Prepared for
MidCoast Council
ABN: 44961208161

**DRAFT**

# Integrated Water Cycle Management Strategy

## Options and Scenarios Report

19-Jun-2023
IWCM Strategy Options and Scenarios

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**Note on Terminology**

AECOM acknowledges the diversity of Aboriginal and Torres Strait Islander people, their communities and cultures. Throughout this document we refer to the Aboriginal and Torres Strait Islander Community as inclusive of the many different First Nations Peoples in Australia, including Aboriginal and Torres Strait Islander communities. The words Indigenous, First Nations and Aboriginal and Torres Strait Islander people are used interchangeably throughout this document.

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# Integrated Water Cycle Management Strategy

Options and Scenarios Report

Client: MidCoast Council

ABN: 44961208161

Prepared by

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# List of Acronyms

| Acronym | Term |
|---|---|
| BASIX | Building Sustainability Index |
| BAU | Business as usual |
| DCCEEW | Department of Climate Change, Energy, the Environment and Water |
| DPE | Department of Planning and Environment |
| ET | Equivalent Tenant |
| IWCM | Integrated Water Cycle Management |
| LGA | Local Government Area |
| LOS | Level of Service |
| QBL | Quadruple Bottom Line |
| RTP | Recycled Water Treatment Plant |
| TRB | Typical Residential Bill |
| STP | Sewage Treatment Plant |
| WTP | Water Treatment Plant |

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# Executive Summary

## Introduction

MidCoast Council (Council) has engaged AECOM to undertake the options and scenarios assessment for the Integrated Water Cycle Management (IWCM) Strategy. The strategy will provide Council with a framework to deliver safe, secure, and cost-effective water and sewer services to the community.

This report provides:

- An overview of the IWCM journey to date
- A description of the strategic issues and the long-list of potential options to address these issues
- An evaluation of options and development of scenarios integrating solutions for identified issues in consultation with key stakeholders, and a recommendation for preferred scenario
- A long-term adaptive plan identifying the preferred servicing pathway that meets the required levels of service, and potential triggers points that may deviate from the preferred pathway.

The objective of this report is to present the options and scenarios assessment of the strategic issues that will be addressed in the IWCM Strategy.

The IWCM Strategy will be supported by the preferred scenario and Council's 30-year investment plan.

## MidCoast and IWCM

The MidCoast Council Local Government Area (LGA) encompasses parts of the New England, Hunter, and Mid-North Coast regions of New South Wales. In 2016, Gloucester Shire, Great Lakes and Greater Taree Councils were amalgamated to form MidCoast Council, covering an approximate area of 10,000 square kilometres. The MidCoast region currently has a population of 93,800 people which is expected to grow by around 42 percent by 2050. With a growing region, Council needs to ensure it understands the servicing needs and preferences of its community and be able to provide safe and reliable water and sewer services over the long-term.

IWCM is a holistic approach to managing water resources that considers all aspects of the water cycle and integrates water and urban planning. The IWCM strategy helps set the objectives, performance standards and associated performance indicators for the water and sewer business, while ensuring infrastructure meets the needs and priorities of all stakeholders.

## Strategic Issues

Council commenced review of the 2015 *Our Water Our Future* IWCM Strategy in 2021 with an Issues Paper. The paper identified a total of 76 issues with 72 of these issues categorised as operational issues and covered under business-as-usual (BAU) activities. The remaining four issues were identified as strategic issues. These are:

- Water security for the Manning, Bulahdelah, Gloucester and Stroud supply systems
- Sustainable effluent management across 13 sewerage systems
- Unserviced villages for sewage (30 villages assessed, with varying priority)
- Climate change

The Issues Paper is available in Appendix A.

### Water Security

The Issues Paper identified insufficient secure yield for the Manning, Gloucester, Stroud, and Bulahdelah Water Supply Schemes as the key strategic issue. Currently, these schemes rely on rainfall dependent sources with limited storage. Climate change is expected to have a significant impact on water security. In 2019-20, the MidCoast region experienced the worst drought on record, requiring the longest period of water restrictions in Council's history, including implementing Level 4 restrictions for the first time. In addition to the changing demand and supply trends, Council also needs to be able to respond to shocks and events like the 2019-20 drought and ensure resilient and sustainable solutions are implemented.

The Manning scheme is the largest scheme of the MidCoast region, servicing over 80 percent of the customers within the LGA. Water is sourced from the Manning River and stored at Bootawa Dam. The dam is located on an unnamed tributary of the Manning River, approximately 7.5 km southwest of Taree has a current storage capacity of 2,250 ML. Due to the criticality of this scheme, a coarse screening assessment that produced a short-list of servicing options was undertaken in 2022. The results of this assessment were then adopted in the scenarios phase of this project.

The Bulahdelah, Gloucester, and Stroud schemes all service small inland townships, located south and west of the Manning scheme. The water supply for each of these schemes are local rivers. Bulahdelah is sourced from upstream of the Crawford Weir, which has 163 ML on-stream weir storage. Gloucester is sourced from the Barrington River and has no weir or off-stream storage dam. It is essentially a 'run of the river' scheme. Water supply for Stroud is sourced from the Karuah River and stored in a 50 ML off-stream storage dam adjacent to the water treatment plant (WTP).

Council has adopted the '5/10/10' level of service (LOS) rule to assess secure yield, which is used to assess whether infrastructure meets the following requirements:

- Total time spent in drought restrictions should be no more than 5 percent of the time
- Restrictions should not need to be applied in more than 10 percent of years and
- An average reduction of 10 percent in water usage during restrictions

This methodology approximates the severity of a '1-in-1,000-year drought' with secure yield defined as the highest annual water demand that can be supplied from a water supply headworks system whilst meeting the 5/10/10 LOS rule. Water security is achieved in the secure yield of a water supply which is at least equal to the unrestricted dry year annual demand. Where current infrastructure does not meet the 5/10/10 LOS rule, options are considered to upgrade the source systems to comply with this rule.

**Sustainable Effluent Management**

Council operates 14 sewage treatment plants across 13 sewerage schemes in the MidCoast region. Recycled water schemes are found within ten of these schemes. Currently, between 10 to 25 percent recycled water is supplied to end users in average rainfall year. Recycled water is supplied for irrigation purposes, to agricultural farms and for open spaces. These practices can be reviewed to further increase reuse or explore other sustainable effluent management practices.

**Unserviced Villages**

The MidCoast region covers 195 towns and localities. Within these communities, there are many villages that remain unserviced and require on-site wastewater management systems. In 2019, Council prepared a risk assessment for 30 villages. Options for unserviced villages were therefore not developed in this project. The outcomes from the 2019 assessment were considered in the development of the preferred scenario.

**Climate Change**

A climate emergency was declared by Council in 2019. Targets for reducing emissions were set by Council, which include achieving Net Zero greenhouse gas emissions and 100 percent renewable energy for all operations by 2040. The strategic issue of climate change therefore needs to be reviewed at the asset level and taken into consideration in the development of options for other strategic issues.

A comprehensive list of options has been evaluated, including options that improve Council's resilience to climate change and opportunities that support Council's path to Net Zero emissions. Ten categories of long-listed climate change options were assessed against six projected long-term climate change trends:

- Increased temperatures including longer and hotter heat waves
- Increased rainfall intensity and flooding

- Rising sea levels
- Increased frequency and severity of bushfires
- Increased frequency and severity of drought and associated water scarcity
- Increased frequency and severity of extreme storms.

## Planning and Assessment Approach

The approach to develop the preferred strategy is presented in Figure 0-1.

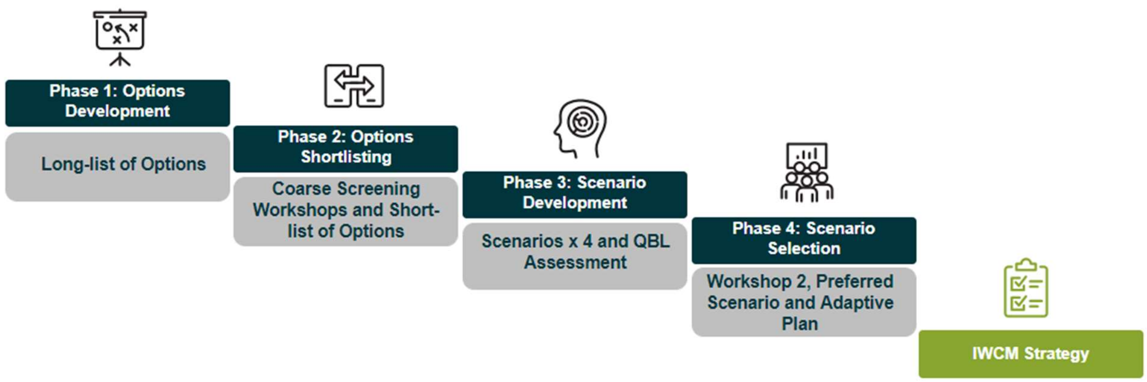


**Figure 0-1: Planning approach for development of preferred strategy**

The strategic planning was completed in four phases:

- Phase 1: an ‘all options on the table’ approach was adopted and a long-list of options identified for each of the four strategic issues identified in the Issues Paper.
- Phase 2: of the long list of options was screened into a short-list through a suite of coarse screening workshops with key stakeholders. The long-list was screened against the assessment criteria, which was developed with indicators that are in line with Council’s Risk Management Framework.
- Phase 3: the short-listed options from Phase 2 were then packaged into four scenarios for Phase 3. These four scenarios were assessed based on a Quadruple Bottom Line (QBL) analysis. The QBL included economic, environmental, social and governance considerations.
- Phase 4: to ensure the solutions accommodated the needs and preferences of the community, the scenarios were presented the community in Phase 4. With feedback received and based on the engineering and QBL assessments completed, a preferred scenario was established. Financial modelling was undertaken to understand the impact on revenue, expenditure and ultimately the cost to householders. The preferred scenario and adaptive plan were then developed for the IWCM Strategy.

Adaptive planning is a structured process to feed new information into decision making through ongoing monitoring and evaluation of the situation. It identifies a wide range of possible futures and accounts for uncertainties that could change decisions in the future. The preferred IWCM strategy was developed with an adaptive plan identifying four alternate pathways, with decision points and triggers that need to be monitored to keep track of the serviceable pathway.

### Stakeholder Engagement

Stakeholder engagement was a key component for the development of the preferred strategy. Various stakeholders were involved throughout the journey, including Council employees, representatives from the Department of Planning and Environment (DPE), community groups and members of the public.

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- The coarse screening workshops presented all options for each strategic issue. Interactive discussions were held with participants from Council and DPE, to arrive at an endorsed short-list of options for each strategic issue to be taken forward to the scenario development stage.
- Several engagement activities were undertaken with the community to understand their needs and values on the strategic issues.
    - The youth were engaged through drawing competition for primary level children. The aim of this was to encourage children to consider the importance of water and present their ideas in a creative format.
    - A Youth Hackathon competition was held for senior high school students. Fifty students split into nine teams developed creative solutions to solve water security, effluent management and climate change issues.
    - The Our Water Our Future Group, consisting of varying members of the community with a diverse range of backgrounds and experiences, was engaged in two workshops. The first workshop served to provide feedback on the strategic issues identified and build the group's understanding of Council's water challenges. The second workshop provided an opportunity for the working group to provide feedback on their concerns and priorities from the four different scenarios. The feedback received was integrated into the QBL assessment for identifying the preferred IWCM strategy.
    - Online engagement was undertaken through Council's 'Have Your Say' page. The community was provided with an opportunity to vote on different options for the preferred strategy.
    - Pop-up stalls at community markets were held. Members of the public has options to ask questions and discuss the strategic issues and the scenarios developed.

**Secure Yield Modelling**

To support verification of water security issue and development of scenarios, a secure yield assessment was undertaken for the Manning, Bulahdelah, Gloucester and Stroud water supply schemes. The assessment was undertaken using bespoke hydrologic water balance models of the schemes utilising GoldSim software. The yield modelling considered the potential effects of climate change on the availability of water using climate data from various sources. The assessment for baseline conditions indicated that water security is not achieved for Manning, Gloucester and Stroud water supply schemes under both present day (2020) and future (2051) demands. The results for Bulahdelah indicated that water security was achieved for present day conditions. Bulahdelah has a 228 ML on-stream weir, with 163 ML usable storage. However, Bulahdelah failed to meet the 5/10/10 LOS rule for future (2051) demands.

## Strategic Options

### Long-listed Options

Options were identified and developed based on desktop assessment and previous investigations for:

- Bulahdelah, Gloucester and Stroud Water Supply Schemes for water security
- 14 sewage treatment plants for sustainable effluent management
- Climate change mitigation and adaptation.

An assessment of key risks, issues and opportunities was completed, and high-level cost estimates were developed.

### Short-listed Options

Three workshops were held with stakeholders from Council and DPE to undertake the coarse screening of long-list options. The screening of options was based on a fatal flaw approach, where any failed criteria resulted in a failed option. At the end of each workshop, a list of options was endorsed for shortlisting.

## Climate Change

Climate change adaptation measures were identified to support resilience in existing and future assets. All identified climate change adaptation measures were retained through the short-listing process, although some measures were likely to be highly location-specific whereas others would apply at a regional scale. It was also identified that while some risks are likely to fall outside the planning horizon of this IWCM, they should still be considered for future infrastructure needs. The options considered are presented in Table 0-1.

**Table 0-1: Climate change options progressed**

| Climate Change Options | |
|---|---|
| Relocation of plant and equipment | Elevation of electrics |
| Network reconfiguration | Drainage works |
| Active management / operational changes | Alternative power supply |
| Erosion management | Automation of plant |
| On-site bunding | Buffer zones |

## Water Security

Demand management and conservation measures were identified as actions under Council's normal operations. These include implementation of a permanent water conservation program, an ongoing water education and behaviour program, installing smart meters and bulk flow meters, pressure reduction and active leak detection. Full details on these measures are available in Section 6.1.1. Table 0-2 provides a summary of the short-listed options for water security. Options that were progressed for scenario development are highlighted in green. Some options were progressed for further planning and/or investigations to determine feasibility of the solution. Others were identified as options considered for supplementary or emergency purposes only. The Nabiac groundwater option is currently being progressed for delivery by Council.

**Table 0-2: Short-listed options for water security**

| Scheme | Short-listed Options | Consideration |
|---|---|---|
| **Manning (from Manning Coarse Screening Report)** | Increase storage yield via new Peg Leg Creek Dam | Progressed to scenario development |
| | Desalination of estuarine water at Nabiac WTP | Emergency response only |
| | Desalination of sea water at Hallidays Point | Progressed to scenario development |
| | Recycled water for municipal irrigation, agricultural and construction use | Supplementary option |
| | Groundwater – Nabiac Aquifer | In delivery |
| | Regional connection – pipeline to Port Macquarie Hastings | Further investigation |
| | Purified recycled water for potable reuse | Progressed to scenario development |
| **Gloucester** | New off-stream storage dam | Progressed to scenario development |
| | Stratford mine dam | Further investigation |
| | Desalination of sea water | Fails as standalone, consideration for integration with Manning desalination option |
| | Recycled water for unrestricted use | Supplementary option |
| | Regional connection – pipeline from Manning via Krambach | Progressed to scenario development |

| Scheme | Short-listed Options | Consideration |
|---|---|---|
| | Regional connection – water carting from Tea Gardens | Emergency response only |
| | Groundwater | Progressed to scenario development |
| **Bulahdelah** | New off-stream storage dam | Progressed to scenario development |
| | Regional connection – pipeline from Manning via Nabiac | Progressed to scenario development |
| | Regional connection – water carting from Tea Gardens | Emergency response only |
| | Groundwater | Progressed to scenario development |
| **Stroud** | Additional off-stream storage with new dam | Progressed to scenario development |
| | Duralie Mine Dam (considered both for pipeline transfer and emergency measure) | Further investigation |
| | Regional connection – pipeline from Hunter via Dungog | Further investigation |
| | Regional connection – pipeline from Gloucester via Stratford Dam | Contingent upon option feasibility for Gloucester scheme; viable for emergency measure |
| | Regional connection – water carting from Tea Gardens | Emergency response only |
| | Groundwater | Progressed to scenario development |

Sustainable Effluent Management

The short-listed options for each sewerage scheme are presented in Table 0-3. In addition to these options, inflow and infiltration management and demand management were identified as actions under Council's normal operations. Council has two dedicated full-time inflow and infiltration crews. Details on these measures are available in Section 6.1.1.

**Table 0-3: Short-listed options for sustainable effluent management for each sewerage scheme**

| Sewerage Scheme | Options Progressed |
|---|---|
| **Hallidays Point** | Recycled water for restricted use (further investigation to identify users) |
| | Recycled water for unrestricted use |
| | Purified recycled water for drinking (long-term water security solution) |
| | Exfiltration |
| **Forster** | Recycled water for unrestricted use |
| | Purified recycled water for drinking (long-term water security solution) |
| | Ocean/shoreline outfall |
| **Taree/Dawson** | Recycled water for restricted use |
| | Recycled water for unrestricted use |
| | Purified recycled water for drinking (long term water security solution) |
| | Discharge to wetlands |
| | River discharge |
| **Wingham** | Recycled water for restricted use |
| | Purified recycled water for drinking (long-term water security solution) |
| | River discharge |
| | Divert flows to Dawson STP |

| Sewerage Scheme | Options Progressed |
|---|---|
| **Hawks Nest** | Recycled water for unrestricted use |
| | Exfiltration |
| **Old Bar** | Recycled water for restricted use |
| | Recycled water for unrestricted use |
| | Exfiltration |
| | Ocean outfall |
| | Divert flows to Dawson STP |
| **Harrington** | Recycled water for restricted use (further investigation to identify users) |
| | Discharge to wetlands |
| | Exfiltration |
| | River discharge |
| **Gloucester** | Recycled water for restricted use |
| | Recycled water for unrestricted use |
| | River discharge |
| **Stroud** | Recycled water for restricted use |
| | River discharge |
| **Lansdowne** | Recycled water for restricted use |
| | River discharge |
| **Coopernook** | Recycled water for restricted use |
| | River discharge |
| **Bulahdelah** | Recycled water for restricted use |
| | Recycled water for unrestricted use |
| | River discharge |
| **Manning Point** | N/A |

<u>Unserviced Villages</u>

Options for servicing unserviced villages were identified in the 2019 risk assessment report. The outcomes of this assessment included a prioritised list of villages and potential servicing options for each village. Options considered included reticulated sewerage, local decentralised cluster system, partial on-site containment of water and full on-site containment of water. High-level costs were developed for each of the 30 villages assessed and servicing options were shortlisted based on land capability, lot size, number of lots and land application area sizing.

## IWCM Scenarios

The short-listed options were packaged into five scenarios. Four scenarios capture the strategic issues identified. A QBL analysis was completed on each scenario. The fifth scenario, called the Everyday Scenario, includes the business-as-usual operations of Council to maintain existing water and sewer services.

With the Manning Water Supply Scheme water security issue considered the most critical by Council, the four scenarios were developed around the solution for this issue.

Unserviced villages were not included in the four scenarios, as these will be considered separately based on public health and environmental risk, and in conjunction with funding solutions.

Climate change is included in the scenarios where specifically aligned with the water security solutions. Specific asset solutions and progress towards Net Zero emissions are consistent across the scenarios and therefore have been captured in the Everyday Scenario. Broader Council initiatives, such as a

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potential solar farm at Nabiac will be considered separately under Council's corporate climate change policy.

Figure 0-2 represents an overview of the scenarios developed. Table 0-4 summarises the scenarios developed.

