, fleet and management and administration costs.

10.1.1.2 New Works – Growth

New works growth is new asset which support growth in the Shoalhaven Region. These projects are generally driven from Development Service Plans produced by Shoalhaven Water.

10.1.1.3 New Works – Asset Enhancement

Enhancing service delivery (ie the level of service provided by the business unit) through upgrades to the asset base.

10.1.1.4 Renewals/Replacement

Renewal expenditure includes rehabilitation and replacement of assets to restore an asset to its original level of service, ie capacity or the required condition. Renewals expenditure forecasts cover the cost of asset renewal through its whole lifecycle through to disposal of the asset. To ensure asset renewals

are keeping pace with asset consumption Shoalhaven Water aim to achieve an Asset Renewal Funding Ratio (ARFR) of 80% depreciation expense over a 5 year average.

Renewal expenditure is work that restores an existing asset to its original level of service, ie capacity or the required condition.

Rehabilitation involves the repair of an existing asset, or asset component. Rehabilitation doesn't provide for a planned increase in the operating capacity or design loading. It is intended to enable the assets to continue to be operated to meet the current levels of service.

10.1.1.5 Disposals

Disposal is the retirement or sale of assets whether surplus or superseded by new or improved systems. Assets may become surplus to requirements for any of the following reasons:

- Under utilisation
- Obsolescence
- Provision exceeds required level of service.
- Assets replaced before its predicted economic life.
- Uneconomic to upgrade or operate.
- Policy changes
- Service provided by other means (eg private sector involvement)
- Potential risk of ownership (financial, environmental, legal, social).

Disposals shall be considered and undertaken in accordance with Council's Asset Accounting Policy (Other Than Land and Buildings) POL22/73.

10.1.2 Assumptions

Shoalhaven Water has adopted a 20 year planning horizon for water and sewer, the minimum required by State Government Best Practice Guidelines. The following assumptions are incorporated into the current 20 year model:

- No State Government subsidies for water supply
- CPI increases for future years = 3% to 5% p a
- Loan borrowings – Period of loan = 15 years
- Interest rates for new loans = 8.75%

10.2 Asset Valuation

In 2021/22 Shoalhaven Water undertook a full revaluation of assets at component level. The level of componentisation is consistent with the Asset Accounting Standards, ISO 55000, Council's Asset Valuation Procedure and the AIFMM. The revaluation was undertaken utilising internal & external resources. Cost estimating tools included, Rawlinsons Construction Handbook, recent works contract, internal cost estimating tools & the NSW Reference Rates Asset valuations. Further details on the revaluation process and ongoing asset accounting practices is available in the Asset Accounting and revaluation reports for each respective year.

The asset value and annual depreciation has more than doubled since 2005/06, and the asset replacement value for water supply assets is now over $872M.

Figure 10-1 Historical Asset Value (Replacement Cost)

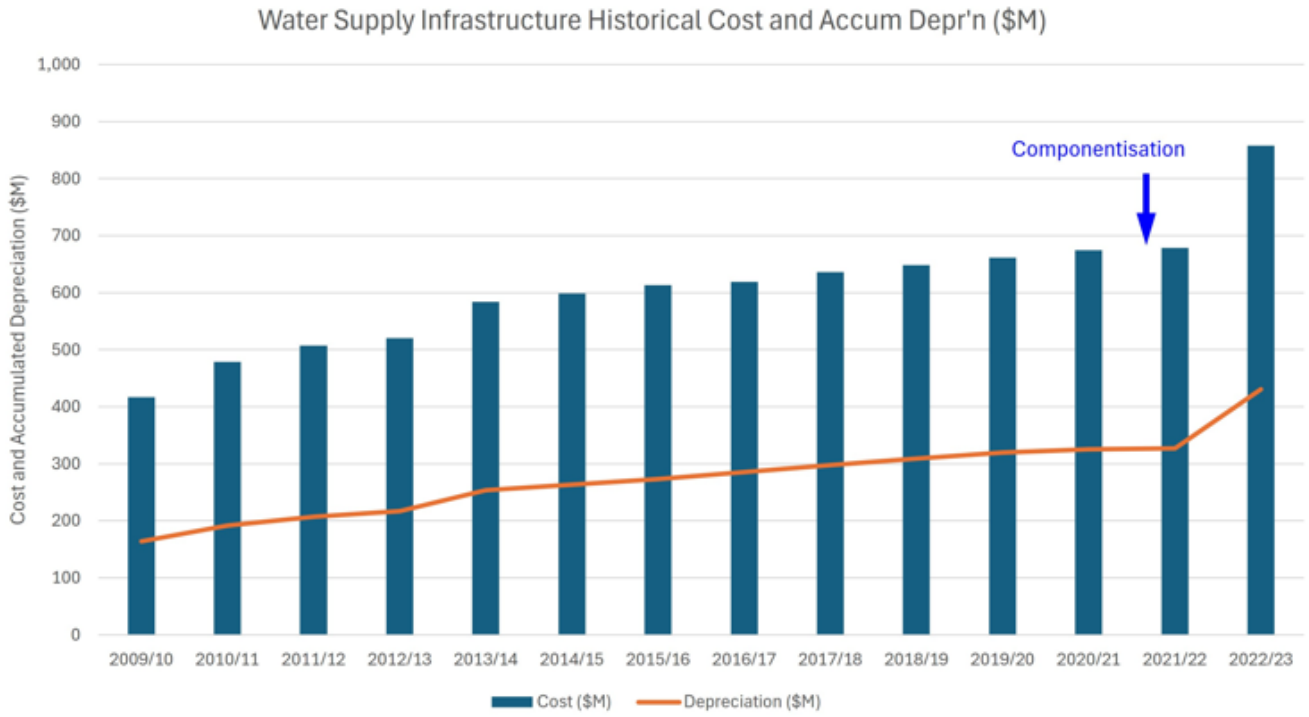
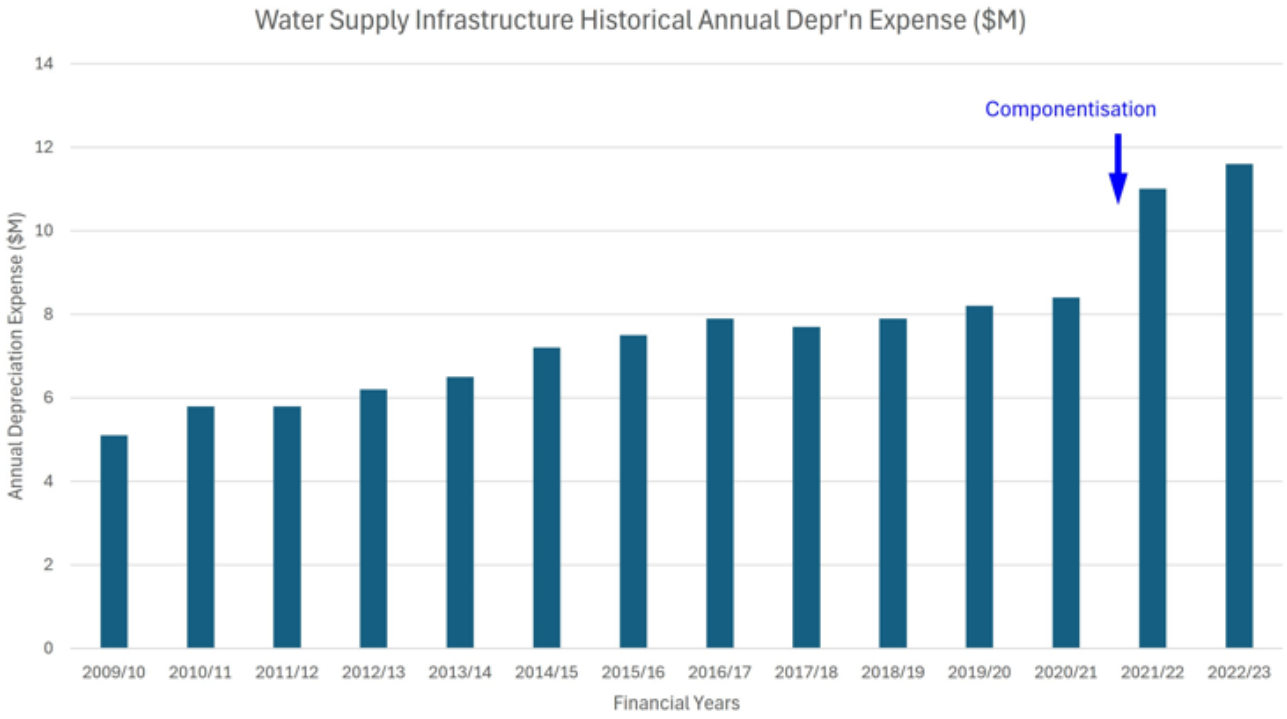


Figure 10-2 Historical Annual Depreciation



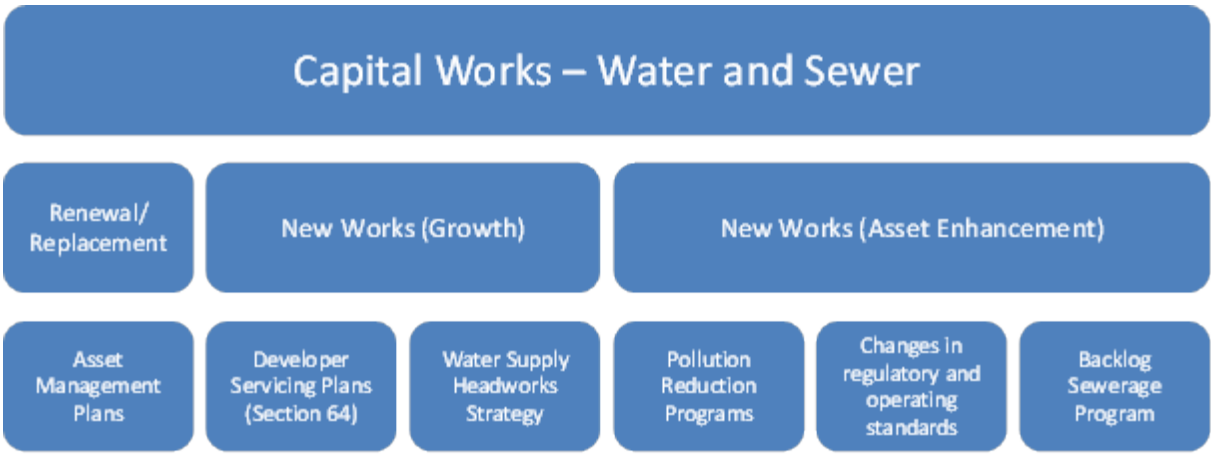
The Asset Information Framework report (April 2013), prepared by GHD, included a review of Shoalhaven Water unit rates and base lives. That report also included recommendations with respect to Shoalhaven Water's valuation practices and development of a new component-level valuation methodology by 2017. As part of the 2016/17 revaluation Shoalhaven Water will be engaging an external consultant to undertake valuation of headworks and distribution assets (other than pipelines).

This project will include componentisation and condition assessment in accordance with the 2013 report.

10.3 Capital Investment Decision-Making

The water and wastewater funds provide for capital programs each year for renewal/ replacement works, new works for growth and new works for asset enhancement (including backlog water supply works). The “building blocks” or drivers of these programs are given in the diagram below.

Figure 10-3 Building Blocks for Capital Investment Programs



10.3.1 Capital Investment Program

The water capital program is dominated over the next 5 years by water main replacement programs. The mains replacement programs have been developed through criticality analyses of the existing system and historical date which and has highlighted the need for replacement of a number of PVC pipes made in the mid 1980’s that are failing prior to their expected lives and the need to upgrade existing smaller mains which cannot provide the required LOS.

Council models the 20-year financial forecasts as required under the Strategic Planning Framework. The water and sewer funds are managed in a manner to achieve an operating surplus in each fund and seek to pay a dividend to Council. Dividends have been paid to Council’s General Fund in accordance with The Department of Climate Change, Energy, the Environment and Water requirements. Further guidance on the payment of dividends is available in Shoalhaven Water’s Strategic Business Plan.

10.3.2 Project Prioritisation

Capital Works Projects are prioritised based on a series of key strategic drivers. The strategic drivers are summarised as follows:

10.3.2.1 Population Affected:

Rates projects based on the projected scope and impact of the project in relation to the size of the population that may be impacted. For example, this assessment may consider the population served by assets addressed by the project, or the impact on population if the assets were to fail. Higher impact projects are given priority.