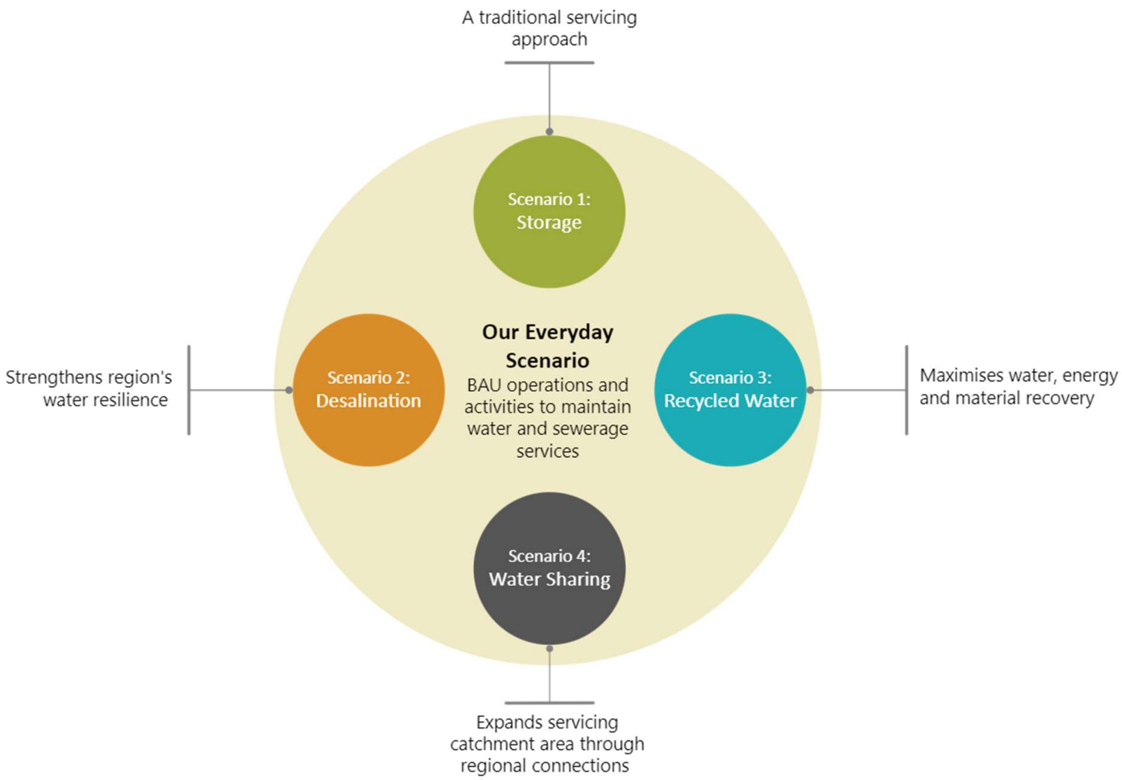


**Figure 0-2: Overview of scenarios**

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**Table 0-4: Scenarios developed for key strategic issues from shortlisted options**

| Scenario | Benefits | Challenges |
|---|---|---|
| **Scenario 1 - Dam** | | |
| Focus on traditional approach of storage to support water security<br>• Peg Leg Creek Dam at Manning<br>• Off-stream storages at Bulahdelah, Gloucester and Stroud<br>• No increase in recycled water, existing services continued<br>• Explore floating solar and hydropower opportunities | • Lowest construction cost<br>• Lowest operating and maintenance costs<br>• Low energy use option<br>• Opportunity for easy integration of opportunities to achieve Net Zero targets at Peg Leg Dam<br>• Utilises existing WTPs and networks | • Climate dependent solution - relies on rainfall<br>• Dams may have environmental and heritage impacts during construction, requiring significant approvals for land clearing<br>• No increase in green spaces irrigated using recycled water during drought |
| **Scenario 2 - Desalination** | | |
| Enhances water security with a climate resilient solution<br>• Desalination plant at Hallidays Point for Manning<br>• Off-stream storages at Bulahdelah, Gloucester, and Stroud<br>• Groundwater investigations for Bulahdelah, Gloucester, and Stroud<br>• Some increase in recycled water for public amenity<br>• Considers solar panels to offset energy use at desalination plant | • Second lowest capital cost<br>• Climate independent solution for critical scheme<br>• Production scalable to meet demand<br>• Utilises existing water distribution networks<br>• Diversification of sources for inland schemes if groundwater identified<br>• Increase in public open space available during drought at Taree Recreation Grounds | • Highest operating cost<br>• High energy use option<br>• Desalination not practical option for inland schemes<br>• Environmental and heritage impacts during construction |
| **Scenario 3 - Recycled Water** | | |
| Regenerative approach that builds on maximising water recovery<br>• Combination of following for Manning:<br>    ○ Purified recycled water via Managed Aquifer Recharge at Nabiac<br>    ○ Peg Leg Creek Dam<br>• Off-stream storages at Bulahdelah, Gloucester and Stroud<br>• Groundwater investigations for Bulahdelah, Gloucester and Stroud<br>• Increase in recycled water for public amenity<br>• Considers solar panels to offset energy use at Tuncurry RTP and Nabiac WTP | • Partially climate independent, but requires Peg Leg Dam which relies on rainfall<br>• Utilises existing water treatment plans and water network<br>• Significant increase in water recycling<br>• Consideration for improving liveability targets by increasing availability of public open spaces available during drought | • Highest capital cost<br>• Second highest operational cost<br>• Less energy use than desalination, but higher than dams<br>• Environmental and heritage impacts during construction<br>• Significant environmental approvals required, for injecting into aquifer and for clearing land for dam<br>• No current supporting regulatory framework for purified recycled water |
| **Scenario 4 - Water Sharing** | | |
| Realises shared benefits through interconnecting regions<br>• Peg Leg Creek Dam at Manning<br>• Connection to Manning scheme for Bulahdelah and Gloucester via pipelines from Nabiac and Krambach respectively<br>• Potential connection to Hunter Water for Stroud via pipeline from Dungog<br>• Engage with Port Macquarie Hastings Council to consider potential opportunities for regional connection with Manning Scheme, particularly if desalination required in future<br>• Significant increase in recycled water for public amenities<br>• Explore floating solar and hydropower opportunities | • Removes need for sourcing additional water supply options Bulahdelah, Gloucester and Stroud<br>• Opportunities to connect unserviced villages along route<br>• Opportunity for easy integration of opportunities to achieve Net Zero targets at Peg Leg Dam<br>• Endeavours to economically meet liveability targets at maximum locations by increasing availability of public open spaces during drought | • Second highest capital cost<br>• Second lowest operational costs<br>• Long pipelines may have environment and/or heritage impacts during construction<br>• Reliant on one water supply source for three schemes ('all eggs in one basket')<br>• Requires negotiation and agreement with Hunter Water |

## Community Engagement

### Our Water Our Future Workshop 2

The developed scenarios were presented to the community in the second Our Water Our Future workshop. Feedback from the workshop did not indicate a clear preference for a preferred scenario, as they were presented in Scenarios 1 to 4. It was suggested that the scenarios be reassessed to consider centralised and decentralised options for the region, as well as water security and sustainable effluent management options separately.

### Have Your Say

The feedback from the Our Water Our Future workshop informed the structure of the wider community engagement, with the 'Have Your Say' engagement targeted to identify views of the community on key components of specific options. Questions were developed to identify preferences for the following:

- Dam vs desalination – for Manning
- Centralised vs decentralised – for connectivity of small Gloucester, Bulahdelah and Stroud to the Manning
- Extent of recycled water use
- Acceptance for use of purified recycled water
- Willingness to pay – for changes to residential bill


**Figure 0-3: Results of 'Have Your Say' engagement**

The results of the online voting are presented in Figure 0-3. The responses revealed strong preferences for dams both for Manning scheme and the smaller schemes. A significant portion of the respondents showed a keen interest in increasing reuse of recycled water in the community. There was a positive response around purified recycled water for drinking.

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## IWCM Strategy

### Preferred Strategy

The preferred strategy is described in Table 0-5 and shown in Figure 0-4 .The preferred IWCM strategy was selected based on:

- Feedback received through all modes of community engagement, which favoured dam over desalination for the most critical issue of water security for Manning supply scheme
- Results of the QBL assessment for the scenarios developed post community engagement, which resulted in two strong options: ‘Dam + recycling’ and ‘Desalination + recycling’
- Council’s preference between the two feasible options for the Manning Water Supply Scheme due to lower capital and operating costs, lower net present cost and maximised use of existing assets.

Environmental approvals are critical to the adoption and delivery of Peg Leg Creek dam. The site identified for the dam is within a known koala habitat and may also be home to Aboriginal heritage. If approvals are not granted, the IWCM Strategy will need to consider the alternative strategy of a desalination plant to provide water security for the Manning scheme.

**Table 0-5: Preferred strategy for strategic issues**

| Approach | Description |
|---|---|
| **Our Everyday Scenario** | Continued delivery of water and sewer services. This includes a focus on water conservation and demand management initiatives, along with broader climate change adaptation and mitigation measures at the asset level. |
| **Water Security** | |
| Manning Scheme | Short-term: **Peg Leg Creek Dam** with construction proposed to be completed by FY 2031-32, with planning commencing in FY 2023-24.<br>Long-term: **Purified recycled water** to supplement supply from Peg Leg Creek Dam, if or when required. |
| Gloucester Scheme | **Off-stream storage**, located at a site TBD in future investigations. Construction is proposed to be completed by FY 2032-33, with planning commencing in FY 2023-24. |
| Bulahdelah Scheme | **Off-stream storage**, located at a site TBD in future investigations. Construction is proposed to be completed by FY 2033-34, with planning commencing in FY 2023-24. |
| Stroud Scheme | **Off-stream storage**, located at the WTP adjacent to the existing storage dams. Construction is proposed to be completed by FY 2047-48. Planning will be commenced after completion of the planning for the Manning, Bulahdelah and Gloucester water security solutions. |
| Gloucester, Bulahdelah and Stroud Schemes | Investigation into potential **Groundwater** sources to supplement off-stream storages. |
| For discussions | Engage neighbouring Hunter Water and Port Macquarie Hastings Councils for climate independent **water sharing** opportunities. |
| **Sustainable Effluent Management** | |
| MidCoast region | **Increase level of water recycling** for public open space irrigation to improve community amenity and liveability. Further investigation is required to identify and prioritise specific recycled water opportunities to meet these objectives. |
| **Climate Change** | |
| Net Zero | Explore opportunities for **solar** and **hydropower** to help achieve Net Zero targets by 2040. |
| **Unserviced Villages** | |
| All villages | Seek and **review funding mechanisms** to support delivery of sewerage services to high-risk villages. |

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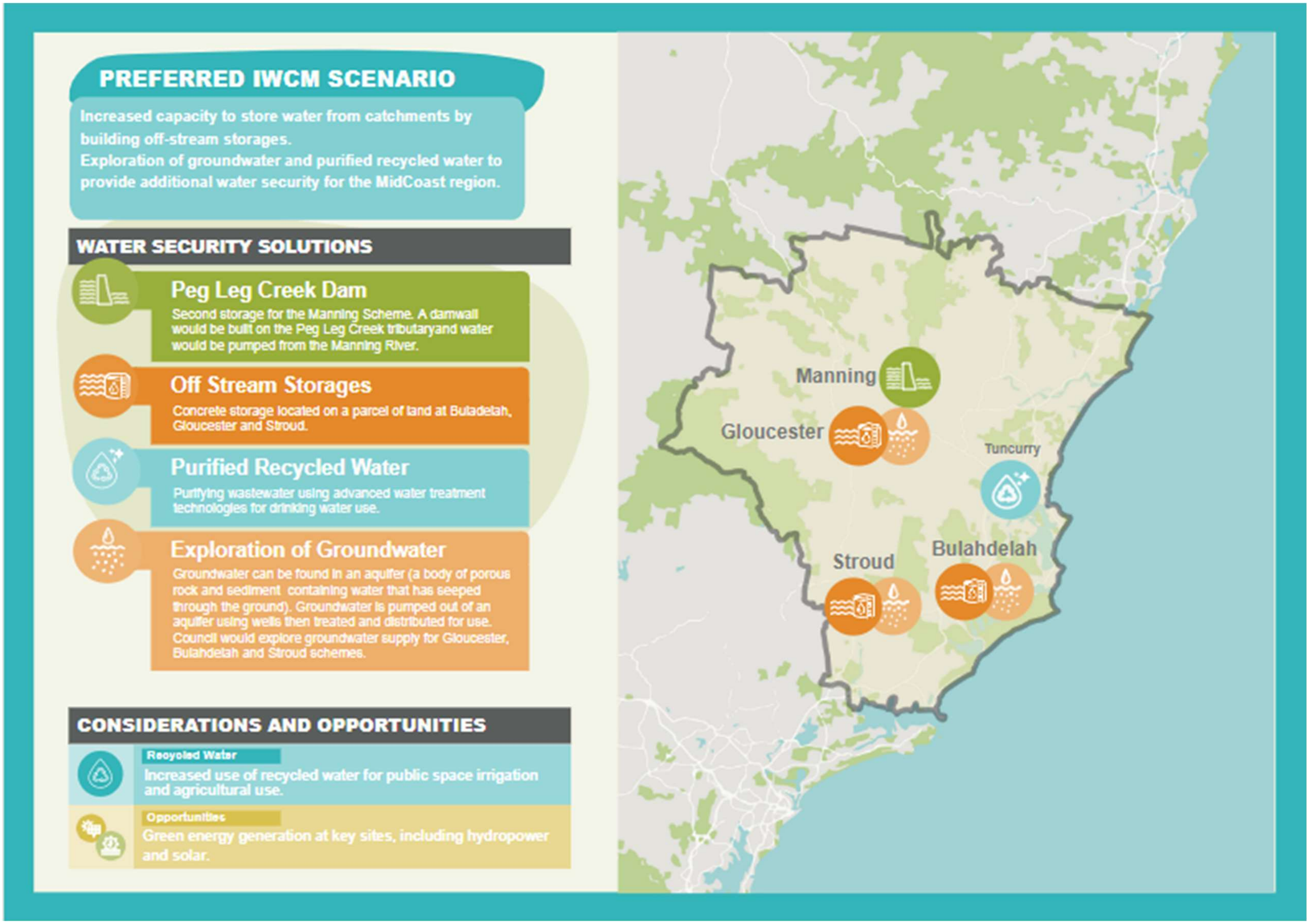


Figure 0-4: Preferred strategy plan

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### Adaptive Plan

Figure 0-5 presents the adaptive plan developed for the assessed scenarios and preferred strategy. The plan highlights the key decision points and provides a response pathway that can accommodate change in external variables.

Five pathways were identified for the adaptive plan based on the scenarios developed. These are as follows:

**Our Everyday Scenario**: business-as-usual responsibilities, including climate adaptations, no change to unserviced villages, and no additional users of recycled water.

**Pathway 1:** Peg Leg Creek Dam for Manning scheme and local storages at Gloucester, Bulahdelah, and Stroud.

**Pathway 2:** Desalination plant for Manning scheme and local storages at Gloucester, Bulahdelah, and Stroud

**Pathway 3:** Peg Leg Creek Dam supplemented by purified recycled water for Manning scheme and local storages at Gloucester, Bulahdelah, and Stroud

**Pathway 4:** Peg Leg Creek Dam for Manning with connections to Gloucester and Bulahdelah, and local storage at Stroud.

The main triggers that affect the preferred pathway include:

- Environmental approval for Peg Leg Creek Dam
- Environmental approval for off-stream storages at Bulahdelah, Gloucester and Stroud
- Introduction of regulatory framework for purified recycled water
- Changes in growth compared with current forecast
- Climate change impacts more extreme than current forecast

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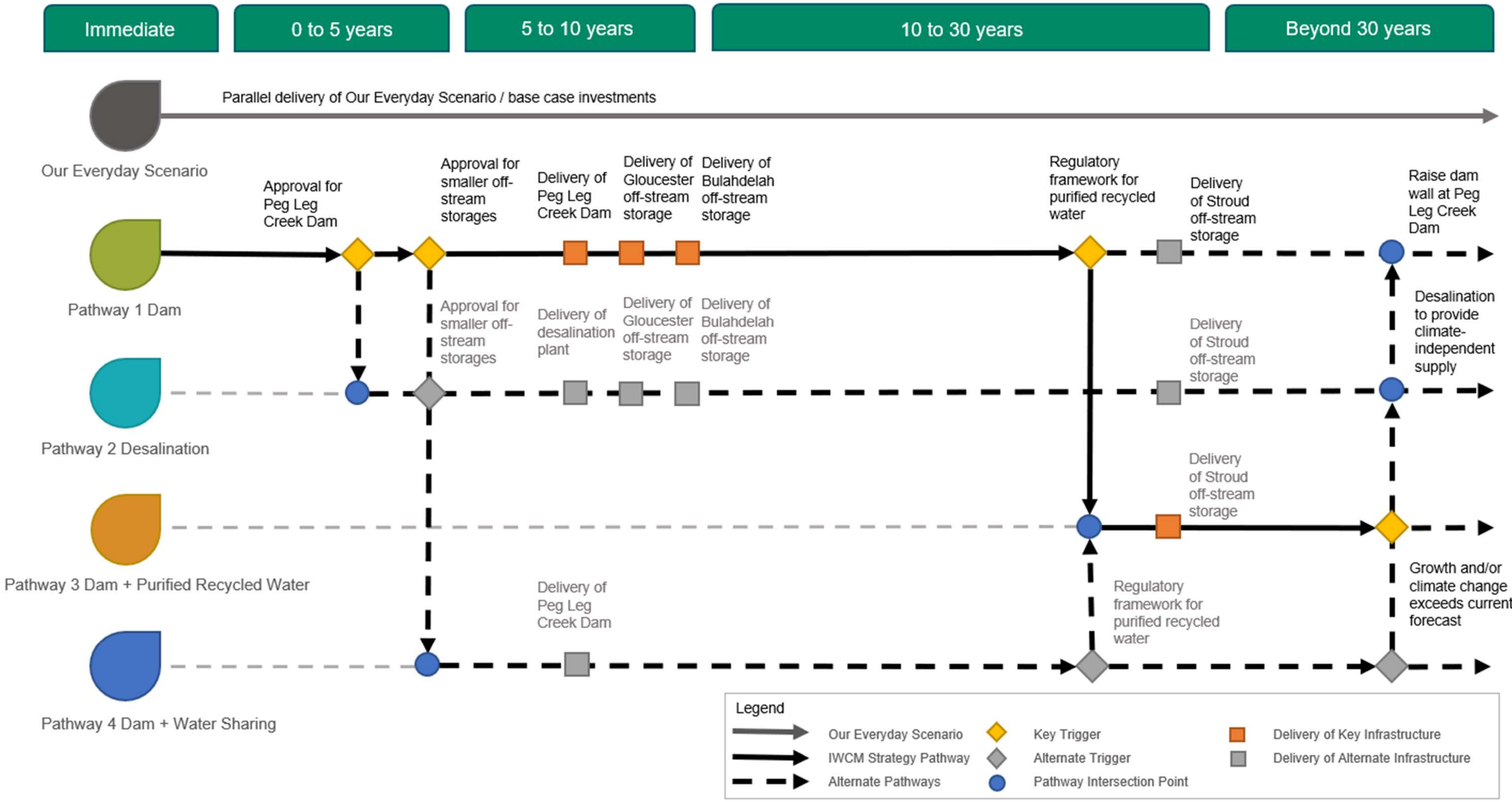


**Figure 0-5: Adaptive plan for identified pathways**

# 1.0 Introduction

## 1.1 Background Information

### 1.1.1 MidCoast Council Area

The MidCoast Council (Council) Local Government Area (LGA) encompasses the New England, Hunter and Mid-North Coast regions of New South Wales. The region covers an area of approximately 10,000 square kilometres across 195 towns, villages and localities.

Taree and the twin towns of Forster-Tuncurry are the two main activity centres in the MidCoast region. Taree serves as the main commercial and strategic town, housing the region's public hospital, airport and train services. Forster-Tuncurry drives much of the tourism and retirement living in the MidCoast. A large percentage of the region comprises National Park, State Forest or nature reserves. The rural area is primarily used for timber production and agriculture. Fishing and oyster farming are also important industries near coastal locations.

The MidCoast region has an aging population with 38.5 percent of residents aged 60 and over. Demographic trends indicate more families relocating to the area, however local employment and education opportunities present challenges to retaining young people.

The region is a popular holiday destination with local beaches, waterways and National Parks popular with tourists during the summer holiday season.


**Figure 1-1: MidCoast Council local government area**

### 1.1.2 The Role of Water

Water is an essential resource in maintaining the health of individuals, communities and the environment. Council currently supplies around 9 billion litres of drinking water per year to residents and businesses across the region.

The economic health of the region is inherently linked to the condition of its water resources. Households need access to clean water for consumption, cleaning and leisure. Businesses and farmers use water for agriculture, oyster farming, lifestyle and tourism activities. All need a secure water supply that is not subject to frequent water restrictions.

Water plays a crucial role to the traditional custodians of the land, the Gathang-speaking Biripi and Worimi people. These Indigenous communities have a deep connection to the land and water. Council recognises and respects the traditional owners' cultural and spiritual values. Collaboration with the Indigenous community is important for protecting and managing the region's water resources.

Water is also an important component in the natural landscape and ecosystems of the MidCoast region. Features such as wetlands and waterways play an important role in managing water quality, in addition to providing ecosystem habitat and recreation for communities. Council is committed to conserving the natural heritage of the region and managing its water resources sustainably to support the health and resilience of its ecosystems. There are several different environmental projects run by Council to enhance or protect the region. A number of these initiatives are managed alongside State Government. Examples of environmental projects include protection and restoration of wetlands and riparian lands, offset tree and native vegetation planting, riverbank stabilisation, Waterwatch, and Share the Shore.

### 1.1.3 Existing Services

#### 1.1.3.1 Water Supply Schemes

Council currently operates six water supply schemes. The towns and communities supplied by these schemes are listed in Table 1-1. The Manning Water Supply Scheme is supplemented by the Nabiac Aquifer water supply.

**Table 1-1: Water supply schemes and towns supplied**

| Water Supply Scheme | Serviced Towns & Communities | |
|---|---|---|
| Manning Water Supply | Coopernook | Crowdy Head |
| | Cundletown | Failford |
| | Forster | Green Point |
| | Harrington | Hallidays Point |
| | Krambach | Lansdowne |
| | Manning Point | Nabiac |
| | Old Bar | Pacific Palms |
| | Rainbow Flat | Redhead |
| | Smiths Lake | Tarbuck Bay |
| | Taree South | Tinonee |
| | Tuncurry | Wallabi Point |
| | Wingham | |
| Tea Gardens Water Supply | Tea Gardens | Hawks Nest |
| Gloucester Water Supply | Gloucester | Barrington |
| Bulahdelah Water Supply | Bulahdelah | |
| Stroud Water Supply | Stroud | Stroud Road |
| North Karuah Water Supply | North Karuah | |

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**Figure 1-2: Water Supply systems in the MidCoast**

### 1.1.3.2 Sewerage Schemes

Council is responsible for 13 sewerage schemes and operates 14 Sewage Treatment Plants (STP) across all schemes except North Karuah. Sewage from North Karuah is collected and conveyed to the Hunter Water network. Table 1-2 lists the sewer schemes and the services areas within the LGA.

**Table 1-2: Sewer schemes and serviced areas**

| Sewer Scheme | Serviced Towns & Communities | |
|---|---|---|
| Bulahdelah | Bulahdelah | |
| Coopernook | Coopernook | |
| Forster | Forster | Seven Mile Beach |
| | Green Point | Smiths Lakes |
| | Pacific Palms | Tarbuck Bay |
| Gloucester | Gloucester | Barrington |
| Hallidays Point | Hallidays Point | Tuncurry |
| | Nabiac | |
| Harrington | Harrington | Crowdy Head |

| Sewer Scheme | Serviced Towns & Communities | |
|---|---|---|
| Hawks Nest | Hawks Nest | Tea Gardens |
| Lansdowne | Lansdowne | |
| Manning Point | Manning Point | Pelican Bay |
| North Karuah | North Karuah | |
| Old Bar | Old Bar | Wallabi Point |
| Stroud | Stroud | |
| Taree | Taree | Taree South |
| | Tinonee | Cundletown |
| Wingham | Wingham | |

#### 1.1.3.3 Recycled Water Schemes

There are 10 recycled water schemes operating across the MidCoast,as listed in Table 1-3. The water produced from these schemes is used for non-drinking purposes, including irrigating farms and open spaces such as golf courses and sporting fields. The average year use percentages are based on volumes reused in FY 2017-18, as this was identified as an average rainfall year for analysis. Refer Section 4.1.3 for further details of this assessment.

**Table 1-3: Existing recycled water schemes**

| Recycled Water Scheme | Percentage Reuse of Effluent (average year) |
|---|---|
| **Farm Irrigation** | |
| Coopernook | 14% |
| Gloucester | 30% |
| Lansdowne | 69% |
| Stroud | 83% |
| Taree | 23% |
| Wingham | 53% |
| **Open Space Irrigation** | |
| Bulahdelah | 16% |
| Harrington | 65% |
| Hawks Nest | 28% |
| Tuncurry | 28% |

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**Figure 1-3: Sewerage and recycled water schemes in MidCoast Council LGA**

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# 2.0 Integrated Water Cycle Management

## 2.1 What is IWCM?

Integrated Water Cycle Management (IWCM) is a holistic approach to managing the water resources of a community in a cost-effective and sustainable manner. The intent of an IWCM strategy is to integrate all elements of water planning with urban planning. Urban liveability is a key consideration when designing systems for water sourcing, its distribution and use and its eventual return to the environment. Promoting an IWCM approach enables:

- Identification of the full range of values and uses of water within the urban water cycle
- Broader engagement within the community to understand water values
- Better decisions and lower cost solutions as a result of higher transparency and evaluation of options at the outset
- Increased collaboration between different sectors by integrating water planning with the management of other natural resources.

As populations grow and climates continue to change, it is important that communities can create sustainable solutions moving forward.

Council has developed a long-term IWCM strategy that integrates management of the water supply, sewage and stormwater services within a whole of catchment strategy. The strategy will:

- Set service level outcomes based on community values for Council's water and sewer business
- Determine the issues and gaps using evidence-based analysis
- Identify the 'best value 30-year' IWCM scenario on a quadruple bottom line (QBL) basis considering social, environmental, economic and governance criteria
- Establish the investment priority and infrastructure needs in consultation with all internal and external stakeholders.

### 2.1.1 State and Regional Water Strategy

The NSW Water Strategy is the first 20-year water strategy that outlines the approach to improve the security, reliability, quality and resilience of the state's water resources over the long term. It sets the overarching vision for the 12 regional and two metropolitan water strategies, with each tailored to the individual needs of the region.

The MidCoast region is included in the Greater Hunter Regional Water Strategy. The strategy outlines the major risks and drivers faced by the Greater Hunter region over the next 20 to 30 years and proposes mitigation actions for consideration. The IWCM strategy at the regional level works together with other water strategies and plans to form the water policy and planning context for NSW.

### 2.1.2 Regulatory and assurance framework for local water utilities 2022

The new Department of Planning and Environment's (DPE) Regulatory and Assurance Framework for Local Water Utilities applies to local water utilities from 1 July 2022. This framework replaces the previous Best Practice Management of Water and Sewerage Guidelines and IWCM Checklist (2019) and provides flexibility in undertaking strategic planning whilst ensuring the process remains sufficient, appropriate and robust. The flexibility and outcomes-focused approach of this framework will be used in completing the IWCM Options and Scenarios phase.

Table 2-1 provides an overview of the 12 strategic outcomes for consideration in the development of IWCM.

**Table 2-1: Overview of strategic planning outcomes**

| Outcome | Overview |
|---|---|
| Understanding service needs | Requires understanding of the needs, values and preferences of customers, requirements and expectations of regulators, and the current and future demand placed on water and sewer services |
| Understanding water security | Ensures reliable access to water supply over time and in response to changes in supply and demand including population growth and climate change |
| Understanding water quality | Requires understanding of water quality risks and requirements for management of risks as per the *Public Health Act 2010* and Regulation 2022 |
| Understanding environmental impacts | Requires understanding of risks and impacts to the natural environment associated with the management of wastewater activities, and management measures to minimise these impacts |
| Understanding system capacity, capability, and efficiency | Requires understanding of the asset and systems associated with delivery of water and sewer services, the ability of said systems to deliver as required, and the actual performance of the systems |
| Understanding other key risks and challenges | Requires identification and management of risks associated with the operating environment |
| Understanding solutions to deliver services | Requires understanding of the economic, environmental, and social costs and benefits of viable options for delivery of services with consideration for key risks in the evaluation and asset management |
| Understanding resourcing needs | Reasonable understanding of resourcing requirements for delivery of services and management of risks to required standards over time |
| Understanding revenue sources | Requires identification of revenues sources available to fund the delivery of water and sewer services, and an understanding the customers' ability and willingness to pay for services |
| Make and implement sound strategic decisions | Requires appropriate processes and systems in place to for decisions to be made on effective, evidence-based strategic planning |
| Implement sound pricing and prudent financial management | Expects management of revenue to be able to deliver water and sewer services over time to desired levels of service, and to promote efficient consumption of water and sewer services in the community |
| Promote integrated water cycle management | Expects understanding of the broader outcomes associated with integrated water cycle management relevant to the region and community, and develop practices to enable delivery of these outcomes |

#### 2.1.2.1 Alignment with Regulatory and assurance framework for local water utilities

The delivery of the IWCM strategy was streamlined to align with the new framework. The following approach was implemented:

- The 12 strategic outcomes were reviewed at a high-level to ensure a strategic focus was maintained throughout
- Expertise of stakeholders was embedded at all major decision points in the process to manage the assessment of options efficiently and effectively, including local knowledge from the wider planning and operations teams and experience of the regulators from DPE officers
- The key theme of IWCM was front and centre in all decisions and all aspects, including the development of assessment criteria for coarse screening and the QBL framework
- Financial modelling was delivered in collaboration with Council's financial modelling team to enable alignment of the approach, inputs and means to appropriately incorporate the preferred future works into Council's long term financial plan.

Table 2-2 provides a high-level assessment summary of the strategic planning outcomes in the context of Council's IWCM. A traffic light grading system is used to assess the outcomes addressed by IWCM, which is also reflected in Figure 2-1. This figure represents the evidence utilised to arrive at these assessment results. The key outcomes of the review are:

- At a broader level, the development of the IWCM Options and Scenarios report and the IWCM Strategy provide answer to relevant expectations of the strategic outcomes
- The sustainable effluent management strategic issue primarily assessed options for sustainable practices for treated sewage. The unserviced villages risk assessment identified a prioritised list of high-risk villages. Council has other programs that are responsible for and consider identification and mitigation of environmental risks
- Water quality is linked to the effluent management practices within this IWCM document, however initiatives pertaining to water quality are captured holistically under Council's Drinking Water Quality Management System.
- Resourcing needs were considered at a high-level for options as necessary. Planning for resourcing will be addressed in detail in Council's Strategic Business Plan.

**Table 2-2: Assessment summary of strategic planning outcomes**

| Outcome | Assessment |
|---|---|
| Understanding service needs | Addressed |
| Understanding water security | Addressed |
| Understanding water quality | Partially addressed |
| Understanding environmental impacts | Partially addressed |
| Understanding system capacity, capability and efficiency | Addressed |
| Understanding other key risks and challenges | Addressed |
| Understanding solutions to deliver services | Addressed |
| Understanding resourcing needs | Not addressed |
| Understanding revenue sources | Addressed |
| Make and implement sound strategic decisions | Addressed |
| Implement sound pricing and prudent financial management | Addressed |
| Promote integrated water cycle management | Addressed |

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**Figure 2-1: Evidence summary for assessment of strategic planning outcomes**

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## 2.2 IWCM Journey to Date

In 2015, MidCoast Water designed a comprehensive IWCM Strategy and produced '*Our Water Our Future 2045'*. Local government reform in 2016 resulted in the dissolution of MidCoast Water into the newly formed MidCoast Council. This provided Council with greater potential to implement true integrated water cycle management solutions, as they now have responsibility for all sources of water including catchment management, stormwater, drinking water and beneficial reuse of treated water.

The MidCoast region experienced a significant drought event in late 2019 through to early 2020. This drought was relatively short in duration but very intense, with water supplies across the region impacted. Several strategies were employed during the event to manage the water supply, including water restrictions and infrastructure expansion. The drought reinforced the need for reliable water security measures and triggered an extensive review of the strategy. The revised IWCM Strategy, *Our Water Our Future 2050*, will deliver water security to the MidCoast region whilst also considering overall integrated water cycle management and the need to provide value for money to the community. The strategy will also meet requirements of DPE's Regulatory Assurance Framework.

An overview of the key phases of the process are outlined in Figure 2-2.

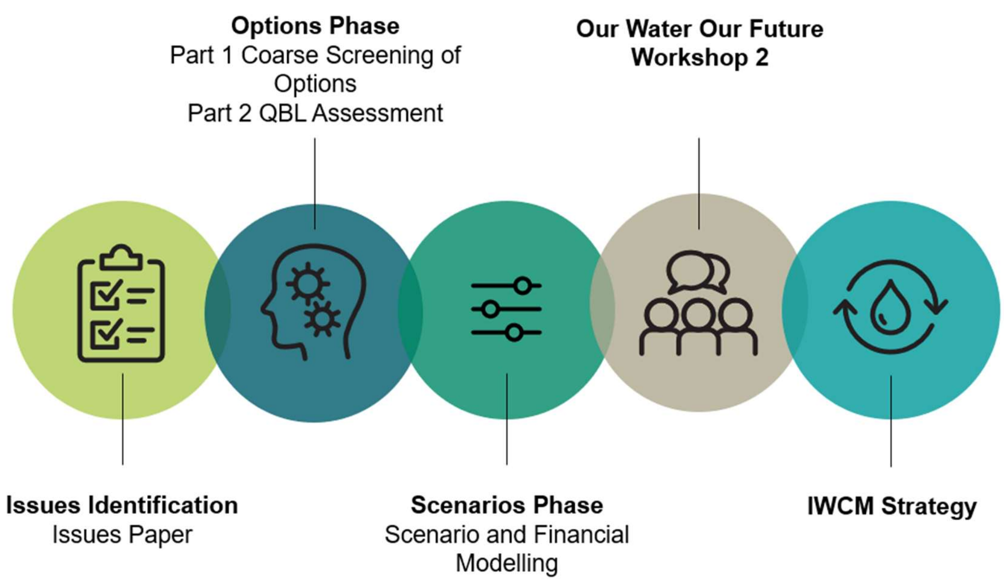


**Figure 2-2: IWCM process overview**

### 2.2.1 IWCM Issues Paper

With a major review of the IWCM Strategy due in 2023, Council commenced the review process in 2021 with a revised Issues Paper. The Issues Paper is available in Appendix A. This was completed in mid-2022 and identified a total of 76 issues. 72 of these were considered as operational issues and will be actioned by Council as 'business as usual' (BAU) under the Everyday Scenario. The remaining four issues were identified as key strategic issues. These are:

- Water security for the Manning, Bulahdelah, Gloucester and Stroud supply systems
- Sustainable effluent management across 13 sewerage schemes
- Unserviced villages for sewage
- Climate change

The first workshop with the Our Water Our Future group was held at Council's office at the conclusion of the Issues Paper phase, to share the outcomes with the group and understand their concerns around water for the region. Further details on the workshop outcomes are discussed in Section 3.2.2.1.1.

### 2.2.2 Manning Water Security Coarse Screening

Insufficient water security for the Manning Water Supply Scheme was identified as the most critical strategic issue in the Issues Paper and was therefore prioritised to progress to options phase while the Issues Paper was being finalised.

The Manning Water Supply Scheme services over 80 percent of the total water customers in the LGA, making its water security a vital component of the IWCM strategy. Working in collaboration with Council, AECOM led the coarse screening of source augmentation and demand management options to address water security within the Manning scheme.

The coarse screening process was based on a fatal flaw approach. 15 water security options were assessed based on criteria developed primarily on Council's values and risk management framework. Each option was assigned a score of either pass, fail or unknown. A high-level financial assessment was also completed for each option to allow comparison. Refer to Appendix B for complete details of the assessment.

Key outcomes from the coarse screening included:

- Seven options in total were short-listed to progress to the next stage:
  - Increase storage yield via new Peg Leg Creek Dam
  - Desalination of estuarine water at Nabiac Water Treatment Plant (mobile unit for emergency use only)
  - Desalination of sea water at Hallidays Point (permanent, when required)
  - Recycled water for municipal irrigation, agricultural and construction use
  - Purified recycled water for potable reuse
  - Increased groundwater supplied via Nabiac aquifer
  - Interconnection with regional schemes (new pipeline to Port Macquarie Hastings)
- Desalination of estuarine water is best suited as a short-term solution emergency response option only.
- Raising Bootawa Dam was not short-listed for the Manning scheme due to:
  - risk to water supply during construction, which would require dam level to be lowered significantly leading to extended period of Level 4 restrictions.
  - additional storage created through raising dam wall not sufficient to achieve water security (i.e. another water security solution required also).
- New groundwater schemes for the coastal strip was not short-listed due to significant infrastructure required across multiple sites to secure yield. This was based on potential sites identified from studies in 1999. These investigations identified the Nabiac Inland Dune Aquifer as the most viable option, which now supplies the Manning scheme.
- Recycled water for irrigation, agricultural and construction use is considered an expansion to the existing schemes and was recognised as a supplementary option that can be explored further under the effluent management investigations.
- Exploring the interconnection with regional schemes was a new option identified through interactive discussions in the workshop. This could include a bi-directional connection to Port Macquarie Hastings water supply scheme to allow water sharing between the two regions if a climate-independent source (such as desalination) was pursued by either. Extensive collaboration and participation with Port Macquarie Hastings Council would be required to progress this option.

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This new option will progress to the next stage for further assessment on technical feasibility and viability in consultation with Port Macquarie Hastings Council.

- The key impact of the demand management options provides opportunity to delay capital investment in water security solutions by several years.

#### 2.2.3 Purpose – Options and Scenarios Phase

The options and scenarios phase for all strategic issues informs the development of the revised IWCM Strategy.

The purpose of this report is to present the options and scenarios assessment of strategic issues to inform the IWCM Strategy. The IWCM Strategy will be supported by the preferred scenario and the 30-year investment plan.

The report documents the processes adopted in the development of the preferred strategic pathway. Core components described in this report include demand and growth forecast, options assessment, scenarios assessment, stakeholder engagement and adaptive pathways.

### 2.3 Everyday Scenario Issues

A total of 76 issues identified in the Issues Paper were defined as either an operational or a strategic issue. An operational issue is one managed through normal ‘business as usual’ operation, whereas strategic issues have the potential to greatly impact the community and the environment, requiring an increased level of effort for identifying appropriate solutions. The Everyday Scenario includes works to address all 72 operational issues and will be actioned by Council as business as usual over the next 30 years. These issues are broadly separated into categories, as listed in Table 2-3.

**Table 2-3: Base case issues and categories**

| Issue | Category |
|---|---|
| General IWCM issues | • Asset and business performance |
| Water supply system | • Asset and business performance<br>• Capacity<br>• Regulatory<br>• Levels of service |
| Sewerage system | • Asset and business performance<br>• Capacity<br>• Regulatory<br>• Performance |
| Stormwater system | • Levels of service |

### 2.4 Strategic Issues

#### 2.4.1 Water Security

Council needs to meet water needs of the community under changing supply and demand profiles and ensure resilience to shocks and emergency events. In particular, climate change has a significant impact on water security. The current water supply for MidCoast is predominantly reliant on climate dependent water sources such as rivers and aquifers, with off-stream storage to buffer variability in rainfall over time.