10.3.2.2 Time Criticality:

Rates projects based on the timeframe required to complete resolution of the project in comparison to the anticipated deadline for completion. Priority is given to projects whose time to completion is greater than or close to the time to deadline.

10.3.2.3 Failure Risk:

Rates projects based on the Risk to Shoalhaven Water in the event of failure of the assets, or failure of the project to be completed on time. Failure risk considers financial impacts as well as reputational risk, risk to service provision etc. Projects with higher risk are given priority.

10.3.2.4 Operational Efficiency:

Rates projects on their potential to provide a tangible operational efficiency improvement (and therefore reduce costs). Projects with higher benefit: cost ratio are given priority.

10.3.2.5 Sensitivity of Affected Environment:

This rating is only considered for Wastewater portfolio projects. It rates projects based on the sensitivity of the potential receiving environment to sewage spills or overflows. Projects targeting assets in the vicinity of highly sensitive environments are given priority.

Each strategic driver for each project is rated on the following scale:

- None
- Low
- Moderate
- Strong
- Extreme

The strategic drivers are weighted based on a consensus weighting determined by the Shoalhaven Water Investment Review Committee. Driver weightings are:

- Water Projects:
  - Population Affected – 41.2%
  - Failure Risk – 29.3%
  - Time Criticality – 22.0%
  - Operational Efficiency – 7.5%
- Wastewater Projects:
  - Failure Risk – 26.2%
  - Population Affected – 25.3%
  - Sensitivity of Environment – 22.1%
  - Time Criticality – 19.8%
  - Operational Efficiency – 6.6%

Once rated, a project weighted score is determined which is used to rank all projects in priority order. Projects are then selected for inclusion in the capital works plan based on priority order and compared against resources and funds availability. The final selection of projects aims to maximise the number of priority projects executed within the business' constraints.

10.3.3 Renewal/Replacement Decision Making

Assets are renewed when it is more cost effective in the long term to replace rather than continue to maintain the asset. There are two elements to renewal decision-making:

- **Renewal financial forecasts** are based on asset depreciation, lifecycle costs and reliability/operational redundancy.
- **Asset renewal decisions** are identified through analysis of criticality, condition and performance information gained through inspections, advanced analysis techniques and maintenance activities.

Renewal decision-making has been reviewed in conjunction with Asset Criticality Framework & Management Strategies Report (GHD 28 March 2013). This report used population, critical customer, environmental considerations, critical infrastructure and legislative requirements to categorise infrastructure. The data is programmed to be workshopped to compare with historical data on main breakage and maintenance costs. Following Council's Financial Sustainability Review Shoalhaven Water will be aiming to achieve ARFR of 0.8.

10.3.4 New Works (Growth and Enhancements) Decision Making

In 2013, servicing strategies were developed for the water supply transportation system and treatment plants, however as a result of the release of the Final 2016 Developer Charges Guidelines for Water Supply, Sewerage and Storm Water a review of the Strategies and Development Servicing Plans is being undertaken. The review will be used to understand the demand for water and wastewater services over the period from 2016 – 2046 and to identify the capital works requirements to accommodate this. These strategies provide a program for system augmentation and capital works that allows Shoalhaven Water to plan for the future.

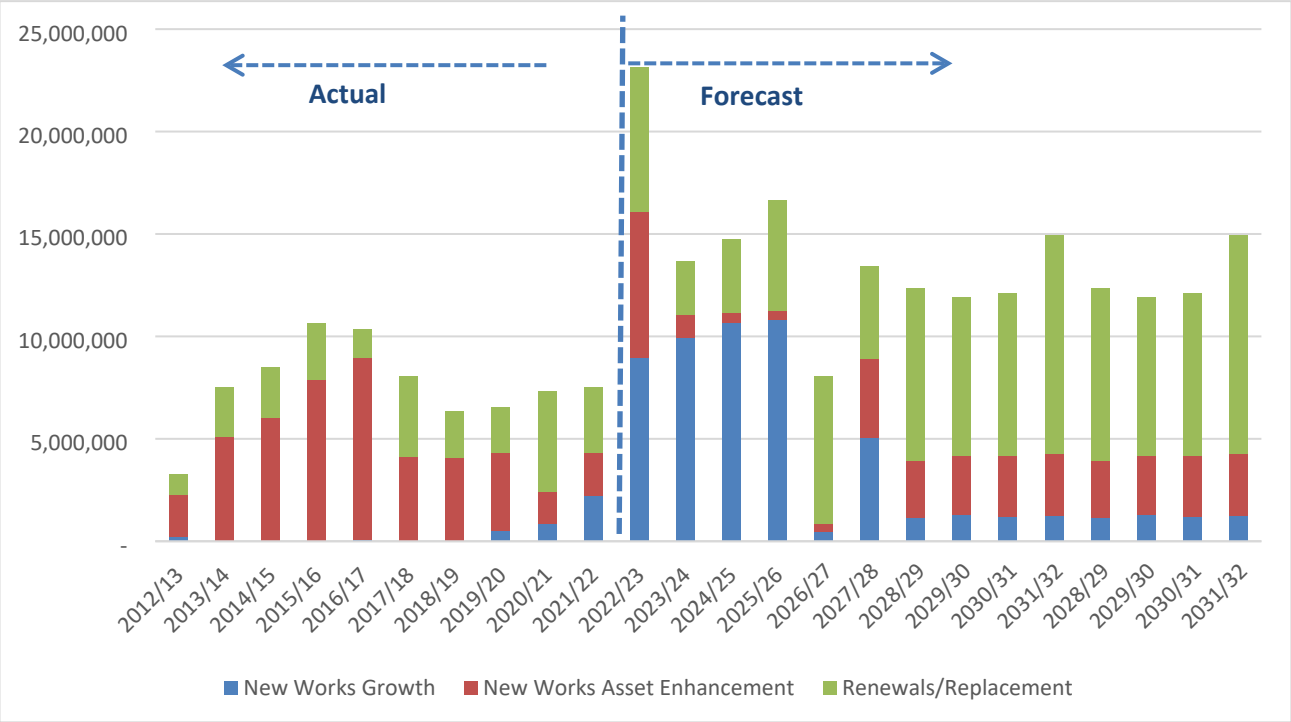
10.4 Financial Statements and Projections

10.4.1 Capital Works Expenditure

Over the period 2002 to 2013 the amount of renewal capital works has been relatively minor, primarily due to the relatively new age and quality of the existing water supply assets. In 2013/14 the expenditure increased to around $7.5M, more in line with wastewater expenditure. This is shown in the graph below.

These figures provide a broad-based categorization of the drivers for the capital works program, but some caution also needs to be applied. Individual projects do not necessarily fall neatly into a "growth", "renewal" or "enhancement" category and can be a combination of all three, which would not be reflected in the financial information for the project.

Figure 10-4 Capital Works Expenditure History and Forecast (June 2022)



Note – Chargeable private works and other capital expenses are excluded from graph above as these are expenses which are not directly attributed to individual asset or asset classes.

Renewals/replacements dominate the capital works expenditure forecast, from 2025 onwards, this is consistent with Council's desire to achieve 80% asset renewal funding ratio. This ratio is a percentage of depreciation, to allow for large renewal projects funding the 80% ratio is over a 5-year period with expenditure varying between $9M and $14M over that period. This will require greater investment than the current rates and these projects and values will be developed over the next 2 years as Shoalhaven Water reviews sustainable expenditure and funding options.

New works growth will reduce after the completion of the construction activities for the Moss Vale Rd URA with $15M worth of work currently underway.

Future Programs will include large investment in asset enhancement as the Bamarang to Milton Stage 2 project progress with between $70M & $100M estimated for that project.

'Other' expenditure includes chargeable private works and other asset capital expenditure.

The supporting expenditure table is shown below.

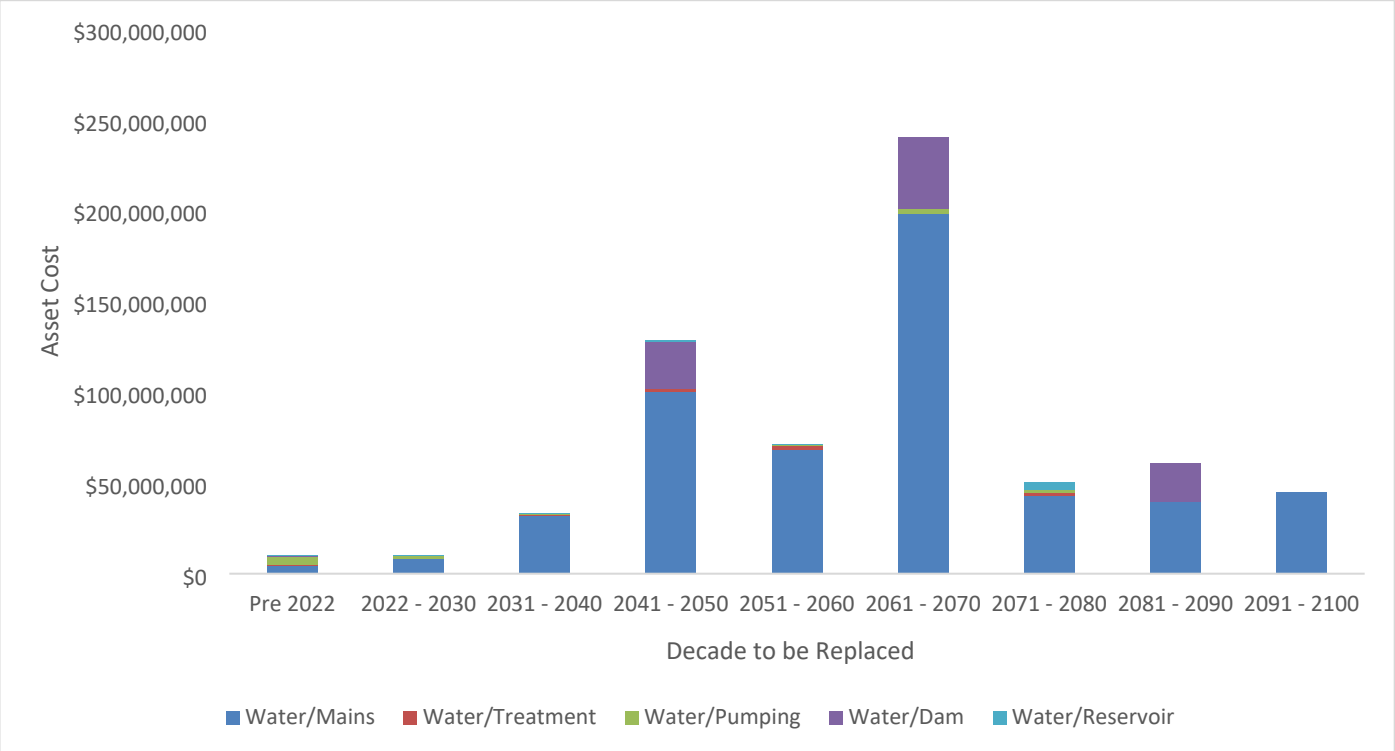
Table 10-1 Capital Works Expenditure Forecast March 24

Category	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Asset Enhancement	$2,702,491	$340,000	$270,000	$270,000	$3,270,000	$2,270,000	$2,000,000	$2,000,000	$2,000,000	$2,000,000
New Works Growth	$17,136,968	$12,610,000	$38,670,000	$38,620,000	$7,870,000	$1,620,000	$1,000,000	$1,000,000	$1,000,000	$1,100,000
Other Assets	$3,369,800	$1,255,000	$1,255,000	$1,255,000	$1,255,000	$1,255,000	$1,255,000	$1,255,000	$1,255,000	$1,255,000
Renewal / Replacement	$11,900,630	$9,500,000	$9,500,000	$9,500,000	$9,500,000	$9,500,000	$9,500,000	$9,500,000	$9,500,000	$9,500,000
Total Capital Expenditure	**$35,109,889**	**$23,705,000**	**$49,695,000**	**$49,645,000**	**$21,895,000**	**$14,645,000**	**$13,755,000**	**$13,755,000**	**$13,755,000**	**$13,855,000**

10.4.1.1 Renewals Forecast

The following graph provides a snapshot of future water supply replacement requirements, based on design asset life only. The timeline has been grouped into decades for simplicity.