Australia and the MidCoast region has experienced some of their driest conditions on record in recent years, with the 2019-20 drought the worst experienced on record. It triggered the longest continuous period of water restrictions in Council’s service area, setting a new record of five months and 20 days between early September 2019 and February 2020. Level 4 restrictions were also introduced for the first time (MidCoast Council, 2021). Consequently, IWCM approaches should consider both capacity and diversity in the water supply portfolio of the future.

Insufficient secure yield within the Manning, Gloucester, Stroud and Bulahdelah Water Supply Schemes was a key strategic issue identified in the Issues Paper. Table 2-5 provides a brief overview of each

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sewerage scheme in the region along with secure yield and annual demands for 2020 and 2051. Full details on the secure yield modelling is available in Section 4.1.5 and Appendix I.

**Table 2-4: Overview of sewer schemes**

| Water Supply Scheme | Scheme Overview |
|---|---|
| **Manning** | The Manning Water Supply Scheme currently services a total permanent population of around 74,000 people, around 80% of Councils service area. Water is drawn from the Manning River either directly to the WTP or to Bootawa Dam, which has a storage of 2,275ML. Water is also drawn from Nabiac Aquifer System and treated at the Nabiac WTP.<br>Extraction from the Manning River ceased in October 2019 and levels in Bootawa Dam dropped to around 30 percent (MidCoast Council, 2021). Therefore the Manning Water Supply Scheme was identified as a critical issue and prioritised for early assessment. A coarse screening of water security options for the Manning Supply Scheme was undertaken with Council stakeholders (refer to Section 2.2.2 for outcomes).<br>The secure yield modelling undertaken for this project indicated that for the Manning scheme:<br>• 2020 secure yield 6,096 ML/annum, annual demand 6,805 ML/year<br>• 2051 secure yield 5,807 ML/annum, annual demand 11,280 ML/year |
| **Gloucester** | The Gloucester Water Supply Scheme currently services a total permanent population of around 4,500 people. Water is drawn from the Barrington River to the Gloucester WTP, and there is currently no off-stream storage within the scheme. During the 2019-20 drought, the Barrington River ceased to flow and water was carted from Tea Gardens to supply the Gloucester community. Council is currently in the process of constructing the Gloucester Reservoir Project. Upon completion, the network will have approximately 10 ML of storage, providing a supply buffer of approximately one week.<br>The secure yield modelling undertaken for this project indicated that for the Gloucester scheme:<br>• 2020 secure yield is 0 ML/annum, annual demand 288 ML/year<br>• 2051 secure yield is 0 ML/annum, annual demand 465 ML/year |
| **Stroud** | The Stroud Water Supply Scheme currently services a total permanent population of around 900 people. Water is drawn from the Karuah River weir either directly to the WTP or via a 50 ML off-stream storage located at the WTP site. The weir pool provides up to 17 ML on-stream storage.<br>The secure yield modelling undertaken for this project indicated that for the Stroud scheme:<br>• 2020 secure yield is 47 ML/annum, annual demand 96 ML/year<br>• 2051 secure yield is 46 ML/annum, annual demand 138 ML/year |
| **Bulahdelah** | The Bulahdelah Water Supply Scheme services a total permanent population of around 1,400 people. Water is drawn from upstream of the Crawford River weir to the WTP. The weir pool provides up to 163 ML on-stream storage. An additional emergency pump was installed in the 2019-20 drought to ensure continued extraction from the river.<br>The secure yield modelling undertaken for this project indicated that for the Stroud scheme:<br>• 2020 secure yield is 139 ML/annum, annual demand 116 ML/year<br>• 2051 secure yield is 139 ML/annum, annual demand 179 ML/year |

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### 2.4.2 Sustainable Effluent Management

Of the 14 sewage treatment plants in operation, effluent from ten of these plants is managed through a recycled water system. Table 2-5 provides a brief overview of each sewerage scheme in the region. The level of treatment across the plants vary in complexity depending on discharge location and/or effluent reuse need. Currently, Council utilises up to approximately 25 percent recycled water in average and below average rainfall years. Recycled water is primarily purposed for agricultural and municipal irrigation use. There is an opportunity to review current reuse practices with a long-term vision and focus on sustainable management practices.

**Table 2-5: Overview of sewer schemes**

| Sewer Catchment | Scheme Overview |
|---|---|
| **Bulahdelah** | The Bulahdelah scheme services approximately 675 connections. Treated effluent is pumped to the nearby golf course for irrigation use, with excess discharged to Fry's creek, a tributary of the Myall River. |
| **Coopernook** | The Coopernook scheme services the town of Coopernook with a total permanent population of approximately 540 people (240 connections). Treated effluent is pumped to the effluent storage pond before disinfection and reuse for private irrigation, with excess discharged to the Lansdowne River. |
| **Forster** | The Forster scheme services the towns of Forster, Green Point, Pacific Palms and Smiths Lake with a total permanent population of approximately 15,700 people (8,000 connections). There is no current reuse and treated effluent is discharged via near-shore outfall at Janie's Corner. |
| **Gloucester** | The Gloucester scheme services approximately 2,100 connections. Treated effluent is stored in an artificial wetland before reuse for pasture irrigation, with excess discharged into the Gloucester River, a tributary of the Manning River. The STP is due for renewal and a new STP is currently in detailed design. |
| **Hallidays Point** | The Hallidays Point scheme services the towns of Tuncurry, Nabiac, Wallamba and Hallidays Point with a total permanent population of approximately 12,500 people (7,300 connections). Effluent from Nabiac STP is first conveyed into the Hallidays Point STP, from where it is then pumped to the Tuncurry RTP where it is treated to a quality suitable for public space irrigation. The RTP has a current capacity of 3.5 ML/d, upgradable to 7 ML/d. Excess treated effluent is discharged via exfiltration beds at the STP. |
| **Harrington** | The Harrington scheme services the towns Harrington and Crowdy Head with a total permanent population of approximately 3,500 people (1,900 connections). Treated effluent is pumped to the nearby golf course for irrigation use, with excess discharged to exfiltrated via two effluent ponds at the STP. |
| **Hawks Nest** | The Hawks Nest scheme services the towns of Hawks Nest and Tea Gardens with a total permanent population of approximately 4,600 people (3,800 connections). Treated effluent is pumped to the co-located RTP where it is treated to a quality suitable for public space irrigation. The RTP has a current capacity of 2 ML/d, upgradable to 6 ML/d. Excess treated effluent is discharged via exfiltration ponds located at the STP. |
| **Lansdowne** | The Lansdowne scheme services the town of Lansdowne with a total permanent population of approximately 600 people (300 connections). Treated effluent is stored prior to private irrigation reuse, with excess discharged to Lansdowne River. |
| **Manning Point** | The Manning Point scheme services the town of Manning Point and Pelican Bay with a total permanent population of approximately 240 people (280 connections). Treated effluent is reused onsite, with wet weather flows stored for future use. |
| **Old Bar** | The Old Bar scheme services the towns of Old Bar and Wallabi Point with a total permanent population of approximately 4,400 people (2,600 connections). There is no current reuse and treated effluent is discharged via exfiltration beds located within the sand dunes 1.2 km south-east of the STP. The exfiltration beds are within the forecast 2100 sea level. |

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| Sewer Catchment | Scheme Overview |
|---|---|
| **Stroud** | The Stroud scheme services approximately 550 connections. Treated effluent is reused for private irrigation, with excess discharged to the Karuah River. |
| **Taree (Dawson)** | The Taree (Dawson) scheme services the town of Taree, Taree South, Tinonee, and Cundletown with a total permanent population of approximately 21,500 people (9,700 connections). The scheme comprises of two plants, with Taree STP providing preliminary treatment and wet weather storage, while Dawson STP provides secondary and tertiary treatment. Taree (Dawson) is part of the Taree Wingham Effluent Management Scheme (TWEMS), which facilitates beneficial reuse for irrigation on farmland. Excess effluent is discharged to the Manning River. |
| **Wingham** | The Wingham scheme services the town of Wingham with a total permanent population of approximately 5,400 people (2,200 connections). Treated effluent is reused for farmland irrigation via the TWEMS, with excess discharged to the Manning River. |

### 2.4.3 Unserviced Villages

As the MidCoast LGA covers a vast region with a region of 195 localities, there are many villages that remain unserviced and require on-site and/or off-site wastewater management systems. Council is both the approver and regulator for these systems. Figure 2-3 illustrates the unserviced villages in the region. The systems across the villages vary in type, age, capacity and condition. On-site wastewater systems require periodic condition inspections and servicing to maintain the system; failure to do so can lead to public health and environmental risk especially to the local waterways and groundwater aquifers.

Council engaged Decentralised Water Consulting (DWC) in 2019 to prepare a risk assessment of unserviced villages in the LGA. A total of 30 villages were assessed. The main categories used in the assessment included: on-site wastewater management capability, reticulated water supply availability, proximity to sensitive receptors and potential for in-fill development. High-risk villages were identified in the process and prioritised. High-level options were also presented for the management of sewage in these areas. Further details on the assessment are presented in Appendix C.

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| Rank | Village |
|---|---|
| 1 | Coomba Park |
| 2 | North Pindimar<br>South Pindimar<br>North Arm Cove<br>Bundabah<br>Nerong<br>Seal Rocks<br>Carrington & Tahlee |
| 9 | Bungwahl |
| 10 | Croki |
| 11 | Allworth<br>Copeland |
| 13 | Tea Gardens<br>Industrial Estate |
| 14 | Coolongolook |

**Figure 2-3: Selected unserviced villages in the MidCoast LGA**

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### 2.4.4 Climate Change

Australia's climate continues to trend hotter and drier. Not only does this increase demand for water, but it also reduces the potential supply from rainfall dependent sources whilst potentially impacting operation and management of water and sewer assets. Building resilience to climate change is crucial in ensuring a sustainable water supply as communities grow.

A high-level climate change exposure assessment revealed that temperature change, extreme heat, extreme storm events, flooding, sea level rise, bushfires and drought are the primary climate hazards posing a threat to Council's assets and operations. This exposure assessment was performed using climate projections which assume global greenhouse gas emissions remain high and continue to rise at a similar rate to today (Dowdy, et al., 2015). The climate projections were calculated for the short term (2030) and long term (2090) and are summarised in Table 2-6.

**Table 2-6: Overview of primary climate hazards for consideration**

| Climate Hazard | 2030 | 2090 |
|---|---|---|
| Mean temperature change | Average temperatures are expected to increase by 1.0°C, with the maximum and minimum increasing by up to 1.4°C and 1.2°C respectively | Average temperatures are expected to increase by 3.7°C, with maximum and minimum increasing by up to 4.9°C and 4.7°C respectively |
| Extreme heat | Extreme heat days and heat waves are anticipated to increase in frequency and duration with very high confidence | Average annual number of days above 35°C for the MidCoast region are projected to increase from 3.1 days (current) to 15 days in 2090 |
| Extreme rainfall – inland flooding | Extreme rainfall events to increase in intensity and severity | Extreme rainfall events to increase in intensity and severity |
| Sea level rise – coastal flooding | Sea level projected to rise on average to 0.10 to 0.19 m | Sea level projected to rise on average to 0.45 to 0.88 m |
| Bushfires | Increased fire weather risk with severe fire weather days to increase by an average of 45% | Increased fire weather risk with severe fire weather days to increase by an average of 130% |

In 2019, Council declared a climate emergency. Climate change is considered a stand-alone corporate-level strategic issue. Council committed to achieving Net Zero greenhouse gas emissions and 100 percent renewable energy for its operations by 2040. Climate change therefore will be addressed both at the asset level and embedded into the options for all other strategic issues.

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# 3.0 Planning Approach

## 3.1 Planning Roadmap

The IWCM strategy was developed through a collaborative planning approach which involved a wide range of internal and external stakeholders. The aim was to develop a strategy that was flexible, adaptive to future conditions, and that delivers the vision and the outcomes required by Council.

The planning process for the IWCM Options and Scenarios phase is presented in Figure 3-2.

### 3.1.1 Adaptive Planning

Adaptive planning is a structured process to feed new information into decision making through ongoing monitoring and evaluation of the situation. This approach is suited to managing situations where the future is uncertain, and where new information that could change decisions is likely to emerge in the future. This is the case for regional water management, where system reliability, water yields, demands and regulations can all vary over time. The incorporation of uncertain and variable futures into planning and decision-making, where key decisions and action triggers are set out in response to events that may be observed into the future, is termed 'adaptive planning'.

The challenge with traditional planning approaches is that in many cases plans and strategies can become redundant the moment external variables change. The IWCM Options and Scenario Phase adopted an adaptive planning methodology to deliver a preferred IWCM strategy that can accommodate change in external variables. The adaptive plan also identifies the antecedent decisions and dependent activities that need to be undertaken to keep certain servicing concepts 'live' and when opportunities are lost. The adaptive plan outcomes for the IWCM Strategy are presented in Section 8.0.

Figure 3-1 describes the uncertainty associated with a traditional planning process, and where an adaptive plan aims to capture and address this uncertainty.

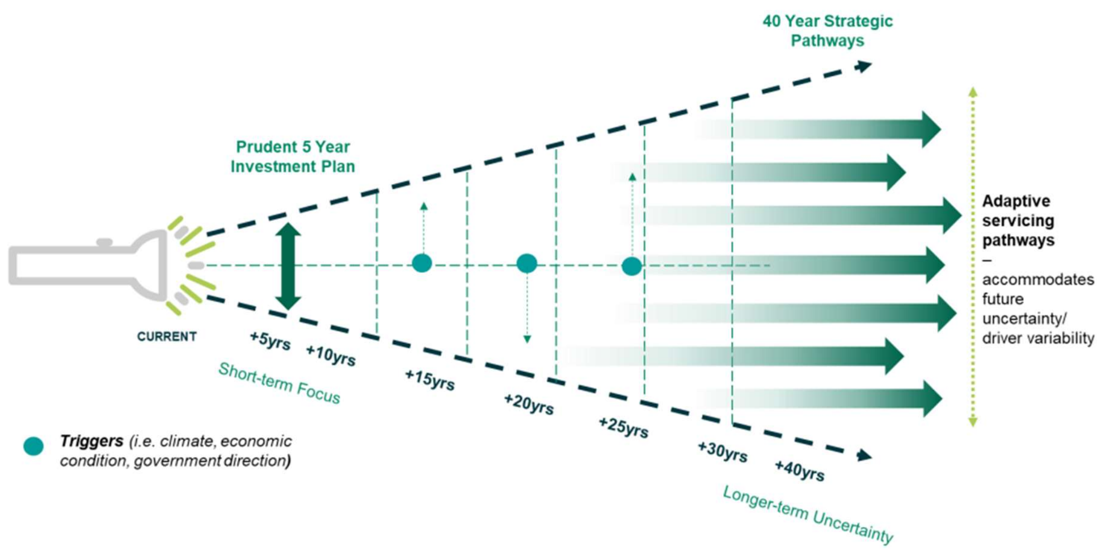


**Figure 3-1: Adaptive planning approach capturing uncertainties in planning**

### 3.1.2 Integrated Project Team

An integrated project team was adopted to deliver the Options and Scenarios Phase, with Council resources embedding within the team. Consultation with stakeholders was a core aspect of the delivery. Stakeholders were engaged at various points throughout including regular touchpoints with key internal stakeholders from Council. External stakeholders were engaged through a series of activities described in Section 3.2.

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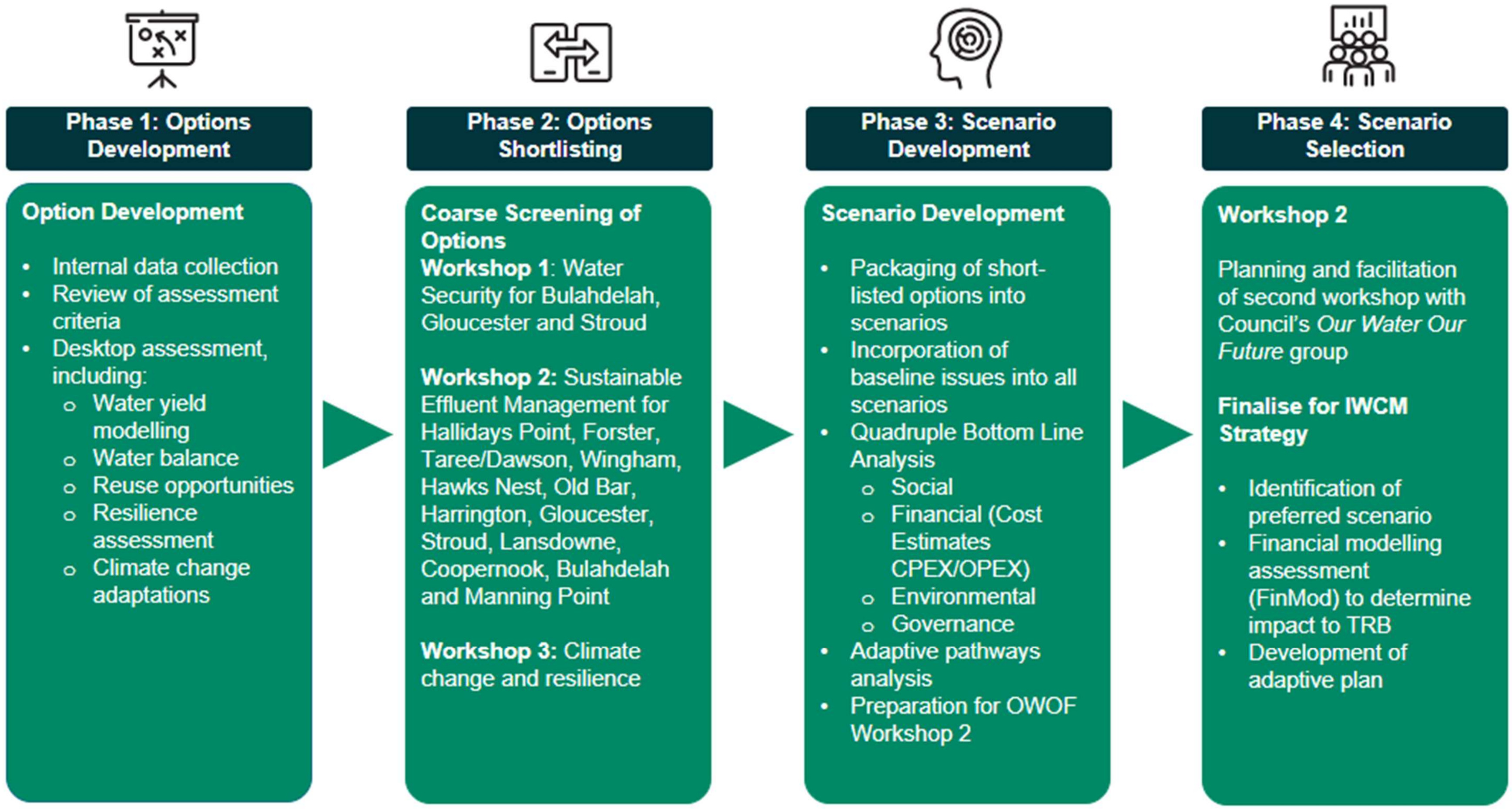


**Figure 3-2: Planning Roadmap for IWCM Options and Scenarios Phase**

## 3.2 Stakeholder Engagement

### 3.2.1 Internal Stakeholders

Internal stakeholders were consulted at various touch points throughout the development of the options, scenarios and IWCM Strategy. The core team was involved at all major decision points in each stage. Various other Council stakeholders were engaged primarily for the coarse screening workshops and community engagement. Details on the participating stakeholders can be found in the minutes of each activity in the appendices.

### 3.2.2 External Stakeholders

Engagement with external stakeholders including the MidCoast community commenced at the start of the IWCM Review process. The sections below summarise all external stakeholder engagement activities that informed and influenced the delivery of the preferred IWCM strategy.

#### 3.2.2.1 Our Water Our Future Group

The Our Water Our Future Group aims to bring together people with a diverse range of backgrounds and experience to help Council develop a long-term water strategy for the region. Participants include:

- Aboriginal elders
- MidCoast Council staff
- MidCoast community members
- MidCoast Councillors
- Department of Planning and Environment – Water
- NSW Environment Protection Authority
- NSW Health
- MidCoast 4 Kids
- Wingham Chamber of Commerce
- Forster Tuncurry Business Chamber
- MidCoast 2 Tops Landcare
- Water Directorate

The group was engaged in two workshops during the IWCM process, to provide feedback with IWCM scenarios and developing the overall strategy.

##### 3.2.2.1.1 Our Water Our Future Workshop 1

The purpose of the first Our Water Our Future workshop held on 28 July 2022, was to collect feedback on the long-term water strategic issues identified by Council. As the Our Water Our Future Group consists of members from the wider community with varying levels of knowledge on the IWCM topic, the workshop also served to inform attendees on the existing services and issues.

The range of potential options and solutions were shared with the group to determine if these achieved the outcomes set out by Council and the community. The group was also encouraged to identify potential issues that may have been overlooked. Additionally, the workshop discussed Council's assessment criteria and how certain elements of the criteria should be weighed in the development of the IWCM Strategy.

Participants shared what water meant to them and their experiences with it. The key themes of the four strategic issues were then discussed amongst smaller groups and the QBL factors were analysed. Emphasis was placed on community engagement, particularly with younger demographics. Climate change was also identified as a key driver of many aspects of the IWCM strategy. The engagement and outcomes from Workshop 1 is included in the Community Engagement Report (Appendix K).

#### 3.2.2.1.2 Our Water Our Future Workshop 2

In the second Our Water Our Future workshop, the four scenarios were presented to the Our Water Our Future Group for discussion and feedback. Background information and an update on the strategic planning process were also presented to the attendees. The feedback from the group provided an indication of the community's values, concerns, and priorities for consideration in developing the IWCM strategy.

The finalists of the Youth Hackathon were invited to present their ideas at Workshop 2, and the submissions from the children's illustration competition were also presented. The inclusion of younger age groups in the strategy design prompts broader considerations in the development of the IWCM Strategy.

Refer to Section 7.1 for outcomes of Workshop 2.

#### 3.2.2.2 Youth Hackathon

The Youth Hackathon, held on 11 November 2022, aimed to engage senior high school students in developing creative solutions to water security, effluent management and climate change issues. Fifty students were invited from six schools across the MidCoast region to form nine teams. Mentors supported each team in working through challenges and developing their solutions. The teams then presented their ideas to a judging panel consisting of various representatives of the community and Council workers. A summary of the event is available in Appendix K.

The results of the hackathon were:

1. Taree High School – Mangrove restoration using drones
2. Great Lakes College – Using wetlands to improve water quality
3. MidCoast Christian College – Rainwater tank scheme

The winning teams were invited to present to the wider Our Water Our Future group in Workshop 2.


**Figure 3-3: Youth Hackathon team presentations**

#### 3.2.2.3 Drawing Competition

The Drawing Competition encouraged children to consider the importance of water and present their ideas in a creative format. The competition was split into three age classes: 5 to 7, 8 to 10 and 11 to 12. Prizes were awarded to the most thoughtful and creative illustrations within each age class. Winning illustrations will also be featured in the *Our Water Our Future 2050 Plan* and on various Council's social media platforms. Figure 3-4 presents the submissions entries of the competition.

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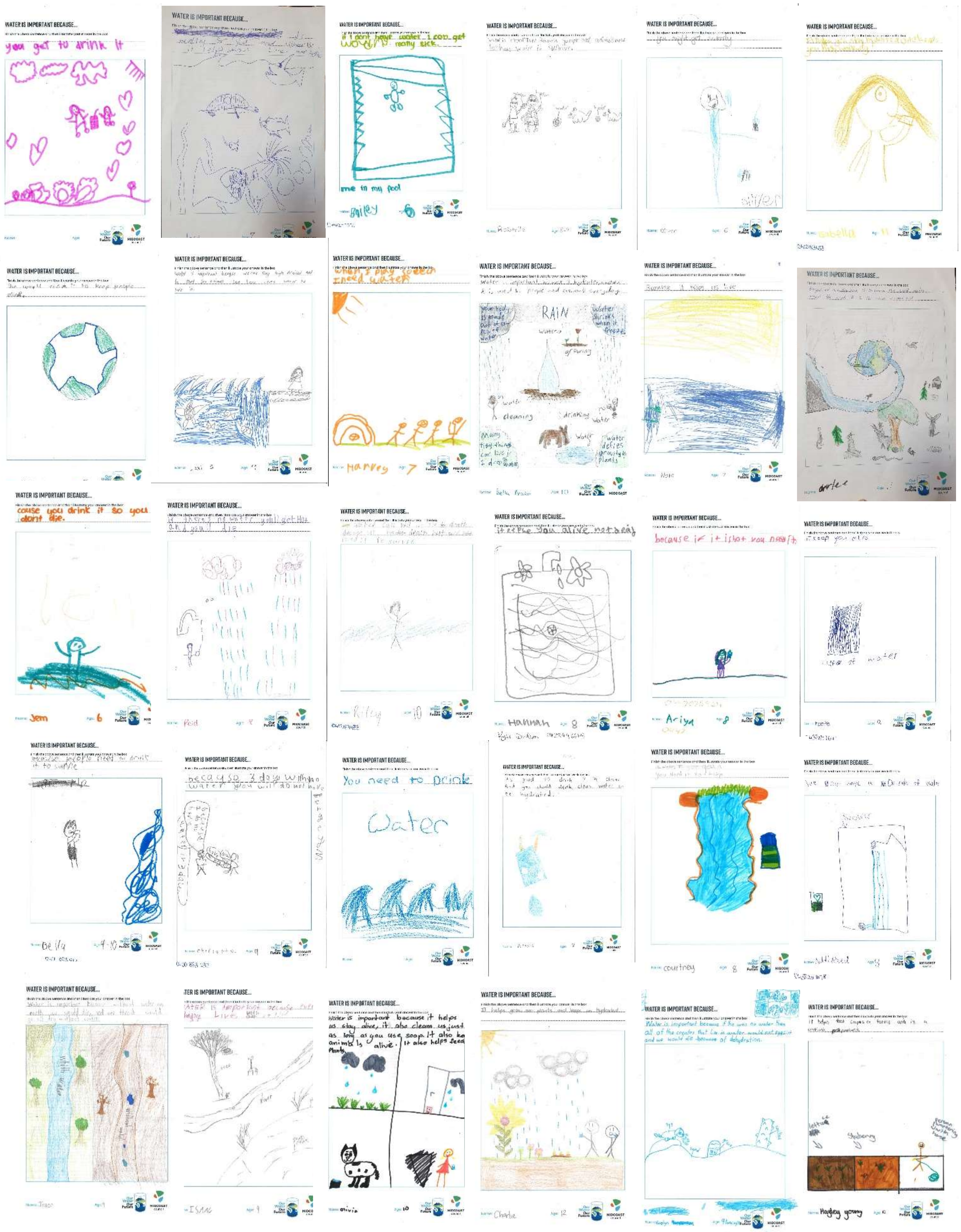

**Figure 3-4: Drawing competition submissions for importance of water**

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#### 3.2.2.4 Have Your Say- Community Consultation

'Have Your Say' is Council's online community engagement platform, which was used to involve the community in the decision-making process for the IWCM Strategy. The community was given the opportunity to select which options they prefer for defined decision points. Refer to Section 7.2 for outcomes of this engagement.

In-person engagement with the community was undertaken during the community consultation phase. This involved kiosks at local markets and community events. The objectives of this engagement included:

- raising awareness of the strategic issues around water and the IWCM strategy
- increasing awareness in the community and answering questions around the 'Have Your Say' page
- building water literacy for those seeking further information.

Section 7.2.1 has further details on the outcomes from this engagement.

#### 3.2.2.5 Public Exhibition of Draft IWCM Strategy

The final draft of the IWCM Strategy, *Our Water Our Future 2050*, along with the IWCM Options and Scenarios Report, will be placed on public exhibition for a period of 25 working days following approval by Council. Comments and feedback received from the community will be considered and incorporated into the final IWCM Strategy reports as appropriate.

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# 4.0 Basis of Planning

## 4.1 Basis of Planning – Water Schemes

### 4.1.1 Level of Service – Water Security

Council has adopted the level of service (LOS) rule '5/10/10' from the 'Assuring future urban water security: Assessment and adaption guidelines for NSW local water utilities' (NSW Office of Water, 2013). The rule requires infrastructure delivering water supply to be sized to meet the following LOS Requirements:

- Total time spent in drought restrictions should be no more than 5 percent of the time
- Restrictions should not need to be applied in more than 10 percent of years and
- An average reduction of 10 percent in water usage during restrictions

This methodology approximates the severity of a '1-in-1,000-year drought' with secure yield defined as the highest annual water demand that can be supplied from a water supply headworks system whilst meeting the 5/10/10 LOS rule. Water security is achieved in the secure yield of a water supply which is at least equal to the unrestricted dry year annual demand.

### 4.1.2 Growth and demand forecasts

The IWCM strategy is based on a best value 30-year scenario. Future demands for the region form the basis of assessment for resolving the key strategic issues. Demand projections are based on Council's growth strategy, which are based on an evaluation of development opportunities and development plans as well as population forecasts. The 30-year residential forecast for the Manning scheme is presented in Figure 4-1. The 30-year residential forecast for the Tea Gardens, Bulahdelah, Gloucester and Stroud schemes are presented in Figure 4-2. This data was obtained from MidCoast Council's water demand and population forecast projections. The 30-year demand forecast for the region for each supply scheme is presented in Table 4-1 to Table 4-5. Full details of the demand forecasts are available in Appendix D. This includes permanent and peak population information for each scheme.

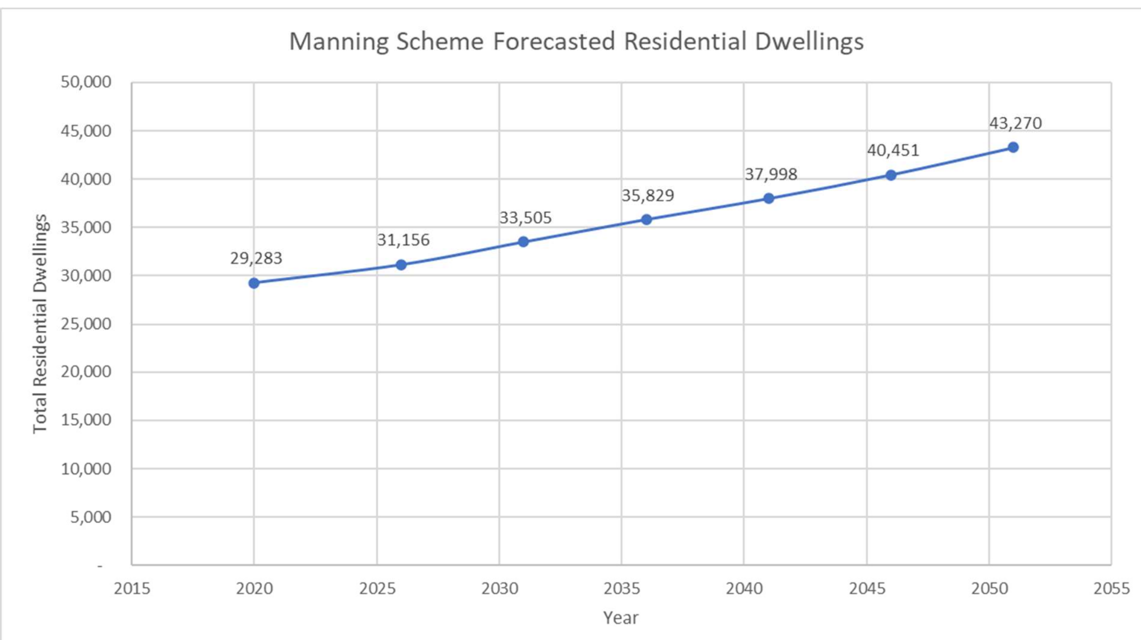


**Figure 4-1: Manning scheme 30-year forecasted residential dwellings**

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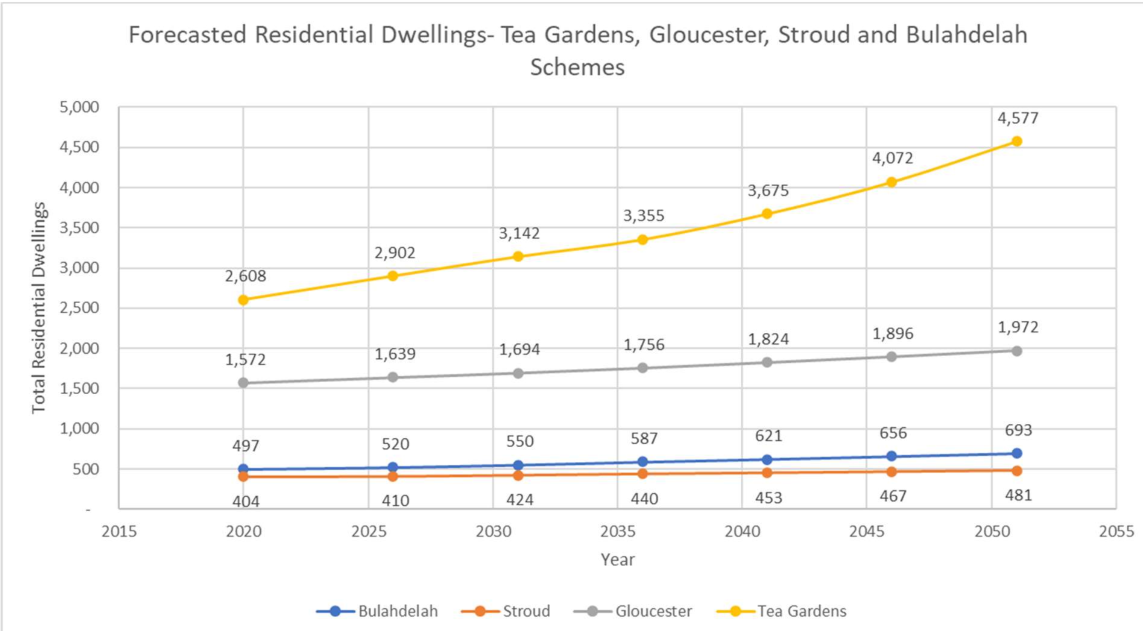


**Figure 4-2: Tea Gardens, Gloucester, Stroud and Bulahdelah scheme 30-year forecasted residential dwellings**

**Table 4-1: Manning supply schemes demand forecast based on L/dwelling**

| | 2020 | 2051 |
|---|---|---|
| Average year demand (ML/year) | 6,085 | 10,695 |
| Average day demand (ML/d) | 18.64 | 30.90 |
| Peak day production (at water treatment plant) (ML/d) | 33.35 | 63.87 |
| Peak day demand (ML/d) | 49.80 | 81.80 |

**Table 4-2: Tea Gardens supply scheme demand forecast based on L/dwelling**

| | 2020 | 2051 |
|---|---|---|
| Average year demand (ML/year) | 533 | 1,036 |
| Average day demand (ML/d) | 1.46 | 3.00 |
| Peak day production (at water treatment plant) (ML/d) | 3.38 | 8.90 |
| Peak day demand (ML/d) | 5.2 | 9.40 |

**Table 4-3: Gloucester supply scheme demand forecast based on L/dwelling**

| | 2020 | 2051 |
|---|---|---|
| Average year demand (ML/year) | 288 | 436 |
| Average day demand (ML/d) | 0.79 | 1.27 |
| Peak day production (at water treatment plant) (ML/d) | 1.5 | 2.8 |
| Peak day demand (ML/d) | 2.19 | 3.29 |

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**Table 4-4: Bulahdelah supply scheme demand forecast based on L/dwelling**

| | 2020 | 2051 |
|---|---|---|
| Average year demand (ML/year) | 116 | 173 |
| Average day demand (ML/d) | 0.32 | 0.49 |
| Peak day production (at water treatment plant) (ML/d) | 0.56 | 1.14 |
| Peak day demand (ML/d) | 0.83 | 1.31 |

**Table 4-5: Stroud supply scheme demand forecast based on L/dwelling**

| | 2020 | 2051 |
|---|---|---|
| Average year demand (ML/year) | 96 | 135 |
| Average day demand (ML/d) | 0.26 | 0.38 |
| Peak day production (at water treatment plant) (ML/d) | 0.52 | 1.07 |
| Peak day demand (ML/d) | 0.95 | 1.14 |

### 4.1.3 Water balance

The Manning scheme water balance is presented in the *Manning Water Supply Scheme: Coarse Screening of Water Security Options* report (Appendix B). The water balance recommended that Council continue to target a reduction in leakage as part of Council's business as usual and focus on customer side demand management for achieving gains in the system. Refer to Appendix B for full details.

In order to identify parts of the system where demand management may be effective, it was first necessary to analyse background demand and performance data. The analysis adopted the International Water Association Water Balance Framework outlined in Figure 4-3.

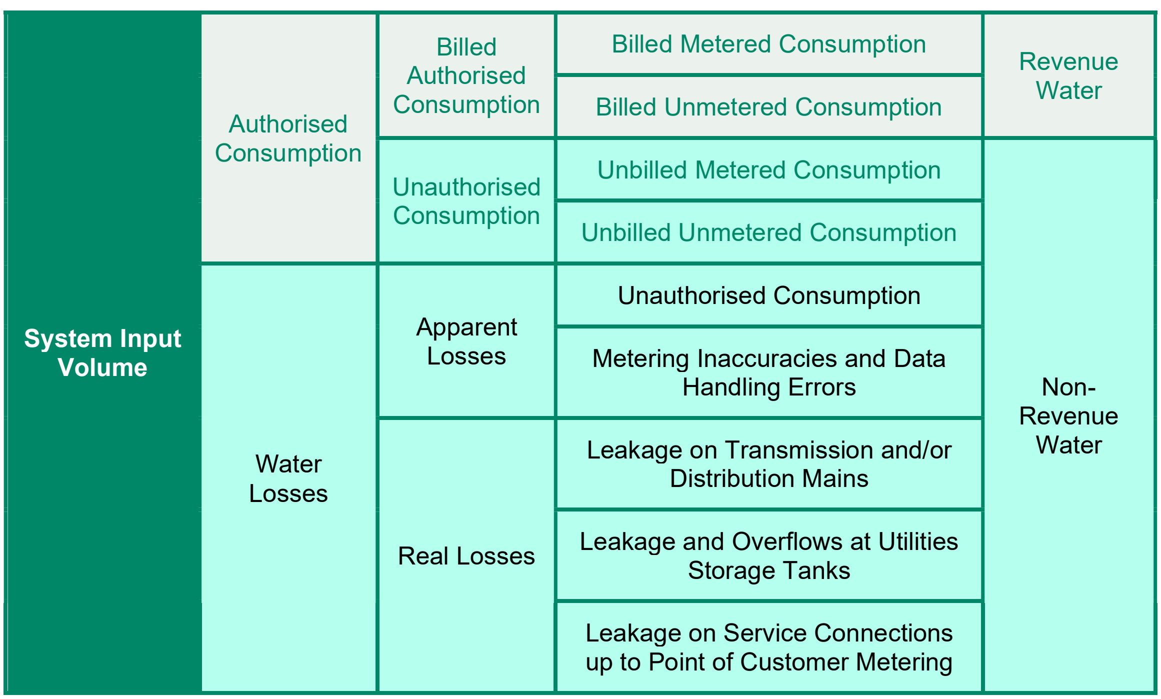


**Figure 4-3: Standard IWA water balance**

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Derivation of the water balance involved analysis of customer billing data for a 5-year period (FY 2015-16 to FY 2019-20). Customer billing data for revenue water is broken down as follows:

- Residential
- Commercial
- Industrial
- Institutional
- Public

Analysis of historical climate data and annual demand was completed to determine a suitable period for the water balance, for example one that was neither too wet nor too dry and represented a long-term climate average. For the Manning scheme water balance, FY 2017-18 was selected.