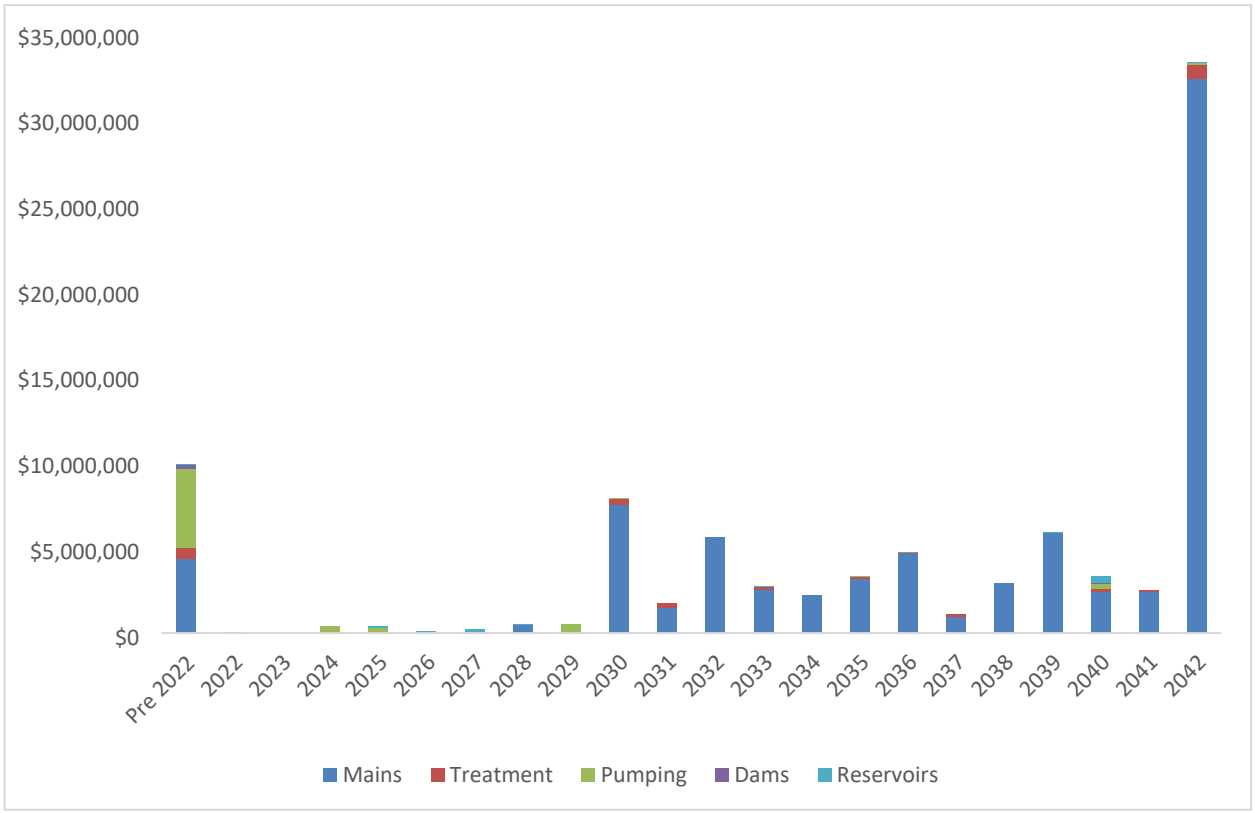
Figure 10-5 Replacement Cost by Decade to be Replaced (based on the End-of-Design Life updated - 30/06/2022)



The graph indicates major replacement liabilities between 2035 and 2075. This is a reflection of the relatively young age of the pipe system, and the assumed life of the pipe types within the asset management system (AMS).

The financial planning period for the capital works program is 20 years, and the 20 year period expanded from the above graph is given below.

Figure 10-6 20-Year Replacement Cost by End-of-Life (Design Life – updated 30/06/2022)



Based on the current information on assets, a 20-year renewal plan is included in the water supply 20 year capital financial plan, as shown in the graph below. Further data interpretation will be required to refine these estimates.

The asset information presented in Section 3.2.5 shows that most pipes are Asbestos Cement (AC) or UPVC. The dominance of AC and UPVC pipes will have a significant impact on the forward renewal program. As further operational data is obtained, the assumed asset lives will be able to be further refined. As part of the annual revaluation/indexation processes asset useful life's will be reviewed using historical information, asset life comparisons and operational advice.

Shoalhaven Water has identified a large package of asset renewal works that will progress over the next 10 years. Design work has been completed and as funding becomes available these projects will be progressed to construction.

Given the quantum of work in this replacement program it was determined that the most efficient method to undertake renewals was through a panel of qualified contractors.

10.4.1.2 Water Meter Renewals

The condition and performance of the water meter fleet is an integral component of Shoalhaven Water's revenue stream and level of customer service. The replacement of water meters from an industry perspective is largely driven by the timescale/volume of water passing through the meter and water usage pricing. As water meters age the unit invariably "under-records" the actual water volume passing through the meter.

The National Measurement Institute, National Framework for Urban Water Metering that was released in May 2010 now provides Water Utilities with more detailed information concerning the performance

tolerances of water meters and places greater demand on the industry to ensure that meter accuracy is maintained through strategies such as meter replacement programs.

The last large-scale replacement of water meters in Shoalhaven occurred in 2003 when 15,000 meters were replaced. Testing was carried out on a cross section of these removed meters by Brisbane City Councils NATA Accredited Laboratory to gauge the reading accuracy of the meters based on age and volume. Based on an analysis of these results against the entire fleet, a water meter replacement and management program has been developed to target;

- Aged meters (+ 10 years),
- High consuming 20 mm meters (+ 8,000 kl), and
- In-situ testing of large meters and meters recording 3,500 kl per year prior to replacement.

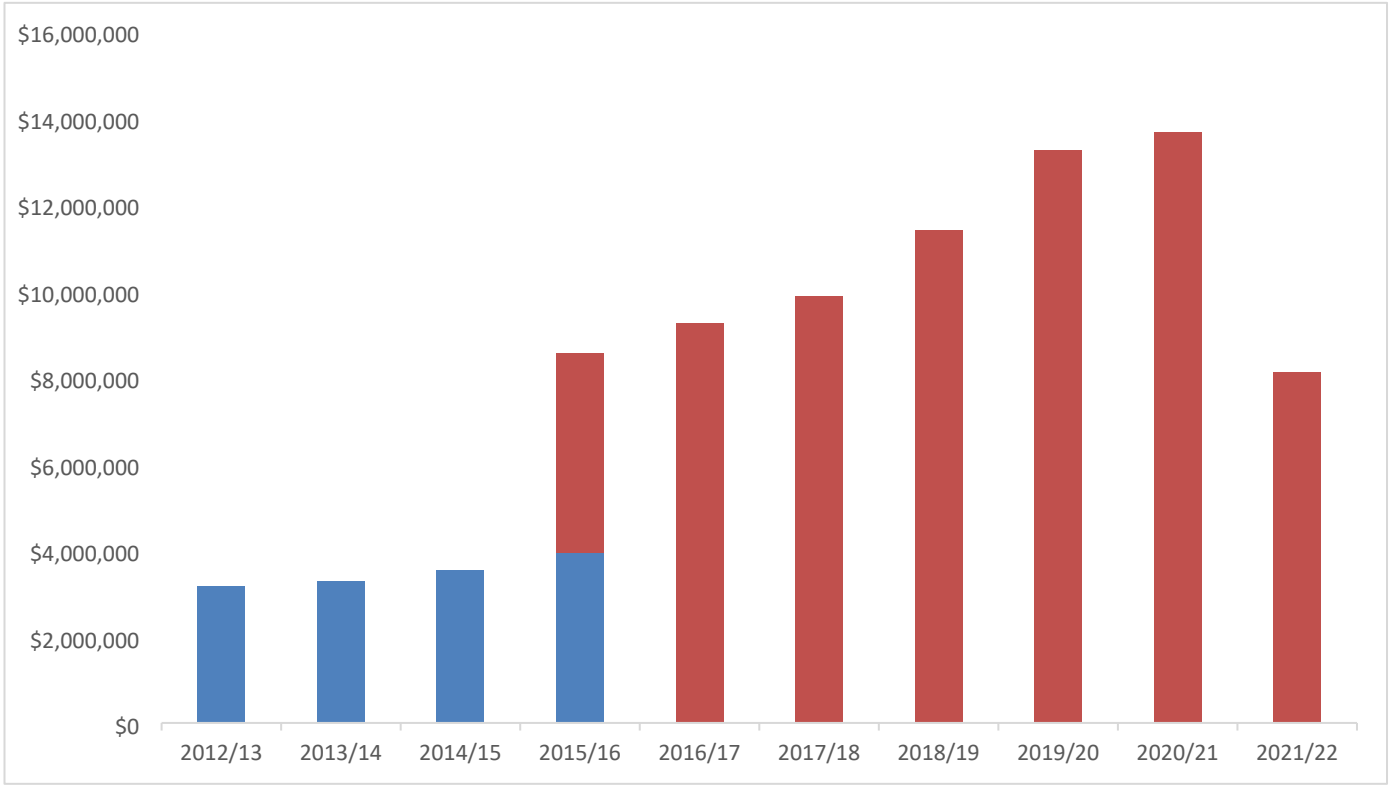
The meter replacement program commenced in 2010 with a total of 20,345 meters replaced as of Dec 2020. This leaves 3919 to be replaced for 2021 to 2022. The total replaced will exceed 25,000 meters with addition meters being replaced on an “as needed basis” in addition to the formal program. This replacement strategy takes cognizance of the National Framework for Urban Water Metering and is targeting as a priority those older meters, some of which have been installed for over 20 years.

10.4.2 Operations and Maintenance Expenditure

10.4.2.1 Operations and Maintenance Expenditure History

Water supply historical maintenance expenses are shown in the graph below.

Figure 10-7 Maintenance Expenditure History



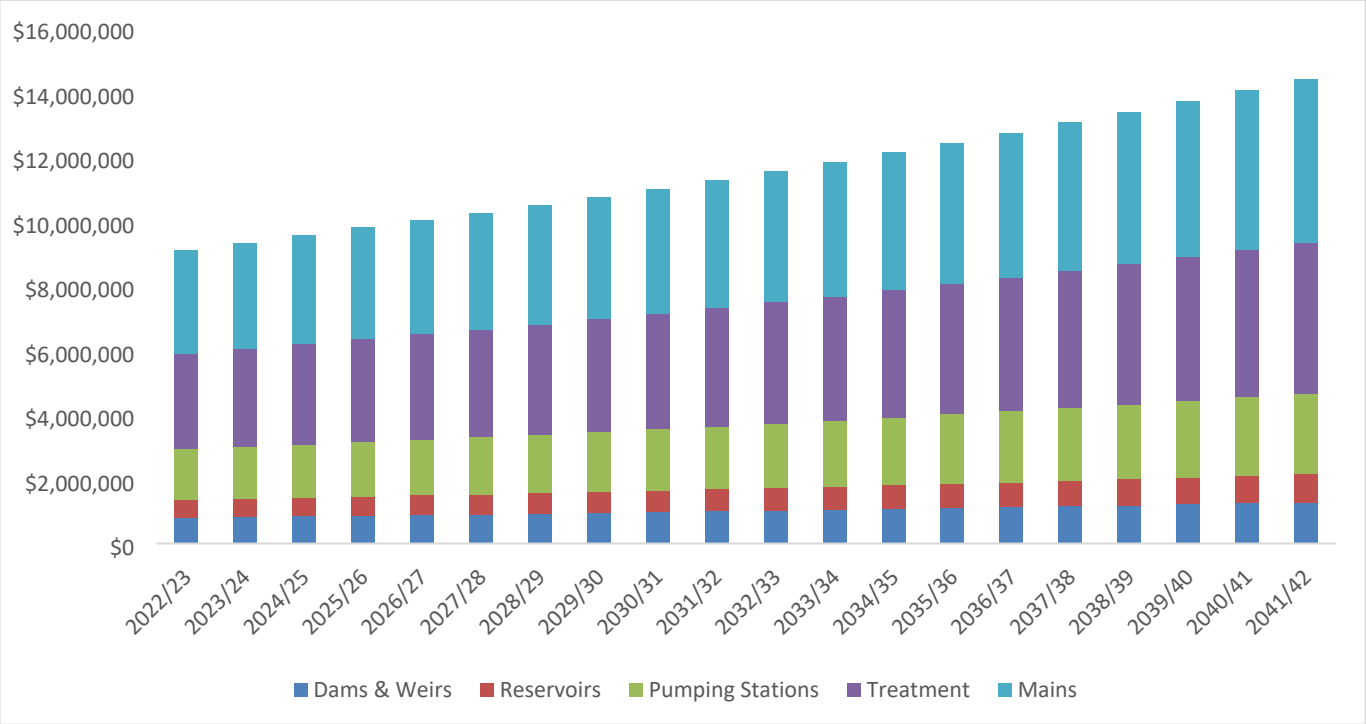
Note – The spike (red) in maintenance expenditure is due to changes in SS7 definition of maintenance.