**Table 4-6: Historical climate and demand data for Gloucester, Bulahdelah and Stroud schemes**

| Scheme | Period | 2015-16 | 2016-17 | 2017-18 | 2018-19 | 2019-20 |
|---|---|---|---|---|---|---|
| Gloucester | Average Demand (kL/d) | 684 | 721 | 799 | 794 | 715 |
| | Yearly Rainfall (mm) | 592 | 813 | 580 | 516 | 432 |
| Bulahdelah | Average Demand (kL/d) | 282 | 298 | 292 | 299 | 278 |
| | Yearly Rainfall (mm) | 1620 | 1345 | 1175 | 846 | 1119 |
| Stroud | Average Demand (kL/d) | 253 | 245 | 253 | 253 | 219 |
| | Yearly Rainfall (mm) | 1078 | 1072 | 975 | 712 | 823 |

The analysis demonstrated that average demand, in kL/d, remained relatively consistent with fluctuations in average yearly rainfall and with population increases over the 5-year period. This is displayed in Figure 4-4 to Figure 4-6. Note that FY2019-20 included a period of water restrictions.

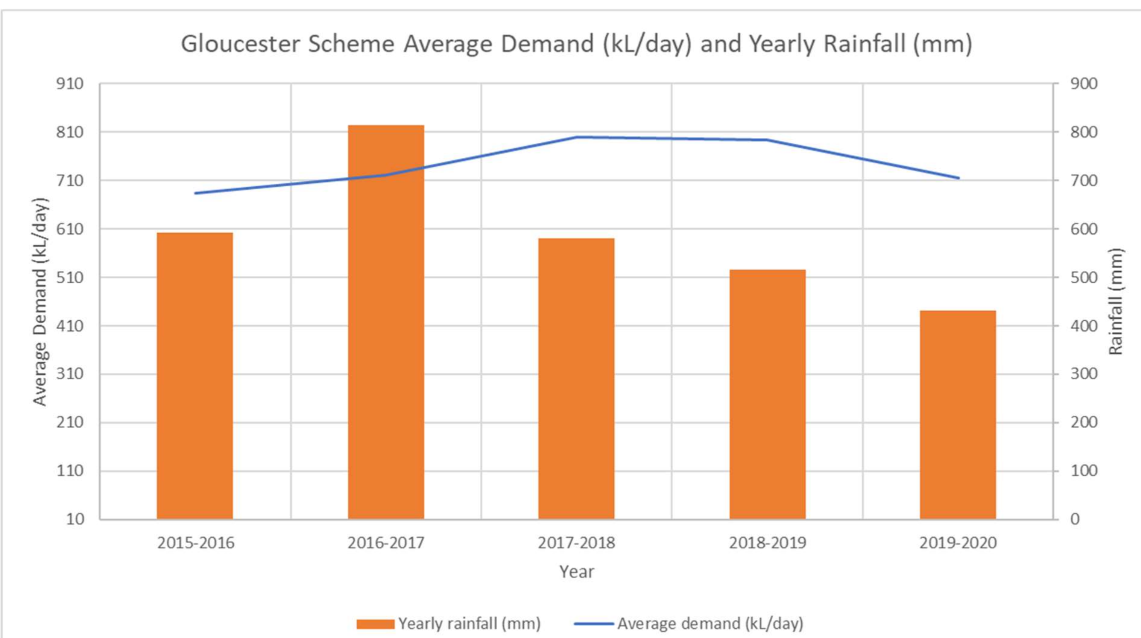


**Figure 4-4: Gloucester historical annual water demand and rainfall**

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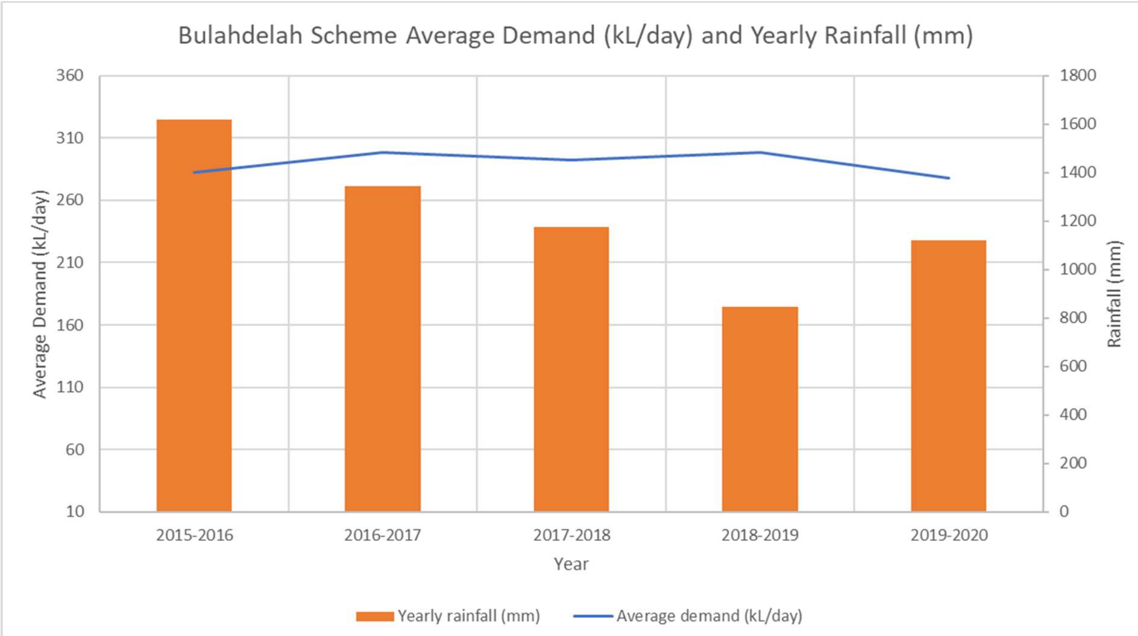


**Figure 4-5: Bulahdelah historical annual water demand and rainfall**

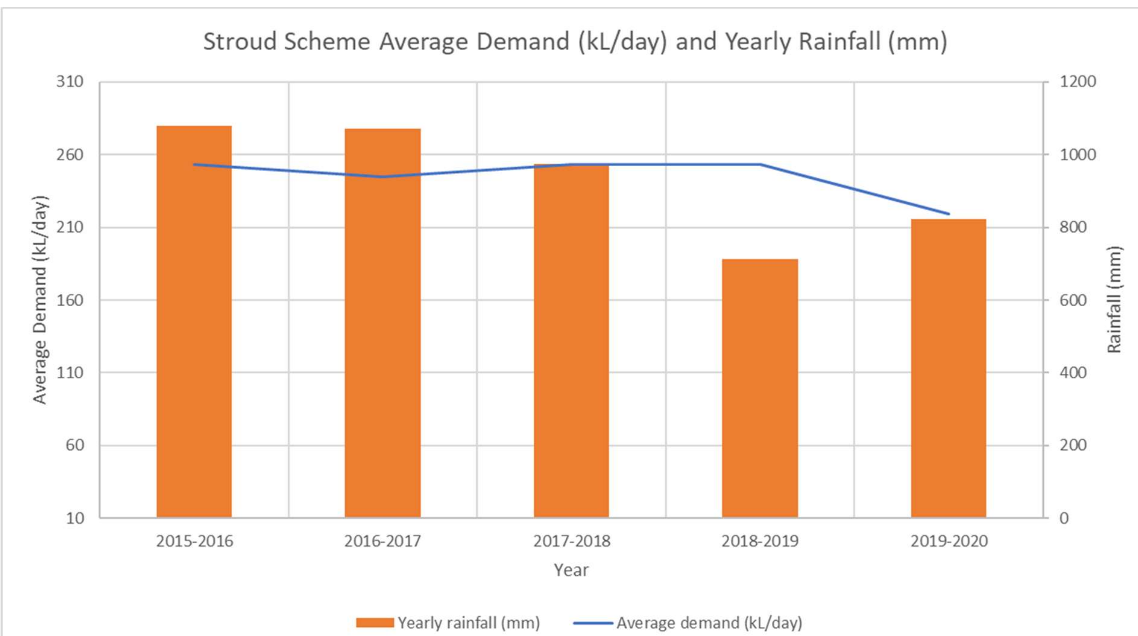


**Figure 4-6: Stroud historical annual water demand and rainfall**

While population growth has continued, water demand for each of the schemes has remained relatively consistent over the past five years. This is likely due to growth in new development area being offset by the installation of more water efficient devices, along with customer behaviour changes linked to Council's water saving education programs and water restrictions during the drought of 2019-20.

The annual rainfall patterns were analysed, with 2017-18 and 2019-20 rainfall generally average for the 5-year period for each of the schemes. However, 2019-20 was a period of high variance of drought and high rainfall. Based on this, the water balance was completed based on 2017-18 for Gloucester, Bulahdelah, and Stroud as this period was identified as a representative year of average climate from

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the analysed data. This period was also selected for the Manning scheme water balance presented in Appendix B.

Council's performance monitoring data (NSW Department of Industry, 2022) has been utilised to establish the components of the water balance. A copy of the water balance is included in Appendix D and summarised below. Results were compared to the local water utility (LWU) performance monitoring to benchmark Council's performance against other utilities. It was identified:

- Council's average water demand per property for 2017-18 (141.6 kL/property) is lower than the 2017-18 NSW state average (171.41 kL/property). Refer to Figure 4-7.
- Council's average annual water supplied per property (kL/property) was benchmarked against different LWU's in NSW of similar climate (annual rainfall). The average of annual rainfall received across Gloucester, Bulahdelah, and Stroud areas were used for this assessment (890 mm). This benchmarking in terms of climate demonstrated that Council's average demand (141.6 kL/property) for 2017-18 was below the average demand (152.4 kL/property) for four NSW LWU's of similar annual rainfall (averaging around 900 mm) for the 2017-18 period (Eurobodalla, Central Coast, Tweed Shire and MidCoast LWUs). Refer to Figure 4-8. Although demand per property is below the state average, there is opportunity to further reduce household water use.
- Council's average water demand since 2013-14 has been relatively stable, fluctuating between 139 kL/property and 155 kL/property. Refer to Figure 4-9.
- Council's non-revenue water per connected property for 2017-18 is 75 L/d/property, which is slightly lower than the 2017-18 state average of 78 L/d/property. Refer to Figure 4-10. These transmission losses, based on the Council-wide average, indicate that losses are reasonable. However, the scheme-specific water balance (Appendix D) has calculated the non-revenue water percentages and volumes in L/d/property, presented in Table 4-7. This indicates that opportunity for Council to reduce non-revenue water by continue ongoing leakage and non-revenue water management programs across the water schemes. Council will target a non-revenue water of 10 percent. This target is in line with the Regional Leakage Reduction Program objective of reducing average non-revenue water across water utilities in NSW to 10 percent (NSW Department of Planning and Environment, 2023). This will be coupled with customer side demand management for achieving gains in the system.

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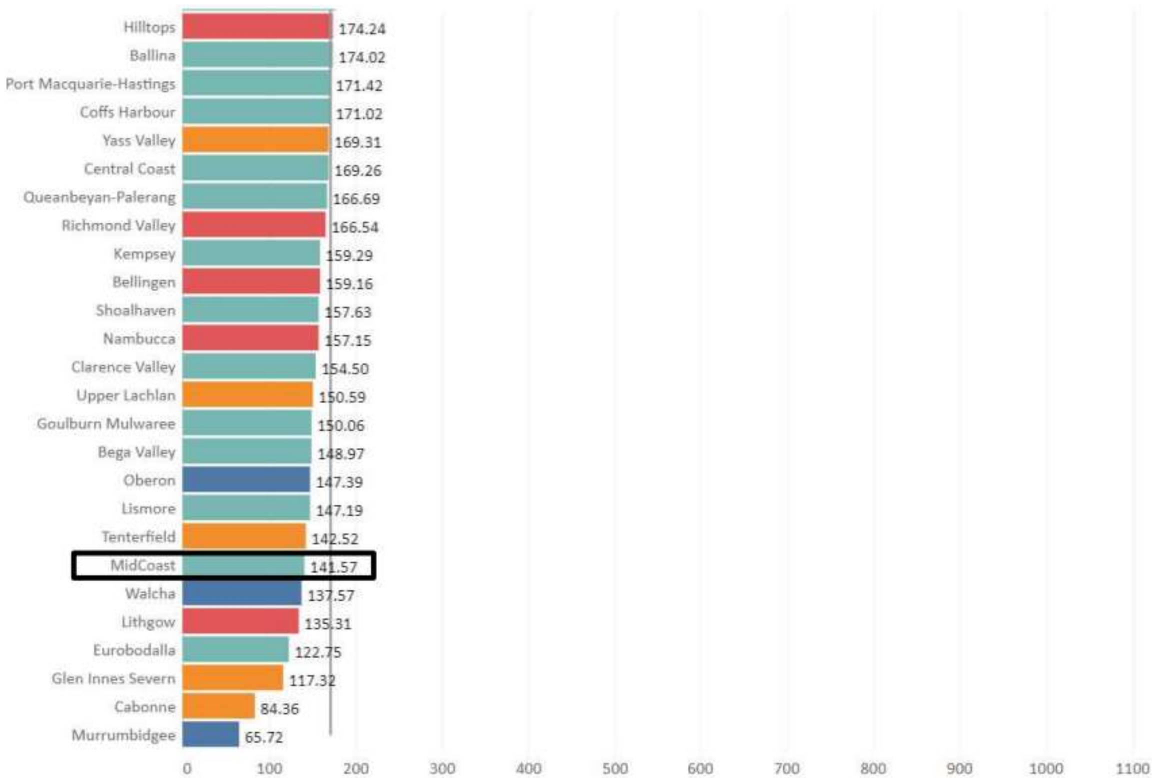


**Figure 4-7: Average annual residential water supplied 2017-18 (potable) (kL/property)**

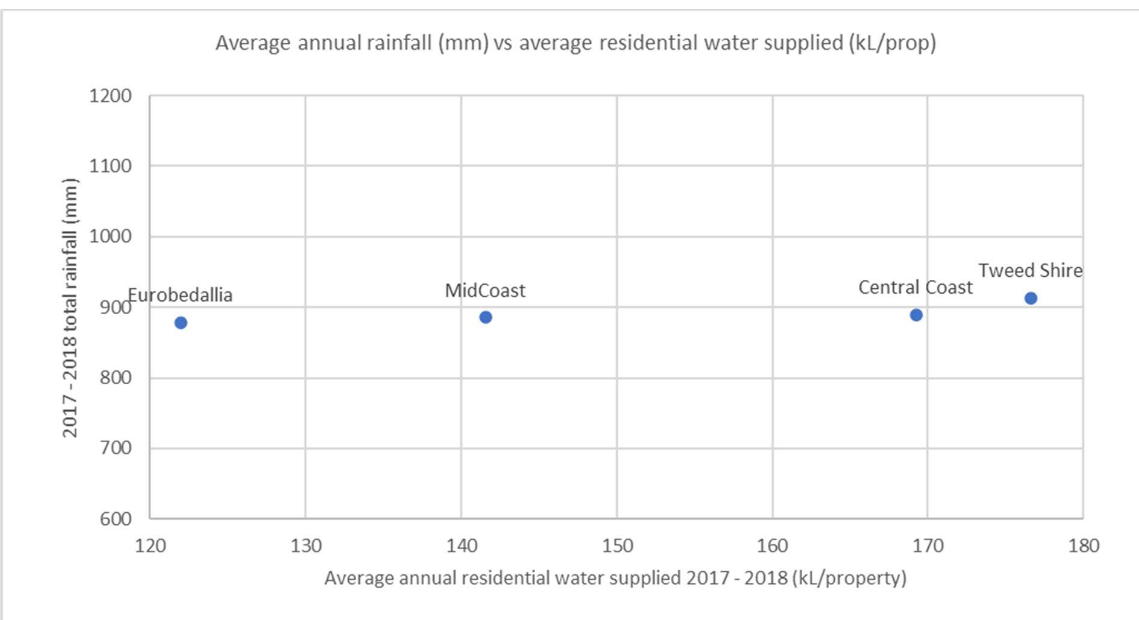


**Figure 4-8: Comparison of average annual rainfall (mm) and 2017-18 average residential usage (kL/property)**

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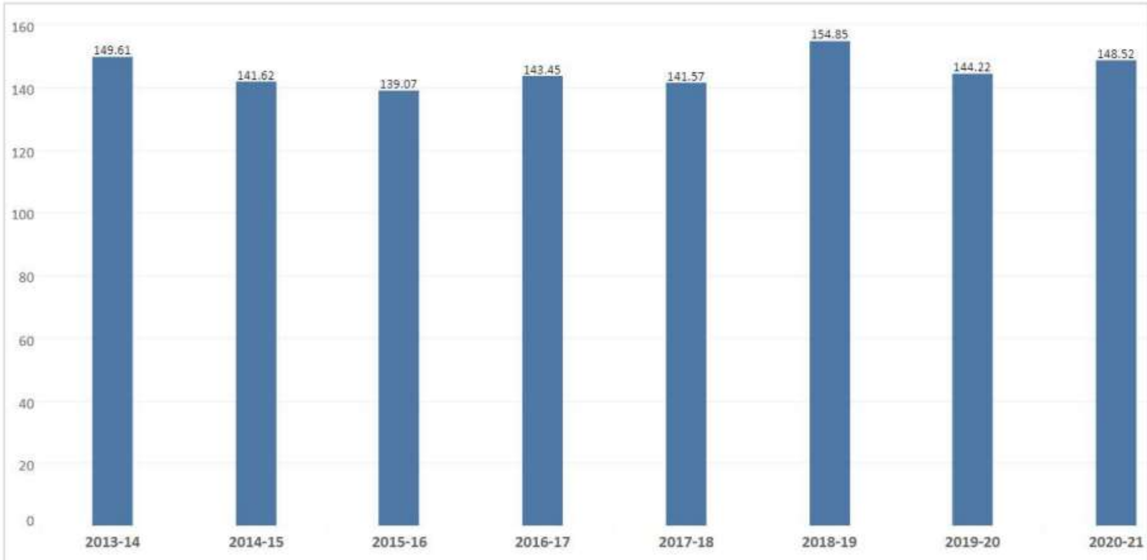


**Figure 4-9: MidCoast average annual residential water supplied (potable) (kL/property)**

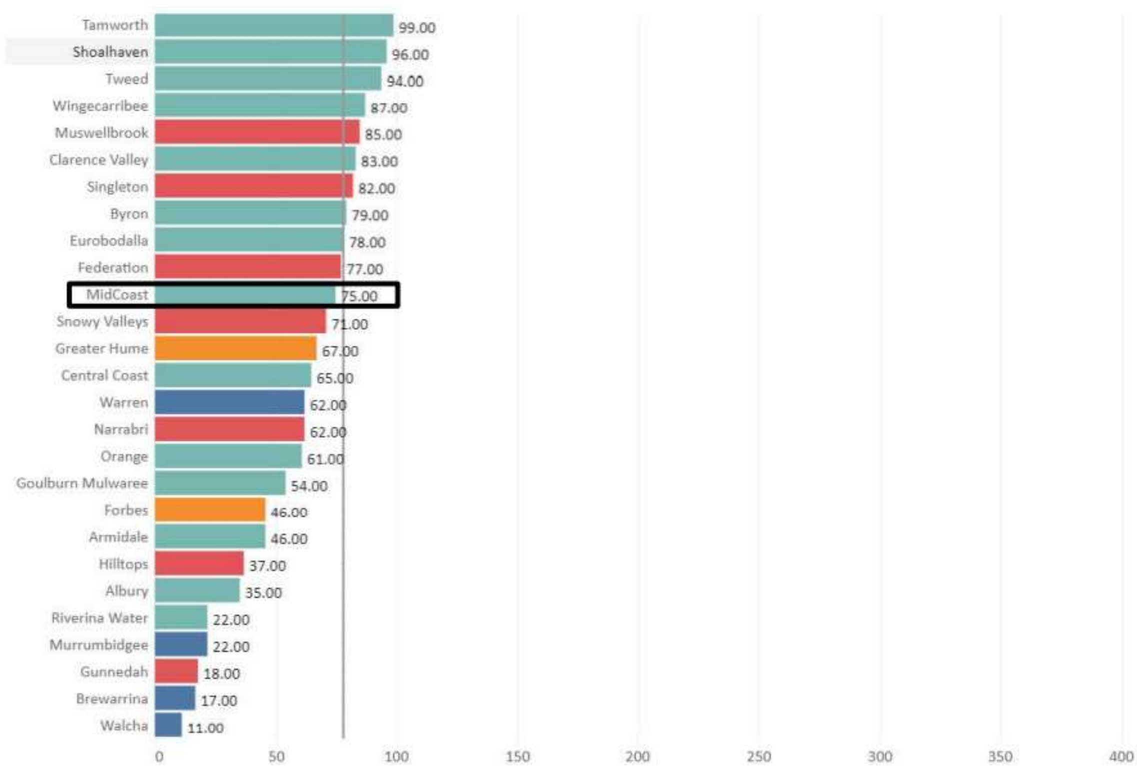


**Figure 4-10: Non-revenue water (potable) 2017-18 (L/d/connected property)**

**Table 4-7: Scheme non-revenue water**

| | 2017-18 | | |
|---|---|---|---|
| **Scheme** | **Bulahdelah** | **Gloucester** | **Stroud** |
| Non-revenue water (%) | 22% | 26% | 26% |
| Non-revenue water (L/d/property) | 142 | 156 | 184 |

### 4.1.4 Opportunities for demand management and water conservation

The water balance indicated opportunities for reduction in both customer-side water consumption (demand management) and non-revenue water (water conservation). While demand management will have a relatively minor impact on water security, overall demand reductions will give Council an opportunity to reduce water consumption, reduce operating and maintenance costs and potentially delay infrastructure in the capital program.

Council has identified several demand management opportunities, including:

- Implementation of a smart meter program
- Increased uptake of water efficient devices including rainwater tanks
- Ongoing community water education program
- Potential implementation of permanent water conservation measures
- Installation of bulk flow meters at strategic locations
- Leak detection programs

Full details are available in Section 6.1.1.

Council is targeting a 5 percent reduction in demand over the next three to five years, with an aim to see a 10 percent reduction in demand over the IWCM strategy timeline (30 years). This target is for all users, both residential and non-residential, including Council itself. Refer to Figure 4-11 to Figure 4-16, which shows projected annual demand (ML/year) with and without demand management targets.

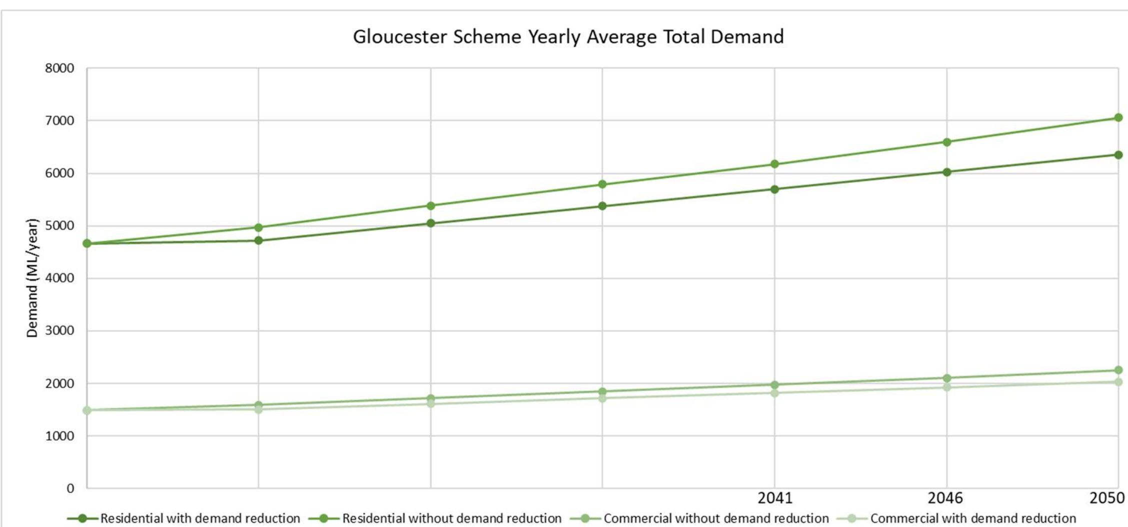


**Figure 4-11: Gloucester scheme residential and commercial yearly average total demand forecasts – with and without demand management targets**

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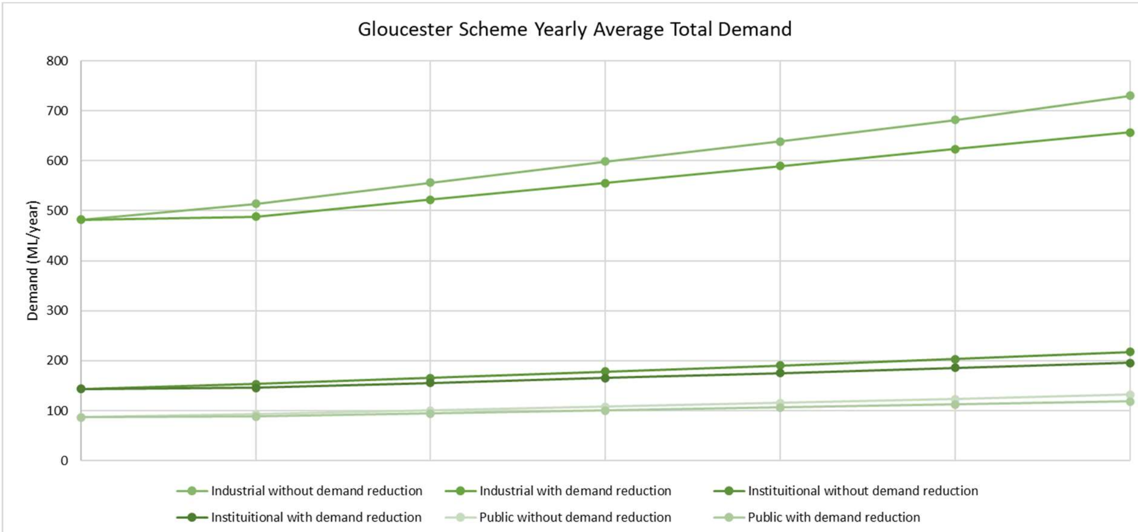


**Figure 4-12: Gloucester scheme industrial, institutional and public yearly average total demand forecasts - with and without demand management targets**

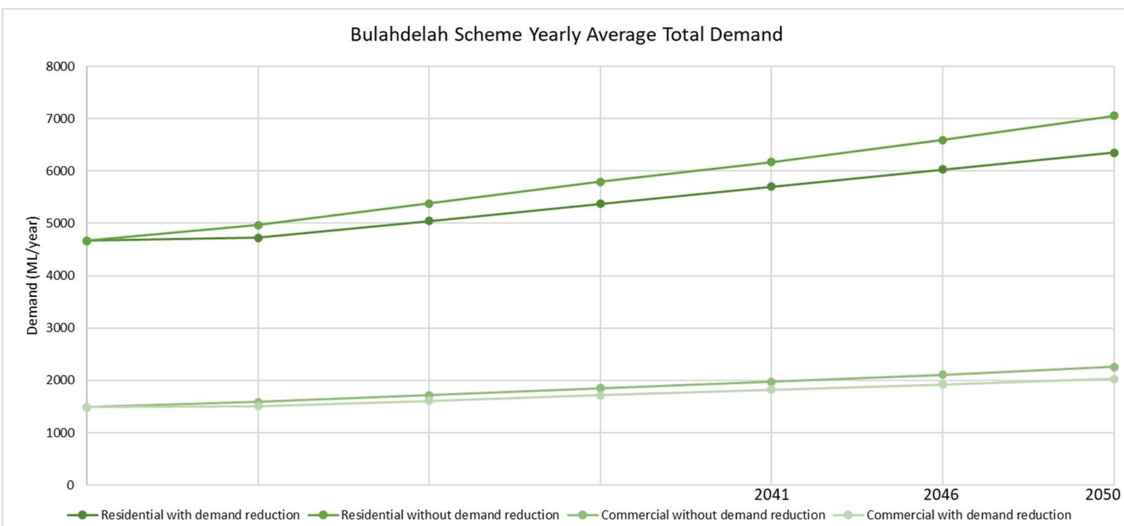


**Figure 4-13: Bulahdelah scheme residential and commercial yearly average total demand forecasts - with and without demand management targets**

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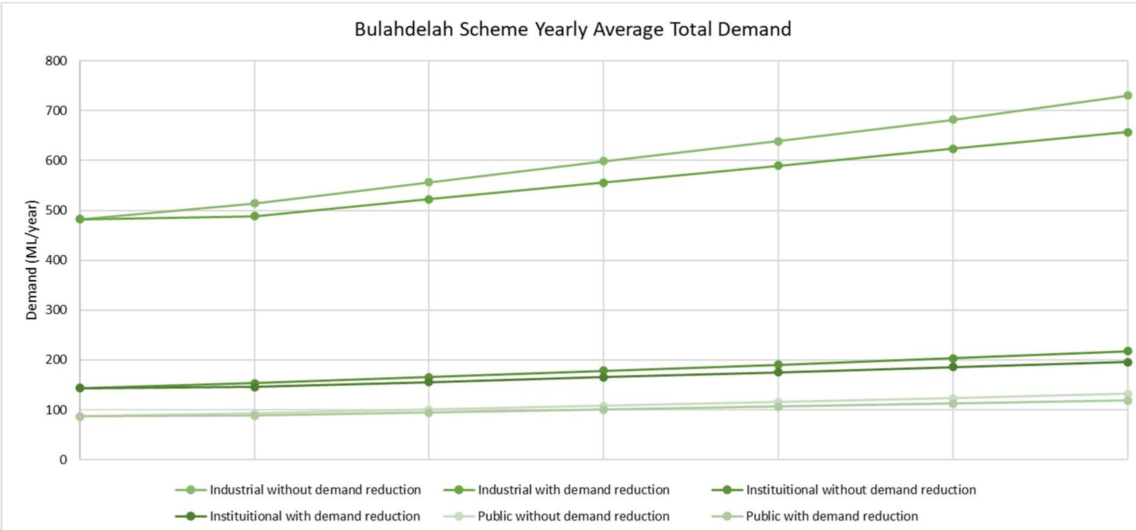


**Figure 4-14: Bulahdelah scheme industrial, institutional, and public yearly average total demand forecasts - with and without demand management targets**

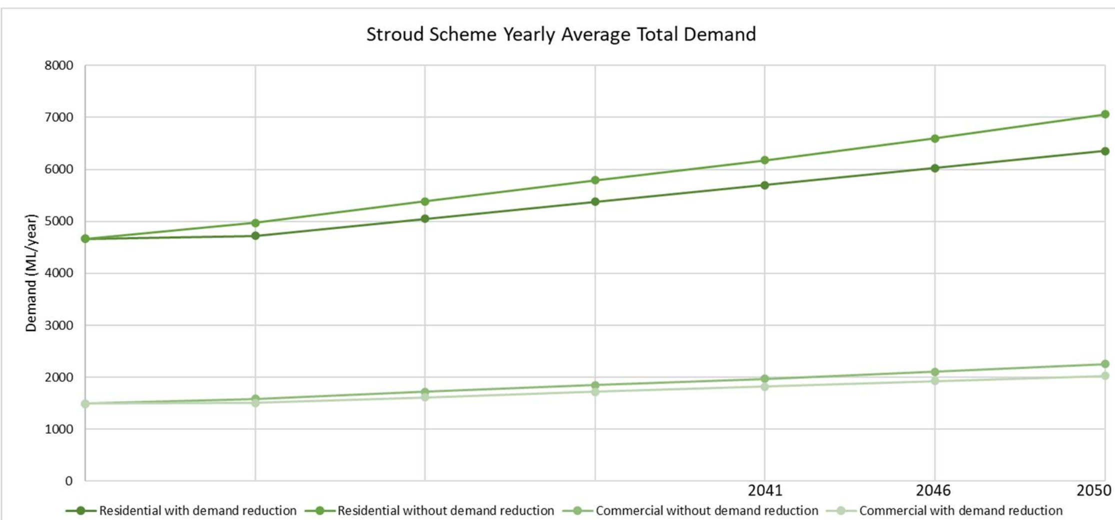


**Figure 4-15: Stroud scheme residential and commercial yearly average total demand forecasts - with and without demand management targets**


**Figure 4-16: Stroud scheme industrial, institutional and public yearly average total demand forecasts - with and without demand management targets**

### 4.1.5 Yield modelling

AECOM was engaged to undertake the secure yield assessment, which identified insufficient yield for water supply security to meet this level of service rule for the following water supply schemes:

- Manning water supply scheme
- Gloucester water supply scheme
- Bulahdelah water supply scheme
- Stroud water supply scheme

Water Balance Models (WBM) were developed for the four schemes using GoldSim software. The streamflow sequence within the GoldSim WBM was generated by embedding Australian Water Balance Model (AWBM) sub-model. An eWater Source Catchment System Model was developed for calibration of the generated runoff sequence and climate data was sourced from SILO, NARCLiM, and ACCESS1.3 databases. A design case GoldSim WBMs dashboard was also developed to facilitate use by Council.

The secure yield assessment considered both historical climate conditions (1889 to 2022) and future predicted climate change conditions for the far future (2060 to 2079) period. The consideration of a climate change scenario is required by ‘Assuring future urban water security: Assessment and adaption guidelines for NSW local water utilities’ (NSW Office of Water, 2013).

Details of the secure yield assessment is available in Appendix I. Below is a summary of the baseline secure yield assessment for each water supply scheme:

- **Manning:** Under both present day (2020) and future (2050) demands, the water supply scheme will need to be augmented with additional water storages and supply from alternate water sources such as desalination, bore water and rainwater harvesting.
- **Gloucester:** Under both present day (2020) and future (2050) demands, the water supply scheme will need to be augmented with additional water storages and supply from alternate water sources.
- **Bulahdelah:** Water security is achieved for the water supply scheme under present day (2020) demands. Under future (2050) demands, the water supply scheme will need to be augmented with additional water storages and supply from alternate water sources.

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- **Stroud:** Gloucester: Under both present day (2020) and future (2050) demands, the water supply scheme will need to be augmented with additional water storages and supply from alternate water sources.

## 4.2 Basis of Planning - Sewerage Schemes

Sewerage scheme loading forecasts were calculated using Council's sewerage scheme demand spreadsheets, with the following inputs:

- Demand forecasts based on Council's 2019-20 billing data to obtain ETs.
- Scheme ET forecasts were estimated for future demands at 5-year increments that aligned with Census years, from 2026 to 2051, using Profile iD growth forecasts.
- Scheme specific operational loading (L/ET/day) was obtained from plant inflows.
- Average dry weather flow (ADWF) for each sewerage scheme determined based on off-peak dry weather operational inflows to the STP
- Peak dry weather flow (PDWF) for each scheme determined based on the highest daily dry weather peak across the full year including holiday season.
- Wet weather flows for 2-year and 5-year average recurrence interval (ARI) were calculated using WSA 02.

Table 4-8 shows projected loading for flows based on operational loading and growth projections. Refer to Appendix D for complete calculations of sewage loadings by catchment.

**Table 4-8: Projected loadings for MidCoast STPs**

| STP | 2021 ADWF ML/d | 2021 PDWF ML/d | 2021 ARI 2 ML/d | 2021 ARI 5 ML/d | 2051 ADWF ML/d | 2051 PDWF ML/d | 2051 ARI 2 ML/d | 2051 ARI 5 ML/d |
|---|---|---|---|---|---|---|---|---|
| Bulahdelah | 0.3 | 0.6 | 2.6 | 3.2 | 0.4 | 0.9 | 3.6 | 4.4 |
| Coopernook | 0.07 | 0.10 | 0.7 | 0.9 | 0.08 | 0.12 | 1.1 | 1.4 |
| Dawson | 3.7 | 7.1 | 51.4 | 62.7 | 4.7 | 9.3 | 66.5 | 80.9 |
| Forster | 3.9 | 6.8 | 28.3 | 34.4 | 5.3 | 9.3 | 36.0 | 43.7 |
| Gloucester | 0.6 | 1.1 | 8.5 | 10.5 | 0.7 | 1.4 | 11.0 | 13.5 |
| Hallidays Point | 3.1 | 5.5 | 23.6 | 28.8 | 4.5 | 8.5 | 36.2 | 44.2 |
| Harrington | 1.2 | 2.2 | 5.8 | 6.7 | 1.7 | 3.2 | 8.4 | 9.8 |
| Lansdowne | 0.05 | 0.09 | 0.8 | 1.0 | 0.07 | 0.11 | 1.0 | 1.3 |
| Manning Point | 0.055 | 0.09 | 0.6 | 0.7 | 0.062 | 0.1 | 1.5 | 1.8 |
| Old Bar | 0.8 | 1.2 | 7.4 | 9.1 | 1.8 | 2.6 | 13.4 | 7.9 |
| Stroud | 0.1 | 0.29 | 1.4 | 1.7 | 0.2 | 0.33 | 1.8 | 2.2 |
| Tea Gardens - Hawks Nest | 1.1 | 2.1 | 7.6 | 9.4 | 1.7 | 3.0 | 10.4 | 12.8 |
| Wingham | 0.7 | 1.0 | 9.0 | 11.3 | 0.8 | 1.2 | 10.3 | 12.8 |

FY 2017-18 recycled water demand was used as the average demand for the recycled water expansion and purified recycled water yield assessments.

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## 4.3 Assessment Approach and Criteria

### 4.3.1 Coarse Screening Process

The coarse screening process formed the first step in the options phase. A long-list of options was developed to address each of the three strategic issues across multiple locations, and then screened to identify a short-list of practical, feasible options to take forward for further investigation.

A series of coarse screening workshops were held with key stakeholders from Council and DPE. A workshop was held for each strategic issue, with the objective to identify and endorse the short-list of options for water security, sustainable effluent management and climate change. The outputs from the coarse screening workshops were then developed into IWCM scenarios, and subject to QBL analysis, financial modelling further stakeholder engagement to determine the preferred IWCM strategy.