Although current maintenance expenditure is sufficient to meet current service levels, further work is required to develop more robust projections of future best practice maintenance scheduling, particularly in the mechanical and electrical areas.

10.4.2.2 Operations and Maintenance Expenditure Forecast

The 20-year operations and maintenance expenditure forecast is shown in the graph below, broken down into the expenditure categories.

Figure 10-8 Operations and Maintenance Expenditure Forecast (June 2022)



Note – Management, plant and other expenses excluded from graph above as these are expenses, which are not directly attributed to individual asset or asset classes.

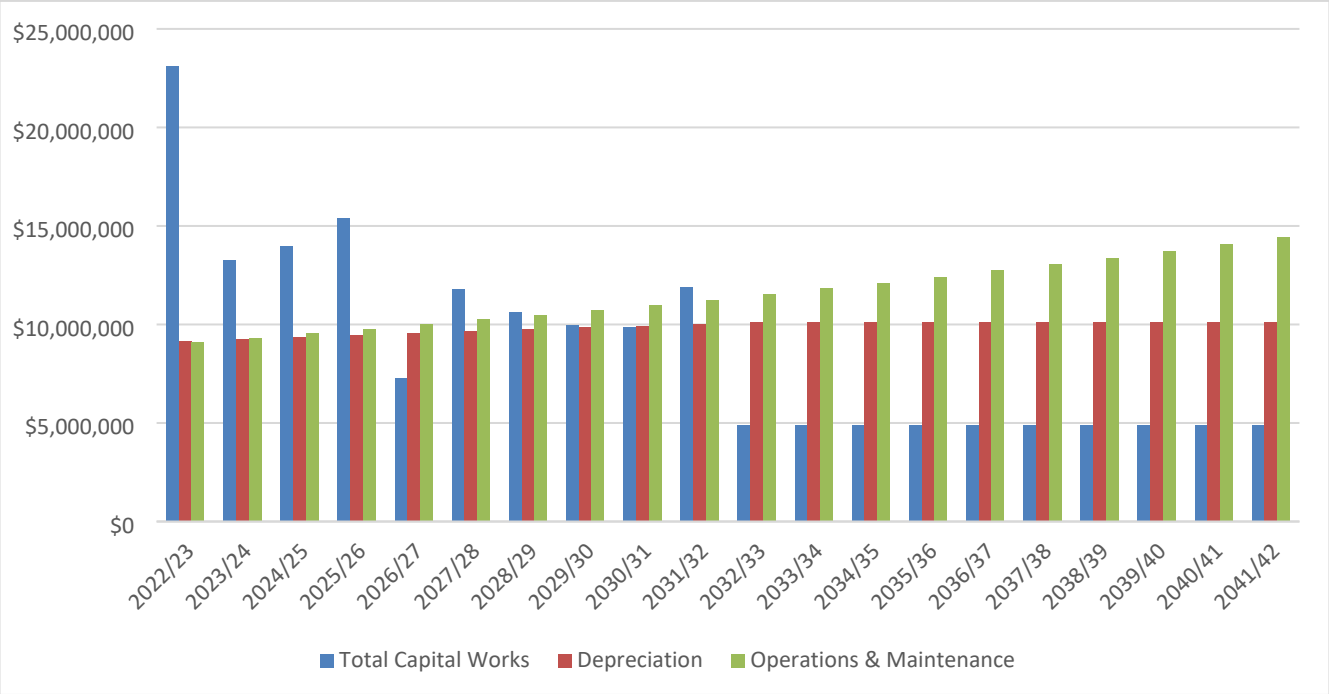
The graph above shows the operational, maintenance & administration budget.

Table 10-2 Operations and Maintenance Expenditure Forecast ($M) June 2023

10.4.3 Expenditure Summary

The 20-year financial projections for planned operating expenditure (operations and maintenance), total capital works and depreciation are given in the graph below.

Figure -9 20-Year Financial Forecast (June 2022)



Note – Management expenses excluded from graph above as these are expenses which are not directly attributed to individual asset or asset classes.

The current program allows for a “smoothing” of the replacement peaks. With little data to validate or dispute the assumed asset lives at this stage, the model will be refined through “what if” scenarios.

Table 10-3 Total Expenditure Forecast ($M) June 2022

Category	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
	2022 /23	2023 /24	2024 /25	2025 /26	2026 /27	2027 /28	2028 /29	2029 /30	2030 /31	2031 /32	2032 /33	2033 /34	2034 /35	2035 /36	2036 /37	2037 /38	2038 /39	2039 /40	2040 /41	2041 /42
Total Operations and Maintenance	9.63	9.88	10.14	10.38	10.63	10.88	11.14	11.41	11.68	11.96	12.26	12.57	12.88	13.20	13.53	13.87	14.22	14.57	14.94	15.31
Total Capital Expenditure	23.13	13.27	13.98	15.38	7.28	11.82	10.61	9.98	9.88	11.88	10.14	10.14	10.14	10.14	10.14	10.14	10.14	10.14	10.14	10.14
Depreciation	9.18	9.28	9.37	9.46	9.56	9.65	9.75	9.85	9.94	10.04	4.92	4.92	4.92	4.92	4.92	4.92	4.92	4.92	4.92	4.92

10.5 Key Projects, Costs and Timing

The following table provides a summary of the key projects, cost and timing for the first five (5) years. Detailed explanations of the projects are included within each of the asset descriptions in Section 3 of this AMP. The full list of capital projects is available in as an appendix to this document.

Table 10-4 Key Projects, Costs and Timing

Project	Relevant Expenditure Categories			Approximate Project Cost and Timing ($M)				
	Growth	Renewal	Asset Enhancement	2023/24	2024/25	2025/26	2027/28	2029/30
Bamarang WTP Renewal & Upgrade	✓	✓	✓	$1.7	$1.5	$1.5	$1.4	$1.0
Moss Vale Road URA	✓			9				
Mains Replacement Programs		✓	✓	$2.5	$2.5	$2.5	$2.5	$2.5
Cambewarra Dam Decommissioning		✓	✓	0.2	0.6			
Relocation of Bream Beach Water Main			✓	0.7	0.4			
Bamarang To Milton Stage 2	✓	✓		0.2	35	35		
KV WTP Membrane Replacement	✓	✓	✓	$0.6				

11 Service Delivery Model

The operations and majority of routine maintenance activities for water assets are currently undertaken by council workforce. Some specialized maintenance tasks (eg reservoir cleaning) are carried out by external contract as Council does not have the resources and/or equipment to economically undertake the activity.

Mechanical and electrical maintenance is currently carried out by Shoalhaven Water's electrical mechanical services sections that operate under Shoalhaven Water's, Water Operations and Maintenance sections.

Some minor construction activities are undertaken by Council staff, but most construction projects are undertaken by contract. This model places more emphasis on internal project management resources and further assessment of technical resources will be required to determine future requirements.

12 Plan Improvement and Monitoring

12.1 AMP Performance Measurement

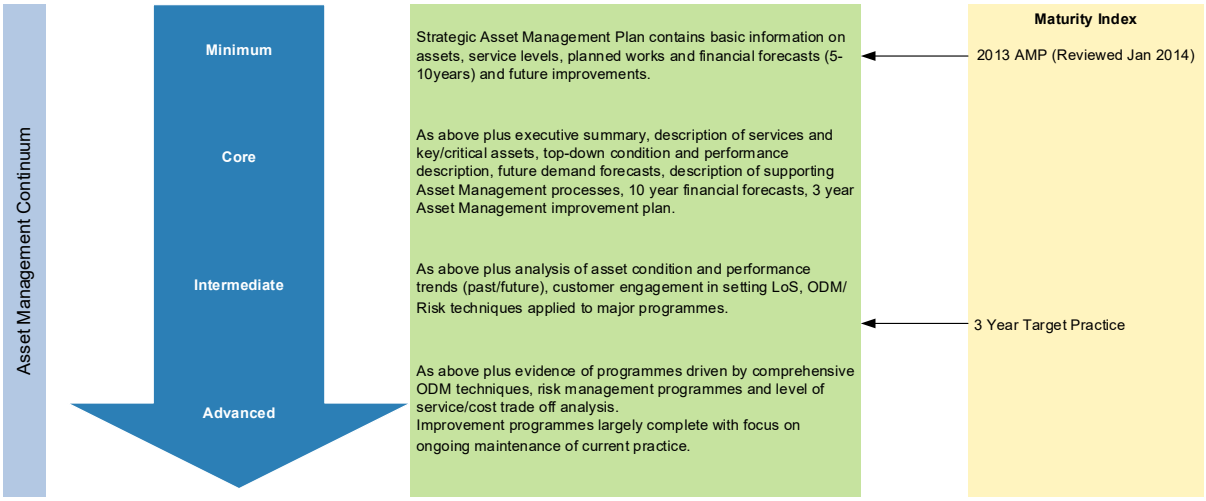
The effectiveness of the asset management plan can be measured in the following ways:

- The degree to which the required cash flows identified in this asset management plan are incorporated into council's long term financial plan and Strategic Management Plan;
- The degree to which 1-5 year detailed works programs, budgets, business plans and organisational structures take into account the 'global' works program trends provided by the asset management plan;
- External or internal assessment against best practice guidelines.

12.1.1 Core and Advanced Asset Management

The development of an Asset Management Plan (AMP) is undertaken over a number of years. Its evolution is dependent on the commitment by Shoalhaven Water and the organisation as a whole to continuous improvement and to provide ongoing investment in its asset management capability. The maturity index provides an indication of where the AMP sits in the asset management continuum, based on the International Infrastructure Management Manual (IIMM 2011).

Figure 12-1 The Asset Management Maturity Index



12.1.2 Shoalhaven Water Supply AMP

In January 2014, Shoalhaven Water engaged an external consultant to undertake a review of the 2013 AMP. The AMP was reviewed against a range of criteria under ten aspects of the asset management framework. The purpose of the review was to identify and prioritise any gaps in the AMP documents and focus improvements to provide the greatest benefit towards achieving Intermediate to Advanced AMP status (based on the International Infrastructure Management Manual AMP Maturity Index).

Overall, the 2013 AMP was found to present a preliminary summary of the asset information available to Shoalhaven Water, however significant improvements were required to both structure and content to improve the AMP. The AMP was found to be at the minimum level of AMP development as demonstrated in Figure 12-1 above.

Shoalhaven Water aims to improve the AMP to an intermediate level, with a score of above 0.70. A prioritised list of improvement tasks was provided as part of the AMP review and was used to inform this update to the AMP. Due to time constraints this AMP update incorporates some, but not all of the

recommended AMP improvements. Further improvements are required to advance the asset management activity to the upper intermediate level of development and these improvements are outlined in the improvement plan section of this AMP.

The AMP status and programme for improvements is explained below:

The 2013 AMP Review showed the AMP at core level of development.

Since the 2013 AMP Shoalhaven Water has continued to make significant improvements in asset management planning and practices and these are recorded in this AMP update.

Shoalhaven Water aim to improve the AMP to an intermediate level and an AMP framework has been developed (not yet populated) to achieve this.

The new AMP framework will be progressively updated.

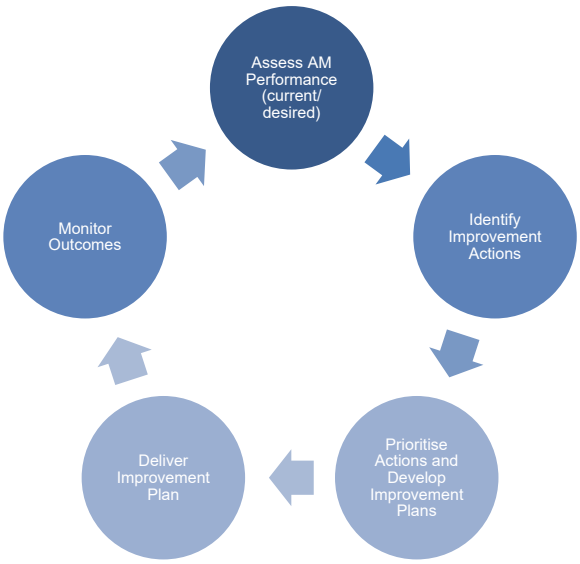
12.2 Continuous Improvement

Shoalhaven Water is adopting a strategic management approach to improvement planning and implementing improvement processes and practices. This Improvement Plan is integral to that approach, quantifying current business practice and measuring progress toward an identified future position.

12.2.1 Improvement Cycle

The purpose of the Improvement Plan is to identify, prioritise and implement specific projects and tasks which will increase the level of maturity over time.

Figure 12-2 Continuous Improvement Cycle



12.2.2 Current Practice Assessment

The first step of asset management improvement planning is to understand the current and future “appropriate practices”. To do this in a systematic way the following elements will be assessed:

- Asset Management Policy Development
- Levels of Service and Performance Management
- Demand Forecasting
- Asset Register Data
- Asset Condition
- Risk Management

- Decision Making
- Operational Planning
- Maintenance Planning
- Capital Works Planning
- Financial and Funding Strategies
- Asset Management Teams
- Asset Management Plans
- Information Systems
- Service Delivery Mechanisms
- Quality Management
- Improvement Planning

These key elements are critical to achieving sustained performance of the organisation at the lowest life cycle cost and to form a clear picture of how well it is performing in each of these elements and where the weaknesses lie. Each of the elements "adds value" to the raw business processes which leads to good asset management practice.

12.2.3 Identified Improvement Actions

A clear understanding of the gap between current and appropriate practice will help drive identification of improvement actions. However, identifying improvements should also be an on-going activity, not just a "one-off" gap assessment process.

Improvement actions need to be clearly scoped and defined. Failure to recognise the full costs associated with improvements may see the projects inadequately resourced and potentially not meeting the desired outcomes.

12.2.4 Develop Improvement Plan & Prioritise Actions

The Improvement Plan will be developed to identify the high priorities requiring action to focus the organisation on the most important areas. Utilising a simple improvement framework that has a clear relationship to the assessment elements will help people understand how the actions relate to the appropriate level of asset management required.

12.2.5 Deliver the Improvement Plan

The Improvement Plan needs to be strongly led, properly resourced and regularly monitored and reported by a steering group. Clear targets must be well defined with well specified deliverables that help focus on what is required.

12.2.6 Monitor the Outcomes

Organisations are under pressure to show the quantifiable benefits from improving asset management outcomes and this is a real challenge across local government. Regular asset management assessments using the frameworks in this section are currently the best way to demonstrate on-going improvement to asset management practices. Assessments should be undertaken over a number of years to track progress.

12.3 Current Asset Management Practice Assessment

In September 2012 Shoalhaven Water, as part of its commitment to improving asset management practices over time, commissioned GHD to undertake an Asset Management Capability review. Following the recommendations made in this review, Shoalhaven embarked on a number of improvements across the business and in September 2014 commissioned GHD to review progress against the initial set of recommendations.

The maturity of the water supply activity across the 9 assessment areas and 17 key asset management elements are shown in Table 12.2 and below. The blue bar in Figure 12-3 represents the baseline maturity determined in September 2012. Green is the recommended target to be achieved by 2016/17. Orange depicts the progress to September 2014 confirming the maturity advancements over the last 2 years.

The framework used to assess the maturity levels of each AM element is from the International Infrastructure Management Manual (IIMM). These elements have also been utilised to develop strategies for improving asset management practices over the next three years later in the section.

As depicted in Figure 12-3 below, progress to September 2014 shows consistent and steady improvements in asset management with the largest increases are in programming and data and information.

An updated list of business enhancement projects and priorities was produced to enable Shoalhaven Water to achieve an intermediate (competent 60 status) level of Asset Management Practice by June 2017.

Figure 12-3 Asset Management Maturity Assessment and Improvements as at September 2014

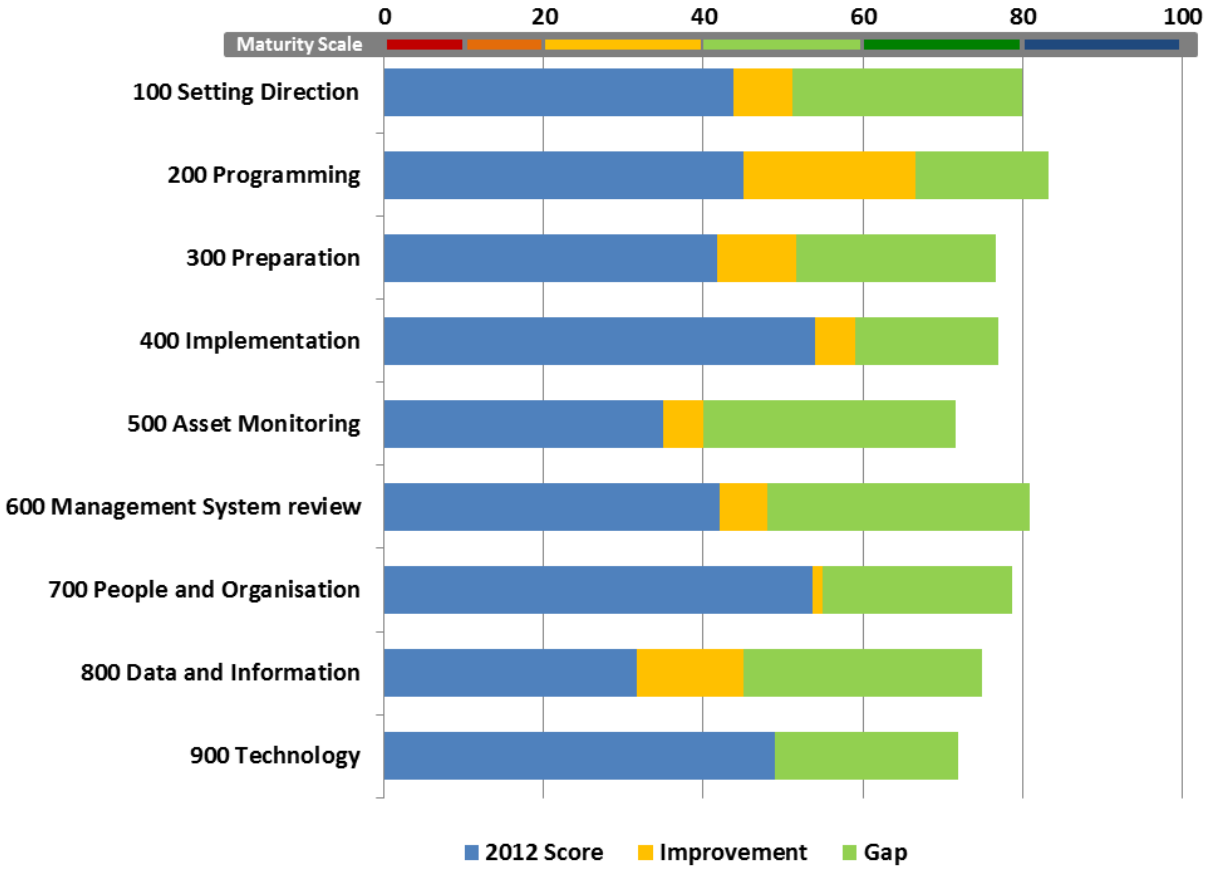
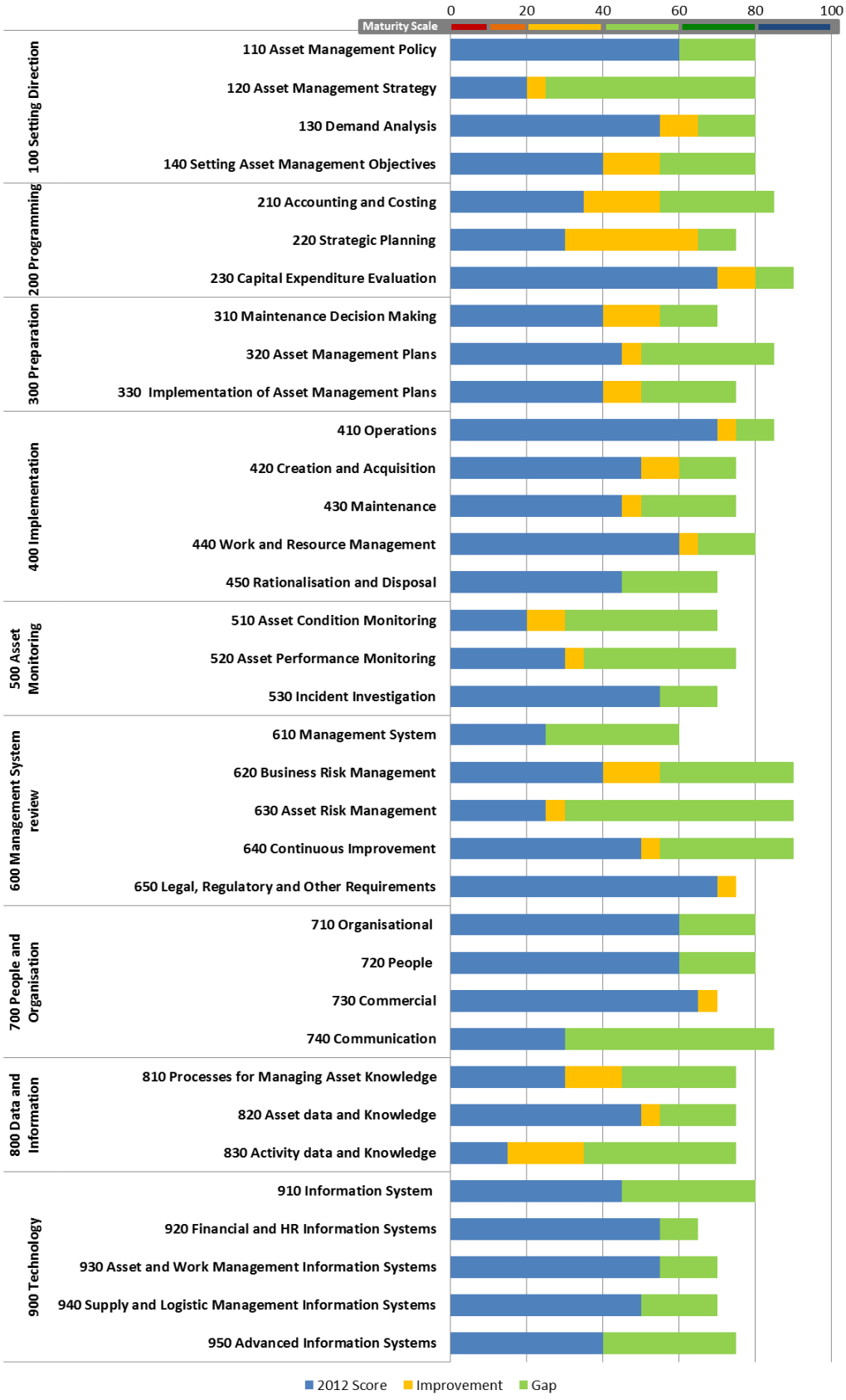


Figure 12-4 Assessment Element Results



Achievements

The improvements achieved over the past 6 years are summarised briefly below:

- Implementation of ArcGIS Collector App for mobile condition assessment of water hydrants, valves and mains.
- Development of Survey 123 for complex asset condition assessment.
- Development of GIS Officer Procedures documentation.
- Componentisation of Asset Register to component level
- Development of a Shoalhaven Water Asset Management Policy
- Review of Shoalhaven City Council Asset Management Strategy
- Adoption of a Community Engagement Policy, customer surveys and reporting
- Critical and Trade Waste customers being mapped into GIS
- Development of an Asset Information Framework
- Development of a Capital Investment Framework and Prioritisation Methodology and documentation of the business processes and policy
- Water and Wastewater servicing strategies to provide a program for system augmentation and capital works
- Asset Criticality Framework and Management strategies, Criticality Framework Implementation and Critical Assets Management Strategies
- Development of a Framework for the Water and Sewer Asset Management Plans
- Asset Management Plan Review
- Established a Shoalhaven Water Asset Management Steering Group and a Terms of Reference.
- Collector and other Asset Data Collections
- Asset Data Hierarchy Review.
- Asset Information Confidence Rating.
- Development of Customer Service Plan
- Update AMP's

12.3.1 Setting Priorities

A thorough asset management review process will often identify more improvements that an organisation is able to realistically deliver within a short timeframe. Therefore, there is a need to prioritise these actions, so they are realistic and affordable.

The projects/tasks are prioritised based on the gap between the current maturity and what is the appropriate target for the business unit, versus the cost. Table 12-1 below provides a general meaning ranging from Priority A (very high priority) to Priority E (very low priority).

Table 12-1 Prioritisation General Meeting

Priority		Explanation
A	Very High priority	These improvement tasks provide very high value for money and should be implemented in the short term (ie in the next year). The improvement tasks identified will provide the most benefit (eg overall improvement towards the appropriate target) for the least cost (less than $10,000) Typically, the higher benefit ones improve legislative compliance, greatly enhance operational efficiency, provide significant cost savings or mitigate major risk
B	High Priority	These improvement tasks provide high value for money and should be implemented in the short to medium term
C	Medium Priority	These improvement tasks provide a medium level of value for money and should be considered for implementation in the longer term
D	Low Priority	These improvements provide relatively low value for money, and should only be implemented after higher priority improvement tasks
E	Very Low Priority	These improvement tasks provide the least benefit for the highest cost and should only be implemented if they are a pre-requisite for another task, or there are no other higher priority tasks.

12.3.2 Three-Year Improvements

The tables that follow contain the improvement projects/tasks to be undertaken over the next 3 years across the organisation and specific improvements to be undertaken for the water supply activity. The table includes levels of resources, funding and priorities (based on the above matrix) for each identified improvement task.

Table 12-2 Improvement Plan

	Policy Statements	Findings	Recommend
Asset Management Strategy / Asset Management Plan			
	The Asset Management Plans (AMPs) will document the plan to manage Shoalhaven Water's assets to support the delivery of our strategic direction and our contribution to the Governments priorities and outcomes,	Asset management plans exist for the water, wastewater and telecommunications systems, and contain comprehensive information about the infrastructure and forecast expenditure needs. It is unclear how the AMPs are used in the management of the infrastructure systems. However, we note the improvements made to the sections on management strategies as compared to earlier versions of the AMPs, with information on current practice and what needs to be done to improve performance. These sections are core to the management of the assets and could be improved with timelines and dollars; i.e. what will be done by when, and how much is that going to cost (both capital and recurrent). Timelines and dollars should form the basis for budgeted investment in the infrastructure.	The asset ma removing the recommende policy docum updating ass Water. Noting that a output from a recommende to the budget The asset ma augmenting t stating long t term/next yea performance planning hori
	The Asset Management Strategy (AM Strategy) will guide the development and review of AMPs and specify appropriate LoS with community consultation,	The Asset Management Strategy is a comprehensive document. Aspects of the information may be repeated in the AMPs (e.g. life cycle costs) to augment the financial content of the AMPs. Figure 2-1 illustrates the relationship between organisational objectives and the asset management program. We find that it is not clear how each aspect of the asset management planning process connects and aligns with each other.	The asset ma by removing It is recomme Management from organisa strategies in with asset ma It is recomme service be in The asset ma in the previou to the Custor are expected performance Similarly, the Service that Service and planning stra investment in contributing t

	The AM Strategy and AMPs will be developed and updated to meet the requirements of the IPR Guidelines and Best Practice Management,	The reference to regulatory requirements or guidelines and other forms of best practice frameworks and concepts is an important part of developing a mature asset management program. We find that there are (more than) sufficient, defined activities to progress towards achieving excellence with the Shoalhaven Water asset management program.	It is recomme asset manag requirements It is recomme frameworks b which is a co shared set of practices. Th briefly review management
	AMPs will be developed for all infrastructure assets,	We find there are relatively current asset management plans for the three major infrastructure systems: water, wastewater and communications facilities. It is noted in the Asset Management Strategy that the asset management plans are to be updated annually. Incorporating updates of the asset management plans as a required activity in the budget development process is best practice with keeping the plans relevant, used and focused.	As reference management
	The AM Strategy and AMPs will be for a minimum time period of 20 years,	The Asset Management Strategy and asset management plans report to the 20 year planning horizon. However, we find that confidence in the quality, completeness and currency of the data is inconsistent and tending towards questioning whether the data may be relied upon. Data around levels and costs of service is considered to be an area for improvement in the strategy and plans.	It is recomme include a sep extent (i.e. po costs, conditi relied upon, v the data (with timelines).

	AMPs will include 20 year financial projections of capital expenditure (separated into renewals and replacements, asset enhancements and growth) and operational expenditure (separated into asset maintenance and operations),	We find that the detail associated with recurrent expenditure - operations costs, maintenance costs, administration/overhead costs - is not yet maturely developed in the asset management plans. There appears to be an underlying assumption that recurrent expenditure will increase, progressively, which may reflect CPI or the growth in an infrastructure system. Discussions in the interviews indicated the challenges in capturing cost data, particularly with the introduction of new software in which the data will ultimately be captured, stored and managed.	It is recomme concerted eff recurrent exp cost analysis can be const It is recomme developed fo comparison a systems and classes (e.g. water).
	Shoalhaven Water will establish and maintain an Asset Management Steering Group to guide the development, review and improvement of AM Strategy and AMPs.	We find that the Asset Management Steering Group is well established and actively involved in governing and directing the asset management program. It is acknowledged that the AMSG was actively engaged in this study.	It is recomme has been wit directing and against polic managemen It is recomme a review of th prime Techni Service.

Levels of Service			
	Levels of Service (LoS) will be aligned with strategic and legal/regulatory requirements and customers/stakeholders will have an opportunity to contribute towards the development of the LoS,	Levels of Service appears to be an area with opportunity for improvement as asset management maturity continues to develop within Shoalhaven Water, certainly with respect to embedding customer service performance within asset management planning processes and the asset management plans.	It is recomme levels of serv levels of serv investment ir with sustainir service perfo

	The LoS statements will be supported by performance measures and targets that are specific, measurable and appropriate,	A range of levels of service-related performance measures and targets were observed. Generally, these were considered to be useful and to be retained; with improvements focused on increasingly numeric or statistical measures and timelines for performance targets. Alignment between measuring the customers' levels of service and spending on the assets is not clearly developed and/or reported on.	It is recomme levels of serv levels of serv investment ir with sustainir service perfo
	The AM Strategy will guide the development and review of the LoS and performance measures and targets,	In its current form the Asset Management Strategy relies heavily on reference to the Customer Service Plan, which does contain levels of service type metrics and data. However, the purpose of the Strategy is to define how organisational objectives (i.e. Customer Levels of Service) are to be realised via the asset management program, through policy objectives, strategies and asset management planning activities. This alignment is not apparent.	It is recomme Managemen of organisatio strategies.
	The AMP(s) will set out how the assets will be managed to deliver the LoS.	Asset management plans typically explain how, technically, customer levels of service goals and targets will be sustained and achieved over the 20 year planning horizon. This is usually by aligning technical levels of service with customer levels of service and developing asset management program activities designed to deliver technical levels of service targets and, therefore, customer levels of service targets. We find that in their current form the asset management plans reflect planning processes that are not yet mature with respect to performance alignment and, therefore, are not yet structured to clearly demonstrate how the activities described in them are resulting in the delivery of customer levels of service.	It is recomme management customer lev planning proc

Risk Assessment and Management

	All sections within Shoalhaven Water will be responsible for undertaking risk assessments and developing risk management plans for their areas of responsibility,	We note from the briefings received at the beginning of this study that a formal risk framework is a high priority for Shoalhaven Water's asset management program. Reference was made to the WSAA Asset Risk Management Framework (PP3-027). It was found that risk is formally used with respect to business risks such as those associated with natural hazards (e.g. bushfires and storms). A criticality assessment has also been completed which correlates to risk management as critical assets (group or sub-group) inform the determination of the consequences associated with asset failure. The discussions during the interviews made reference to informal or ad hoc applications of risk management techniques, with a general willingness to apply practical risk tools when they become available. Risk, conceptually, was evident in asset management planning process. For example, age and condition criteria reflected the increasing likelihood of asset failure as assets aged and their condition deteriorated.	It is recomme as its risk ma such as asse register sprea developed to Current risk m assessments new tools. Criticality fram inform augme enable correla assessments.
	Risk management plans will be reviewed annually,	Risk management plans is, conceptually, a broad subject. A risk management plan could be developed for a critical pump station, or one could be developed for the entire water system, with a correlation between the two. On the basis that a risk management plan, as defined in the policy document, represents a summary document of all significant business risks in the asset management program, we find that such a plan does not yet exist.	It is recomme 027, Shoalha risks from cur edition of a S Plan, detailing business risks management (e.g. the next
	Training will be provided to an appropriate level to ensure that risk management is practiced throughout Shoalhaven Water's activities,	It is noted that, in the absence of a formal risk management business function, training in risk management is yet to be formally commenced across Shoalhaven Water.	It is recomme accompany th the form of an defined in ISO the PP3-027 f
	The AM Strategy will identify critical assets and outline risk management strategies for these assets,	Critical assets were determined and tabulated in a report, dated 2013. While critical assets don't necessarily change all that frequently, the nature of critical assets is such that updated versions of	It is recomme edited to inclu assets". It is recomme

		the critical assets report ought to be routinely kept up to date and readily available. The report also makes reference to "critical customers". It is noted that the policy document does not refer to this aspect of criticality. Critical assets are referred to in the Asset Management Strategy and the asset management plans.	critical assets in the Shoalha
	Shoalhaven Water's Emergency Response Plans will provide clear guidelines to assist Shoalhaven Water staff involved in responding to and recovering effectively from emergency situations,	A review of the Emergency Response Plan is outside the scope of this study. We note that the document appears to be comprehensive but, as an August 2019 version, is beyond its annual review date. The Plan contains information that may be used to inform business processes in the asset management program. For example: Level of Alert factors, Potential Effects of asset failures, and flowcharts that form the basis of standard operating procedures for, say, wastewater overflows.	It is recomme the Emergenc requirements
	Shoalhaven Council's Business Continuity Plan will ensure critical business functions can be maintained and/or restored in a timely fashion in the event of a material disruption to the organisation arising from internal or external events,	In the absence of available documentation no findings or recommendations are provided for this Policy Statement at this point in the study.	No recommer
	Shoalhaven Water's Drought Management Plan (DMP) is to ensure the water utility business of Shoalhaven Water, has an appropriate mechanism in place to allow it to carry out its responsibility to soundly manage water use during droughts and to minimise the risk of system failure in times of drought,	A review of the Drought Management Plan is outside the scope of this study. We note that the document appears to be comprehensive and published in 2013 (not confirmed). The Plan contains information that may be used to inform business processes in the asset management program. For example: Section 2.11 Water Supply Customers references average yearly usage by major customer type and reference to minimum water volume requirements. The Plan is, essentially, a basis for reducing Customer Levels of Service during low water availability periods and, as such, can be used to inform the development of Customer Levels of Service for abnormal operating periods.	It is recomme - as defined ir used to inform Service.

	The Operational Environment Management Plan (OEMP) will set out how the treatment plants are to be operated and will be updated as required.	In the absence of available documentation no findings or recommendations are provided for this Policy Statement at this point in the study.	No recommen
	Develop climate change resilience as in integrated part of the asset life cycle.	It is noted that climate change resilience is a current area of activity with Shoalhaven Water, starting before the 2019/2020 bushfire season with coastal assets with respect to sea level rise, but with increasing importance and attention following that season.	It is recomme with climate c assessments, likelihood of f climate. In ev given to the s existing/propo climate over a horizon.
	Capital works will be prioritised based on an assessment of project benefits and available budgets for both asset acquisitions and renewals,	The asset management plans describe a capital works prioritisation process and discussions in the interviews indicated that this was generally the process followed. Asset management program documentation also references prioritisation criteria. It was noted, however, that a life cycle process view was not available. This correlates with interview discussions around project initiation and the (limited) data available at that time that supports the project need.	It is recomme developed tha delivery proce into operation workflow inclu for information emphasis on
	Asset acquisition decisions are to be based on the evaluation of alternatives that take into account full life cycle costs, environmental, social and economic benefits and risks,	It is not clear from the available documentation the extent to which full life cycle costs are considered in asset acquisition decisions. It is considered that this is likely constrained to assumptions and typical percentages rather than being based on historical asset cost data. Triple bottom line benefits and risks are alluded to but are not clearly evident in the absence of an overarching workflow process that defines the analysis and reporting requirements for each step in the asset life cycle.	It is recomme introduced int planning and
	Minimum utilisation measures shall be determined for all assets to determine surplus assets,	Utilisation is conceptually referred to in the Asset Management Strategy and the asset management plans. It is not evident that utilisation measures have been developed.	It is recomme measures be other recomm process, an in evaluating uti
	All construction, whether it is asset replacement, renewal, upgrade or new, must consider ecological sustainable development,	In the absence of available documentation no findings or recommendations are provided for this Policy Statement at this point in the study.	No recommen

	Water and sewerage infrastructure will be provided to service planned development areas in accordance with the Development Servicing Plans (DSP) that will be maintained in accordance with the Best Practice guidelines.	A review of the Development Service Plans is outside the scope of the study. However, they have been made available and will be reviewed with a view to provide comment here.	No recommer
	A 20-year capital works plan will be developed to meet IPR and Best Practice guidelines.	The development of 20-year capital works plans appears to be relatively robust, albeit subject to the potential for improvement as alluded to in this study's findings and recommendations.	It is recomme management recommendat noting that th improvements subsequent v

Asset Operations and Maintenance			
	The water and wastewater assets will be operated and maintained to ensure that the Levels of Service are delivered at the most efficient long term cost,	As mentioned elsewhere we find the correlation between customer levels of service and asset management activities is limited. We note from interviews with operations staff and the staff maintaining the assets that data on their costs is fragmented, not readily captured in new information solutions, and generally low in confidence with respect to accuracy or relevance. As such, we find that demonstrating cost efficiency with respect to levels of service is unlikely to be determined to appropriate levels of detail.	It is recomme concerted effo recurrent exp
	Update the maintenance plans using reliability centred maintenance analysis techniques and cost benefits to determine the most appropriate economic practices to suit the assets and Shoalhaven Water,	We note from interviews with the staff maintaining the assets that data on their costs is fragmented, not readily captured in new information solutions, and generally low in confidence with respect to accuracy or relevance. We further note that staff indicate that the majority of their time is spent on reactive maintenance, with a corresponding lack of available resources to shift the effort to a better balance between reactive and planned maintenance activities. The latter appears to be constrained, in the short term, by the ongoing implementation and configuration of the new information solution.	It is recomme current plan f new informati that will enabl its asset man adjustments t planning impr realistic and a
	Undertake benchmarking of asset maintenance and lifecycle management techniques to ensure that Shoalhaven Water is adopting best appropriate practices in all areas,	It is noted that benchmarking comes in many forms. Benchmarking that Shoalhaven Water has previously participated in provided an opportunity to identify new practices - now incorporated into the Asset Management Policy document as Policy Statements - and to compare industry 'standard' metrics. The latter provide a degree of reassurance that asset management program outputs are generally in line with industry expectations.	In addition to benchmarking Water continu activities that outputs acros recommende effort, the timi ought to be n years. In the interim, focus its effor comparison o asset class, ir actual useful reliability met acquisition un this approach wastewater p

	Shoalhaven Water recognises the need to maintain its asset base and will target a long term asset sustainability index (actual replacement/renewal budget versus required funding as per AMPs) averaging 90-95% for each of the asset types,	While reference to a sustainability index, as defined in the Policy Statement, was not observed in the documentation made available for this study, we note in general that asset management planning activities are directed towards realising the long term asset sustainability index target (i.e. goal).	It is recomme developed as levels of servi
	20-year operation and maintenance budgets will be developed and included in the AMP and shall include an allowance for additional costs arising from addition of new assets through development, acquisition, dedication or leasing and/or licensing as well as an allowance to cover cost increases in line with indices relevant to each asset class,	It is noted that 20-year budgets for operations and maintenance activities are included in the asset management plans. It is not known how those costs are arrived at, but appear to be predominantly indexed from one year to the next.	It is recomme reflect a chan increases to f analysis. It is recomme forecasts be u increases ass increases for
	Adequate resources shall be provided to undertake regular agreed levels of inspections for risk, identifying programmed works, asset condition and renewal priorities,	In interviews with staff undertaking operations or maintenance activities it was determined that data on the volumes of work undertaken was not available and data from inspections was considered likely to be incomplete or unreliable. It was noted that improvements in this area are constrained until the implementation and configuration of the new information solution is complete.	It is recomme capturing insp incorporated i the new inform
	Appropriately audited preventative maintenance programs will be undertaken on all infrastructure and other assets to ensure that the lowest life cycle cost is achieved, and asset values are maintained,	In interviews with staff undertaking maintenance activities it was noted that the majority of the maintenance is, at the moment, deemed to be reactive. Additional notes on this have been made previously. We find that the preventative maintenance program requires the injection of additional resources to support staff in shifting from mostly reactive to more appropriate levels of preventative maintenance, subject to the availability of suitable functionality in the new information solution.	It is recomme preventative m the implemen information so additional res transition from
	Monitor and improve the planned (scheduled) maintenance regime for all infrastructure and other assets to ensure that the assets meet their design life in the most cost-effective way.	Based on previously documented findings in this table we find that, currently, it will be difficult to clearly link maintenance to actual asset useful life outcomes.	It is recomme preventative m the implemen information so

Asset Accounting, Costing and Budgeting			
	• Assets will be valued at intervals of no greater than 5 years using modern engineering equivalent replacement asset (MEERA) costs,	Based on the available documentation is not known when the most recent, complete MEERA-based valuation took place. Based on the interviews we understand that there is an ongoing effort to restructure asset registers - partly in response to the implementation of the new information solution, partly to address past errors and inconsistencies - but we are not certain on the current status of MEERA-based valuations.	No recommer
	Effective economic lives will be given to each asset with the written down value and depreciation value determined in accordance with accounting regulations,	We understand from the interviews that updated effective economic lives are being developed as a result of other improvements to the asset registers. Based on the documentation provided we understand that asset depreciation is stated to be in line with accounting regulations; noting that this is typically the case given the regularity of formal, mandated, routine financial audits.	No recommer
	In no case will the depreciation be less than the average annual annuity of the renewal cashflow necessary to sustain the existing assets group in a condition capable of delivering the level of service required by Shoalhaven Water's customers,	It is not observed in the documentation made available for this study how the average annual annuity aligns with depreciation, renewal cashflow requirements, maintaining appropriate asset condition and, ultimately, sustaining customer levels of service. It is noted that investment forecasts are intended to realise the outcome implicit in the policy statement, and we note from the interviews that there is a structured approach to calculating the annuity figures.	It is recomme annual annuit workflow impr table, and cor management
	Shoalhaven Water will determine the cost of asset service delivery on a full cost recovery basis which includes appropriate distribution of costs and overheads to: – Administration including any finance charges, – Operation, – Maintenance, – Depreciation expressed as either straight line or average annual annuity of the renewal cash flow. Where appropriate a capital use charge will be included at an appropriate opportunity cost of capital applied to the written down value of the assets to provide Shoalhaven Water with a return on assets invested and enable users to better	Elsewhere in this table we have found that the cost data that would enable the realisation of this policy statement is considered to be incomplete or otherwise unavailable.	Previous recc respect to dev following whic for full cost re applied.

	understand the true cost of service delivery.		
	That all costs will be determined on an accurate accrual basis and that any cost subsidies or community service obligations will be clearly defined and transparent to all stakeholders and customers,	We have noted previously that the limited granularity and low confidence in cost data is likely to impact on decision making based on that data. We find that likely to be the case here as well. However, we note that cost subsidies and community service obligations are important financial aspects that are likely to be appropriately tracked in Shoalhaven Water accounts.	Previous reco respect to dev following whic methodology remains valid
	That joint use facilities will be costed as stated above and full costs transferred to the relevant operating business units based on usage of assets,	It is not clear to what extent the costs associated with joint use facilities are subject to an equivalent degree of scrutiny that would allow Shoalhaven Water to confidently report on those costs, use those costs in life cycle and other analyses, and project future costs for those services.	It is recomme better historic applied to the facilities with and appropria
	Shoalhaven Water will keep detailed asset registers on all assets owned or under the control of Shoalhaven Water.	We understand that the implementation of a new information solution has provided the opportunity to update Shoalhaven Water's asset registers, with follow on opportunities to make other asset management planning improvements. At this time is not possible to form an opinion on the extent to which asset registers have been maintained, noting the references elsewhere in this table to challenges in maintaining comprehensive, accurate historical data sets. It is presumed that, as the new	It is recomme configuration the developm core, asset m asset register old assets are replaced.

		information solution is rolled out, new workflows will be developed such that newly updated asset registers will be kept up to date, routinely, in the future.	

Asset Reporting			
	Annual reports will meet the requirements of the Local Government Code of Accounting Practice and Financial Reporting, Best Practice Guidelines and the National Water Imitative.	An audit of asset management documentation against the specific requirements of legislative and regulatory instruments is outside the scope of this study.	No recommen

Appendix 1 – Critical Water Supply Assets

Appendix A – Critical water dams, reservoirs and balance tanks

Asset number	Name	Class	Reason for criticality
53636	Pointer Mt Balance Tank	Balance Tank	Protects main against over pressure
53650	Bamarang Off-stream Storage	Dam	Water source, valuable infrastructure
53651	Danjera Dam	Dam	Water source, valuable infrastructure
53656	Porters Creek	Dam	Water source, valuable infrastructure
53616	Cambewarra	Reservoir	Only way to supply the whole of Cambewarra
53619	Shoalhaven Heads	Reservoir	Critical asset potentially only until watermain is upgraded *
53627	Coonemia (Large)	Reservoir	Feeding large population
53646	Pitt Street (Low)	Reservoir	Only way to supply the Cambewarra reservoir
53660	Bewong	Reservoir	Transfer tank to feed southern areas
53637	Milton	Reservoir	Major feed to large area and transfer tank
53634	Berringer Lake	Reservoir	Back up to feed Milton
53657	Flatrock WTP (Low Level)	Reservoir	Feeds large area and cannot feed from Network, feeds critical customer
53654	Flatrock WTP (High Level)	Reservoir	Feeds large area and cannot feed from Network
53658	Bamarang WTP1	Reservoir	To ensure functioning of WTP, feeds large population
53659	Bamarang WTP2	Reservoir	Main supply to Nowra
53638	Narrawallee	Reservoir	Feeds large area, capacity of reservoir is required
53632	Vincentia	Reservoir	Feeds very large area
53640	West Ulladulla (Large)	Reservoir	Feeds large area, capacity of reservoir is required
53649	Radar Hill	Reservoir	Break pressure tank, feed to defence
53609	Bendeela Pondage (Kangaroo Valley)	Reservoir	No bypass at the tank
53661	Milton WTP Clear Water Tank	Reservoir	WTP relies on this reservoir

Appendix B – Critical water supply pump stations

Asset number	Locality	Name	Reason for criticality
52307	Burrier	Burrier	Primary draw for water supply
52308	Bamarang	Bamarang	Only pump supplying water treatment plant
227562	Bamarang WTP	Bamarang WTP 2	Primary supply to southern area and Defence
52316	North Nowra	Cambewarra	No other source to feed Cambewarra reservoir
52302	Berry	Berry	No other source to feed Berry reservoirs
227415	Bamarang WTP	Bamarang WTP 1	For water treatment plant operation
52323	Worrigee	Brundee	No other source to feed Vincentia Reservoir
52312	Lake Conjola	Conjola	No other source to supplement southern scheme
52301	Kangaroo Valley	Bendeela (Kangaroo Valley)	No other source to feed water treatment plant
52314	Ulladulla	Croobyar Road	Small population, no other supply to residents, further info required to assess criticality (tank supply)
247782	Yatte Yattah	Pointer Road	Small population, gravity feed to some residents, further info required to assess criticality (tank supply)

Appendix 2 – 5 YR CAPITAL EXPENDITURE (21/22-26/27)

Existing_Proposed	Existing Project Code	Existing Project Name	Proposed Project Name	Review Status	Year 1 Amount	Year 2 Amount	Year 3 Amount	Year 4 Amount	Year 5 Amount
Current	104079	Communication Towers Capital -GF		Draft	0	0	1,000,000	0	0
Current	104080	Communications Section		Draft	8,800	9,000	9,200	9,400	9,600
Current	104198	Water New services instal & relocate		Draft	600,000	600,000	600,000	600,000	600,000
Current	104199	Water Meter New Services/Replacements	Trf to 104198 as discussed with MK check with Teddy can these be charged to chargeable pvte wks?	Draft	0	0	0	0	0
Current	104202	Water Office furniture & equipment		Draft	120,000	120,000	120,000	120,000	120,000
Current	105218	Sewer Office furniture & equipment		Draft	120,000	120,000	120,000	120,000	120,000
Current	104201	Water Land Purchases		Draft	100,000	100,000	100,000	100,000	100,000
Current	104275	Sewer Land Purchases		Draft	200,000	200,000	200,000	200,000	200,000
Current	104147	Water A&W minor works program		Draft	250,000	250,000	250,000	250,000	250,000
Current	104262	A&W minor works program - Sewer		Draft	60,000	60,000	60,000	60,000	60,000
Current	104210	Nth-Sth transfer system improvements		Draft	10,000,000	10,000,000	5,000,000	0	0
Current	105165	Sewer Coastal Zone Management-Concept Options Report-South		Draft	950,000	1,000,000	1,000,000	1,000,000	1,000,000
Current	104231	Water Minor main extension		Draft	50,000	50,000	50,000	50,000	50,000
Current	104248	Sewer Various new electrical cabinets		Draft	550,000	550,000	550,000	0	0
Current	104235	Yalwal tourist upgrade		Draft	50,000	2,000,000	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Berry STP storm pond	Draft	0	100,000	800,000	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Bom Crams Rd New SPS 28 + RM + GM	Draft	0	0	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Cabbage Tree Lane TM (200mm x 1.2km)	Draft	0	360,000	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Callala STP New 8000 Eat Tank	Draft	0	0	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Culburra STP Upgrade tertiary filters	Draft	0	0	0	0	0

Proposed	999960	10YR Capital Plan - Proposed Project A60	Culburra West New SPS - 1 +RM	Draft	0	0	0	526,000	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Culburra West New SPS - 2 + RM	Draft	0	0	0	420,000	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Culburra West New SPS - 4 +RM	Draft	0	0	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Danjerra Dam Bridge	Draft	600,000	0	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Edwards Ave Bomaderry, SPS 8 Inlet GM	Draft	235,000	0	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Erowal Bay Sewer Protection	Draft	0	1,500,000	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Manildra Raw Water main relocation ? Princess Highway Nowra	Draft	0	0	0	1,000,000	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Manyana (Kylor Development) SPS + RM	Draft	0	0	0	0	540,000
Proposed	999960	10YR Capital Plan - Proposed Project A60	Milt/Ull Downstream SPS U5 GM upgrade	Draft	0	0	170,000	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Milt/Ull GM between SPS M2 & SPS M3	Draft	0	0	120,000	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Milt/Ull M2 RM	Draft	0	0	0	150,000	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Milt/Ull SPS B4 GM	Draft	0	0	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Milt/Ull SPS M3 GM upgrade	Draft	0	0	100,000	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Milt/Ull SPS N1 RM upgrade + GM	Draft	0	715,000	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Milt/Ull SPS SPS Z7 New RM	Draft	0	2,250,000	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Milt/Ull SPS U5 RM upgrade	Draft	0	100,000	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Milt/Ull SPS Z2 RM upgrade	Draft	0	420,000	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Milton Elevated Reservoir	Draft	0	575,000	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Milton WTP Augumentation	Draft	0	0	0	2,000,000	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Mundamia - 200mm Feeder Main	Draft	4,320	85,680	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Mundamia SPS N-F4 - RM and GM	Draft	850,000	0	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	New Asset Enhancement Works to be determined	Draft	0	0	350,000	3,000,000	2,000,000
Proposed	999960	10YR Capital Plan - Proposed Project A60	New Asset Enhancement Works to be determined	Draft	0	0	2,000,000	0	2,500,000

Proposed	999960	10YR Capital Plan - Proposed Project A60	New Growth Works to be determined	Draft	0	0	0	0	1,000,000
Proposed	999960	10YR Capital Plan - Proposed Project A60	New Growth Works to be determined	Draft	0	0	0	1,000,000	2,000,000
Proposed	999960	10YR Capital Plan - Proposed Project A60	New Renewals Works to be determined	Draft	0	0	2,500,000	1,500,000	2,500,000
Proposed	999960	10YR Capital Plan - Proposed Project A60	New Renewals Works to be determined	Draft	0	0	0	3,000,000	2,000,000
Proposed	999960	10YR Capital Plan - Proposed Project A60	Nowra GM upstream SPS 3 StAnnes St	Draft	0	0	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Nowra GM Upstream SPS 4	Draft	0	0	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Nowra Golf Club WM Renewal	Draft	0	250,000	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Nowra Lyrebird SPS2 GM Upgrade	Draft	2,000,000	0	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Nowra Nth Illaroo Rd East GM Replacement	Draft	0	212,000	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Nowra Sewer Main Upgrade Program	Draft	0	700,000	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Nowra Sth Residential SPS D (179D)	Draft	0	430,000	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Nowra SthSPS 20 Surcharge main	Draft	140,000	0	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Nowra SthWest Gaol Construct 225dia.Sew Main Fut Indust Land	Draft	0	0	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Nowra West Cabbage Tree Gravity Trunk Mainupstream of SPS3	Draft	0	0	0	1,000,000	1,000,000
Proposed	999960	10YR Capital Plan - Proposed Project A60	Nowra West Cabbage Tree-Service Expan,SPS+RM+upstream GM	Draft	0	0	0	1,162,000	250,000
Proposed	999960	10YR Capital Plan - Proposed Project A60	Nowra West SPS 21 Decommission	Draft	0	100,000	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Nowra West SPS 26 (Uni) RM	Draft	0	0	588,000	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	SGB STP New 8000EP tank x 2	Draft	0	0	0	2,963,000	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Sussex Badgee Lag TM Ext.Suncrest Ave&Expansion(220mmx1.8km)	Draft	0	285,000	0	0	0

Proposed	999960	10YR Capital Plan - Proposed Project A60	Sussex Inlet STP Augumentation	Draft	0	1,555,000	2,000,000	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Ulladulla STP Filters & Storm pond	Draft	0	0	0	300,000	4,000,000
Proposed	999960	10YR Capital Plan - Proposed Project A60	UV Upgrade - Sussex Inlet Treatment Plant	Draft	0	1,000,000	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Various Emergency Storage	Draft	50,000	2,000,000	0	50,000	2,000,000
Proposed	999960	10YR Capital Plan - Proposed Project A60	Various Sewerage DSP	Draft	0	100,000	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Various Sewerage Strategy	Draft	0	100,000	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Various Water Supply DSP	Draft	0	100,000	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Various Water Supply Strategy	Draft	0	100,000	0	0	0
Current	105178	North Nowra surcharge main excluding bridge works		Draft	81,000	0	0	0	0
Current	104329	St Anns St Rising Main Replacement		Draft	1,125,000	0	0	0	0
Current	104279	Sewer Various minor development works		Draft	50,000	50,000	50,000	50,000	50,000
Current	105200	Bamarang WTP upgrade clarifier		Draft	1,511,944	2,398,126	0	0	0
Current	104154	Burrier WPS 33 kv Substation		Draft	1,423,867	0	0	0	0
Current	104221	Burrier Replacement of Raw Water Supply		Draft	176,000	0	0	0	0
Current	104163	Central Region AC water main replacement		Draft	1,146,666	151,111	0	0	0
Current	105177	Husk Vincentia SPS 7 RM & GM upgrade		Draft	807,000	0	0	0	0
Current	105228	Water Moss Vale Road expansion area		Draft	3,750,000	3,750,000	3,750,000	0	0
Current	105228	Water Moss Vale Road expansion area		Draft	0	0	0	0	0
Current	104286	Moss Vale Rd expansion area - WWtr		Draft	4,750,000	1,250,000	5,250,000	4,500,000	3,000,000
Current	104286	Moss Vale Rd expansion area - WWtr		Draft	0	0	0	0	0
Current	105201	Bendeela Reservoir		Draft	180,800	0	0	0	0
Current	105174	SPS Emergency storage upgrade program		Draft	1,275,000	0	0	0	0
Current	104184	Water Various white PVC main replacements		Draft	1,542,000	582,000	0	0	0
Current	100674	Water Vehicle Purchases		Draft	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
Current	101588	Water Plant Purchases		Draft	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
Current	100676	Sewer Vehicle Purchases		Draft	200,000	200,000	200,000	200,000	200,000

Current	101695	Sewer Plant Purchases		Draft	500,000	500,000	500,000	500,000	500,000
Current	104238	Nowra Sth, Flinders Depot electrical work		Draft	3,000,000	0	0	0	0
Current	104230	Milton WTP MCC replacement - investigati		Draft	240,000	0	0	0	0
Current	104237	Various reservoirs security upgrades		Draft	20,000	20,000	20,000	20,000	20,000
Current	104301	Various CCTV STP install		Draft	30,000	30,000	30,000	30,000	30,000
Current	105286	Water Various Chlorine Safety Improvements		Draft	90,000	90,000	90,000	90,000	90,000
Current	104323	WstWtr Various chlorine safety improvements		Draft	30,000	30,000	30,000	30,000	30,000
Current	104180	Water Various electrical replacements		Draft	20,000	20,000	20,000	20,000	20,000
Current	104299	Various microwave & VOIP upgrade		Draft	30,000	30,000	30,000	30,000	30,000
Current	104233	Water Various microwave and VOIP upgrades		Draft	100,000	100,000	100,000	100,000	100,000
Current	104305	Sewer Various Optical Fibre Install-Replacement		Draft	15,000	15,000	15,000	15,000	15,000
Current	105221	Water Various optical fibre install-Asset Enhancement		Draft	15,000	15,000	15,000	15,000	15,000
Current	104940	Sewer Various optical fibre install asset enhancement		Draft	25,000	25,000	25,000	25,000	25,000
Current	104239	Various reservoirs CCTV instal alarm upgrade		Draft	30,000	30,000	30,000	30,000	30,000
Current	104254	Sewer Various SPS electrical replacements		Draft	20,000	20,000	20,000	20,000	20,000
Current	104251	Sewer Various SPS VSD replacements		Draft	60,000	60,000	60,000	60,000	60,000
Current	104263	Various pump failure replacement program		Draft	200,000	200,000	200,000	0	0
Current	104256	Sewer Various access road renewals		Draft	10,000	10,000	10,000	10,000	10,000
Current	104304	Various odour control		Draft	20,000	20,000	20,000	20,000	20,000
Current	104253	Sewer Various security fence replacements		Draft	20,000	20,000	20,000	20,000	20,000
Current	104318	Various STP WHS improvements		Draft	10,000	10,000	10,000	10,000	10,000
Proposed	999960	10YR Capital Plan - Proposed Project A60	Callala SPS 3 RM Replacement	Draft	400,000	0	0	0	0
Proposed	999960	10YR Capital Plan - Proposed Project A60	Refurbishment of St Georges Basins Inlet Works	Draft	47,500	0	0	0	0
Current	105198	Bolong Rd & Shoalhaven Hds Rd main repl		Draft	93,600	0	0	0	0
Current	105199	Albert St Berry minor mains repl		Draft	83,600	0	0	0	0
Current	104244	Water Various additional valves		Draft	20,000	20,000	20,000	20,000	20,000
Current	104157	Water Various PRV replacements		Draft	100,000	75,000	50,000	25,000	20,000

Current	104181	Water Various fencing replacements		Draft	120,000	120,000	100,000	100,000	100,000
Current	104182	Water Various steel work replacements		Draft	20,000	20,000	20,000	20,000	20,000
Current	104167	Various reservoir hatch upgrades		Draft	20,000	20,000	20,000	20,000	20,000
Current	104183	Water Various road replacements		Draft	25,000	25,000	25,000	25,000	25,000
Current	104243	Various WTP WHS improvements		Draft	20,000	20,000	20,000	20,000	20,000
Proposed	999960	10YR Capital Plan - Proposed Project A60	Berry 1.4ML Steel Reservoir Repainting	Draft	0	0	0	0	0