The agenda of each coarse screening workshop included:

- Presentation of the long-list of respective options for discussion, including key risk, issues and opportunities
- Collaborative coarse screening of the long-list of options based on a fatal flaw approach
- Agreement on the short-list of options for further investigation

During the coarse screening process, each option was assessed against the agreed assessment criteria and assigned a score:

**Pass** Option meets the criteria and should progress for further investigation

**Fail** Option does not meet the criteria and should not progress for further investigation

**Unknown** Option is not scored due to lack of information, therefore progresses for further investigation

The assessment criteria are presented in Table 4-9 and were developed by the project team based on:

- Council's values
- Council's Risk Management Framework
- AECOM's experience with similar projects
- Advice from Department of Planning and Environment (DPE)

**Table 4-9: Assessment criteria for coarse screening workshops**

| Council Values | Council Risk Category | Indicator for Coarse Screening | Description and Objectives of Indicator |
|---|---|---|---|
| **Wellbeing** | Worker and public health & wellbeing | Health and wellbeing | Fit for purpose water quality- meetings legislative requirements |
| | | | Construction and operating/maintenance risks |
| | | | Delivering the option in a safe manner to customers- both during construction and service delivery |
| | Service delivery & infrastructure | Availability (applicable to Water Security only) | Available when it is needed, in drought or when demand is high (climate independent / dependent) |
| | | Beneficial to pursue | Option will give a measurable improvement in water security by either reducing demand or increasing supply (option improved long-term water security) based on future water supply and demand forecasts<br>Or<br>Option will provide beneficial and sustainable effluent reuse<br>Or |

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| Council Values | Council Risk Category | Indicator for Coarse Screening | Description and Objectives of Indicator |
|---|---|---|---|
| | | | Option will give a measurable improvement in climate resilience and/or lead to reduction in carbon emissions |
| | | | Reduce environmental discharges. |
| | | | Meet existing and future recycled water demand forecast at appropriate water quality. |
| | | Practically viable | Option can be delivered by Council and external support |
| | | Integration with existing network | Project can be integrated into the existing and/or (planned) future supply network, based on built environment and operations |
| **Integrity** | Compliance | Regulatory and governance | Option is achievable or supported by existing legislation and framework |
| | Project timeline | Timeline for planning and delivery | Adaptive planning considerations. Is the timeline required for planning pathways and delivery known? Are there any unknowns about the planning and delivery pathway for this option? |
| | Financial | Cost- capital | Capital costs (qualitative only) |
| | Project budget | Cost – O&M | Operating and maintenance costs (qualitative only) |
| **Sustainability** | Environment | Environmental impact | Impact to environment (during construction/delivery), including footprint of asset, clearing, flora/fauna and heritage impacts |
| | | Sustainability and resource consumption | Resource consumption, including carbon emissions, power use, resource consumption and recovery (ongoing environmental impact) |
| | | | Option aligns with principles of ecologically sustainable development and intergenerational equity |
| **Respect** | Reputation | Community acceptance | Option likely to have community support (based on assumption that there is enough information for the community to make a balanced judgement) |

### 4.3.2 Financial Assessment

#### 4.3.2.1 Cost Estimates

Strategic-level cost estimates were completed for both base case issues and strategic issues. Existing cost estimates specific to the option were adopted where available and indexed as appropriate.

Capital costs for options with no prior information available were derived through a combination of unit rates from NSW Reference Rates Manual, Valuation of water supply, sewerage, and stormwater assets (NSW Office of Water, 2014) and from AECOM's experience with similar projects. Indexation rates were applied to unit rates as necessary.

Operational costs were based on either existing costs supplied by Council or from AECOM's experience with similar projects.

Costing for strategic issues was completed for options that:

- Relied on cost as the deciding criteria for coarse screening outcome
- Options carried forward to the scenario development stage.

To account for inherent risk, the following assumptions were adopted for CAPEX costing:

- Contingency – 30% of direct cost for base case issues
- Contingency – 50% of direct cost for strategic issue options

- Planning stage – 5% of total direct cost for works less than $1 million
- Planning stage – 3% of total direct cost for works greater than $1 million
- Design stage – 10% of total direct cost for works less than $1 million
- Design stage – 5% of total direct cost for works greater than $1 million
- Finalisation and project management stage – 5% of total direct cost.

The above contingencies have been applied to cover the following excluded items that have not yet been costed due insufficient detail at this strategic planning stage:

- Land acquisition
- Environmental offsets including nutrient and biodiversity offsets.
- Site-specific constraints such as availability of electrical supply and access tracks
- Impact of new infrastructure on existing services
- Trenchless rates, where applied, were based only on desktop level assessment; additional investigations are required to determine the suitability of ground profile and extent of construction difficulty.

#### 4.3.2.2 Financial Modelling

FINMOD is Council's financial modelling tool for the IWCM Strategy. FINMOD is used tool to model the price path and financial position of Council over the 30-year strategy period. FINMOD requires inputs for capital and operating expenditure over the period and models the impact to typical residential bill (TRB), borrowings and cash and investments for the organisation, based on growth and income from serviced areas and developer charges.

FINMOD enables sensitivity analysis on different variables, including:

- Inflation rate
- Borrowing and investment rates
- Level of funding
- Growth rates
- Developer charges
- Amount of borrowings

Full details on the financial modelling, including results of the preferred strategy and sensitivity analysis, is available in Section 8.3 and Appendix J.

### 4.3.3 QBL Framework

The QBL assessment is a framework for measuring overall performance and impact in terms of the themes defined in Table 4-10. The table also provides the total weighting used to assess each theme area. These weightings were workshopped with the Our Water Our Future group in Workshop 1.

**Table 4-10: QBL assessment themes and weighting**

| Assessment Theme | Weighting |
|---|---|
| Social costs and benefits | 20% |
| Economic costs and benefits | 30% |
| Environmental costs and benefits | 30% |
| Governance | 20% |

The QBL assessment provides a comprehensive measure of performance that goes beyond traditional financial measures of performance, such as profit and loss. It considers a broader range of factors that reflects overall impact on the community and the environment. The QBL is therefore primarily a qualitative assessment with majority of criteria reflecting non-cost considerations.

The purpose of the QBL assessment is to assist Council in assessing a short-list of feasible options which have been developed to inform the preferred IWCM Strategy. Following the coarse screening process, four separate scenarios were developed, each of which address Council's key strategic issues for the IWCM in different ways. The QBL assessment was undertaken on each of these scenarios.

Each of the four scenarios address the identified strategic issues through differing intervention solutions with different strengths and weaknesses. As the Everyday Scenario does not address these strategic issues, it was not considered as part of the QBL. Instead, a 'reference scenario' that represents the minimum intervention needed to address the strategic issues was adopted, to assess the relative performance of each scenario.

The QBL assessment incorporated relevant criteria and measures under each of the assessment themes. Refer to Appendix H for complete details and description of criteria. The assessment used a five-point traffic light system to compare the expected performance of each scenario against the criteria, relative to the reference scenario. Using this system, an overall (average) score was generated for each scenario. This overall score was used to compare the separate scenarios and inform the identification of a preferred scenario.

A summary of the QBL assessment scoring system is provided in Table 4-11. It provides an overview of the QBL assessment framework used to assess each scenario.

**Table 4-11: QBL assessment scoring system**

| QBL Rating | Score | Description |
|---|---|---|
| Strong positive | 5 | Strong positive impact relative to the reference case |
| Moderate positive | 4 | Minor or Moderate positive impact relative to the reference case |
| No significant impact | 3 | No significant positive or negative impact relative to the reference case |
| Moderate negative | 2 | Minor or Moderate negative impact relative to the reference case |
| Strong negative | 1 | Significant negative impact relative to the reference case |

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# 5.0 Strategic Options

## 5.1 Review of Strategy Options

An 'all options on the table' approach was adopted for the options development phase. Options for water security, sustainable effluent management and climate change strategic issues were first established based on available data and previous investigations. Gaps in options were then identified by the core project team to achieve an exhaustive options list. Each option was then developed to include an assessment of key risks, issues and opportunities. High-level cost estimates were only established for options with a dependency on cost for final screening, or where required to rule out an option based on cost and/or value for money. Cost estimates are available in Appendix G.

Previous planning studies and reports were considered at a high-level only. Completeness, accuracy, and precision of these studies was not assessed. Knowledge gaps where known were taken into consideration for option development.

### 5.1.1 Long-list of Climate Change Options

A comprehensive list of options to enhance the resilience of the development of the IWCM Strategy to climate change has been evaluated, including options that improve Council's resilience to climate change and opportunities that support Council's path to Net Zero emissions. Adaptation options for drought (and therefore water security) were not explored explicitly under climate change as these are explored in detail under the water security issue.

The long-list of options include:

1. Relocation of plant and equipment
2. Network reconfiguration
3. Active management / operational changes
4. Erosion management
5. On-site bunding
6. Elevation of electrics
7. Drainage works
8. Alternative power supply
9. Automation of plant
10. Buffer zones

The long-listed climate change options were assessed against six projected long-term climate change trends:

- Increased temperatures including longer and hotter heat waves
- Increased rainfall intensity and flooding
- Rising sea levels
- Increased frequency and severity of bushfires
- Increased frequency and severity of drought and associated water scarcity
- Increased frequency and severity of extreme storms

### 5.1.2 Long-list of Water Security Options

A comprehensive list of water security options, including both water demand and source augmentation options, have been evaluated. Noting there are localised opportunities specific to each water supply scheme, at a high level these options include:

1. Off-stream storage

2. On-stream storage
3. Desalination of seawater
4. Desalination of estuarine water
5. Interconnection with regional schemes – pipeline
6. Interconnection with regional schemes – water carting
7. Stormwater harvesting
8. Groundwater
9. Recycled water for restricted use
10. Recycled water for unrestricted use
11. Recycled water for non-potable use via dual reticulation
12. Recycled water for environmental flow replacement
13. Purified recycled water

A summary of the options is presented in Table 5-1 to Table 5-3 for Gloucester, Bulahdelah, and Stroud Water Supply Schemes respectively. The tables include options identified during coarse screening discussions which were assessed for completeness of ‘all options on the table’ approach. The complete assessment of long-list water security options is available in Appendix E.

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**Table 5-1: Long-list of options for Gloucester Water Supply Scheme**

| Option | Description | Additional Yield | Risks | Issues | Opportunities | CAPEX | Annual OPEX |
|---|---|---|---|---|---|---|---|
| **Off-Stream Storage** | New off-stream storage with raw water supplied from Barrington River and pumped to Gloucester WTP for treatment | Designed to as required | • Approvals and permits – potential for pipeline crossing across Gloucester River and rail track<br>• Land acquisition for storage site<br>• Impact from potential spillway or dam flows – on rail infrastructure or town<br>• Suitability of water quality as a result of impacts from Gloucester Landfill Facility on run-off and groundwater | • Rainfall dependent water source – extraction limited to favourable river flow conditions<br>• Potential for long lead times on negotiations with Australian Rail Track Corporation for boring under rail track (if required)<br>• Potential for complex geology resulting in increased CAPEX – fractured rock<br>• May require easements for sections of pipeline | • Flexibility in staging<br>• Enhanced raw water quality management with availability of alternative water source when Barrington River conditions are unfavourable | $20.8M | $530K |
| **On-stream Storage** | Raising existing weir crest or creation of new weird for additional storage | Requires further investigation | • Approvals and permits – environmental impacts to aquatic habitat and river<br>• Environmental impacts to aquatic and river ecology – disruption to fish passage, reduced biodiversity, increased erosion and sedimentation, decrease in water quality | • Rainfall dependent water source – extraction limited to favourable river flow conditions<br>• Increased siltation upstream of weir | • Significantly less infrastructure required | Not assessed | |
| **Stratford Mine Dam** | Return water dam at the mine site holds approximately 1000 ML of water Option to either:<br>• Transfer directly to Gloucester WTP for treatment and distribution<br>• Utilise dam water to inject flow into Barrington River upstream of raw water offtake point for increased extraction | 1000 ML but requires further investigation into source | • Replenishment of dam water – availability, duration, source<br>• Suitability of dam water for drinking water standards<br>• Acquisition of dam (coal mine near end of life) | • Highly likely rainfall dependent water source<br>• Stratification of stored water from poor water quality | • Low investment of CAPEX for significant storage and new water source<br>• Consideration for emergency measure if unsuitable for permanent solution | $19.1M for pipeline transfer | Not assessed |
| **Desalination of River Water via Gloucester River** | Construction of a permanent packaged desalination plant adjacent to existing Gloucester WTP, with raw water intake via new offtake point from Gloucester River and reject discharge to ocean | Flexible as required | • River not saline – unsuitable for desalination | • N/A | • N/A | Not assessed | |
| **Desalination of Sea Water** | Construction of a permanent desalination plant near the coastline located adjacent to Hallidays Point STP with treated water pumped from coast to Gloucester network for distribution | Flexible as required | • Approvals and permits – pipeline crossing across creeks and Avon River, and rail track<br>• Aquatic ecology – impingement and entrainment<br>• Aquatic ecology – reject discharge<br>• Community acceptance | • Feasible but impractical option for inland community due to significant infrastructure required for small community<br>• High energy intensive operation of desalination plant and long pumping distance<br>• High operation and maintenance costs for plant and transfer pipeline | • Rainfall independent supply<br>• Potential for pumped hydropower | $90.5M | Not assessed |
| **Regional connection (pipeline from Manning via Krambach)** | Connection to Manning Water Supply scheme via pipeline from Krambach, integrating Gloucester into the Manning scheme | Entire township supplied from Manning, 2050 ADD 1.27 ML/d | • Approvals and permits – pipeline crossing creeks and Avon River and rail track<br>• Increase in risk from impacts of natural disasters<br>• Environmental impacts along pipeline construction corridor<br>• Community acceptance for integrating Gloucester with Manning scheme | • Considerable carbon footprint with long pumping distance<br>• Potentially rainfall dependent solution dependent on water security solution for Manning | • Decommission Gloucester WTP, which may either reduce or offset operational expenses for new pipeline<br>• Potential for pumped hydropower<br>• Potential to connect new customers along pipeline route | $41.2M | $1.0M |
| **Regional connection (water carting from Tea Gardens)** | Water carting from Tea Gardens approximately 120 km via road, activated during times of emergency only | Required yield as per circumstances and availability at Tea Gardens (2019-20 Level 4 restrictions 538 kL/d) | • Impact and / or delay of transport from unforeseen circumstances<br>• Dependent on availability of water supply at Tea Garden bores<br>• Freight availability for prolonged periods | • Short-term supply solution – impractical for prolonged periods,<br>• Greenhouse gas emissions from daily use of freight | • Cost-effective short term water security solution until long term solution implemented<br>• Successfully implemented previously<br>• Infrastructure for loading from Tea Gardens and unloading at Gloucester in place | Not assessed | |

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| Option | Description | Additional Yield | Risks | Issues | Opportunities | CAPEX | Annual OPEX |
|---|---|---|---|---|---|---|---|
| **Stormwater Harvesting** | Stormwater collection and transfer to Gloucester off-stream storage to supplement extraction of raw water from the Barrington River | Investigation of 20 Ha catchment with 25% soil capacity found an estimated yield of 114 ML/y in a typical rainfall year, and 30 ML/y during lowest rainfall period | • Potentially poor water quality requiring a higher level of treatment<br>• Multiple small catchments | • Rainfall dependent water source<br>• Minimal growth in Gloucester for developer driven opportunities<br>• Requires large storage to capture flows during wet weather<br>• Requires reconfiguration of stormwater network to route stormwater to collection basins | • Flow attenuation in low flow events<br>• Reduced pollutants in natural waterways<br>• Potential for localised opportunities | $191.5M (based on capturing all local runoff with 8000 ML storage) | Not assessed |
| **Groundwater** | Considers potential for groundwater sources in or near Gloucester<br>• 1999 PPK study did not identify any potential sites in the Gloucester area | Requires further investigation | • Approvals and permits<br>• Availability of groundwater<br>• Suitability of groundwater for potable water supply | • No prospective sites have been identified for Gloucester region<br>• Long lead time for new borefield from planning and construction to operation | • Diversification of water supply sources for future generations | Not assessed | |
| **Reticulated Recycled Water** | Dual reticulation network to supply both potable and recycled water for new development areas only, requiring upgrade of Gloucester STP for effluent treatment to unrestricted public access standards | Approximately up to 478 kL/d by 2050 (up to 30% of current effluent used for irrigation in 2017-18, and 70% used in 2019-20 drought) | • Insufficient recycled water demand due to low growth<br>• Cross-contamination<br>• Community acceptance | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse<br>• Only suitable for new residential developments (not practical to retrofit existing properties), can be discriminatory<br>• High operation and maintenance costs with dual network | • Effluent management<br>• Maintains aesthetic values during drought | $16,000 per dwelling including cost for treatment and distribution | Not assessed |
| **Recycled Water for Restricted Use** | Option considers expansion of existing scheme to new users to four potential agricultural users in near vicinity to STP | Approximately up to 478 kL/d by 2050 (up to 30% of current effluent used for irrigation in 2017-18, and 70% used in 2019-20 drought) | • Insufficient recycled water demand for material impact on potable water demand<br>• Users not guaranteed over longer term | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse during drought<br>• Rainfall dependent demand | • Effluent management – removes reliance from single user<br>• No upgrades required to treatment | Not assessed | |
| **Recycled Water for Unrestricted Use** | Upgrade of Gloucester STP to meet standards for unrestricted use for open space irrigation to potential sites including Gloucester Showground, Gloucester District Park, Billabong Native Park, Minimbah Native Garden and Gloucester Golf Course | Approximately up to 478 kL/d by 2050 (up to 30% of current effluent used for irrigation in 2017-18, and 70% used in 2019-20 drought) | • Existing uptake of potable water for sites negligible – insufficient for material impact on potable water demand | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse during drought<br>• Rainfall dependent demand<br>• Increase in operation and maintenance costs | • Provision for future treatment in current STP upgrades<br>• Effluent management<br>• Maintains aesthetic values during drought | Not assessed | |
| **Recycled Water for Environmental Flows** | Substitution of flows downstream of Barrington River offtake point for Gloucester WTP with replacement flows supplied from Gloucester STP, potentially enabling increased extraction upstream for storage in future off-stream storage dam | Approximately up to 478 kL/d by 2050 (up to 30% of current effluent used for irrigation in 2017-18, and 70% used in 2019-20 drought) | • Approvals and permits – specifically for land clearing adjacent to STP required for expansion<br>• Impact on river health and ecology from substitution flow and increased offtake | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse<br>• Supporting legislation not fully developed<br>• May not improve yield / supply if river extraction limits are reached<br>• Requires additional off-stream storage to enable increased extraction | • Effluent management<br>• Adaptable to growth | Not assessed | |
| **Purified Recycled Water** | Expansion of Gloucester STP to advanced level treatment for indirect purified recycled water use with treated water redirected to future off-stream storage to mix with raw water extracted from Barrington River | Approximately up to 478 kL/d by 2050 (up to 30% of current effluent used for irrigation in 2017-18, and 70% used in 2019-20 drought) | • Community acceptance<br>• Failure at critical control points can result in severe public health consequences<br>• Approvals and permits | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse<br>• Supporting legislation not fully developed<br>• High energy intensive operation of recycled water plant<br>• Significant increase in operation and maintenance costs | • Can be aligned with delivery of new WTP required within next 5 to 10 years<br>• Effluent management | Not assessed | |

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**Table 5-2: Long-list of options for Bulahdelah Water Supply Scheme**

| Option | Description | Additional Yield | Risks | Issues | Opportunities | CAPEX | Annual OPEX |
|---|---|---|---|---|---|---|---|
| **Off-Stream Storage** | New off-stream storage with raw water supplied from Crawford River and pumped to Bulahdelah WTP for treatment<br>• Limited selection for storage sites, ideally located close to raw water pump station | Designed to as required | • Approvals and permits<br>• Highly likely land acquisition required for storage site<br>• Impact to environment including local ecology dependent on site | • Rainfall dependent water source – extraction limited to favourable river flow conditions<br>• Large construction carbon footprint<br>• Limited options for storage site<br>• Stratification from poor water quality | • Flexibility in staging<br>• Enhanced raw water quality management with availability of alternative water source when Crawford River conditions are unfavourable | $17.6M | Not assessed |
| **Additional On-Stream Storage** | Raising existing weir crest or creation of new weir for additional storage | Requires further investigation | • Approvals and permits – environmental impacts to aquatic habitat and river<br>• Environmental impacts to aquatic and river ecology – disruption to fish passage, reduced biodiversity, riparian corridor inundation | • Rainfall dependent water source – extraction limited to favourable river flow conditions<br>• Increased siltation upstream of weir | • Significantly less infrastructure required | Not assessed | |
| **Desalination of River Water via Myall River** | Construction of a permanent packaged desalination plant with raw water extraction from Crawford River and reject discharge to ocean | Flexible as required | • Approvals and permits – pipeline crossing across Myall River, extraction licence, ocean discharge<br>• Aquatic ecology – impingement and entrainment<br>• Community acceptance – impact to local industries dependent on river water from increased extraction<br>• Land acquisition for desalination plant | • Rainfall dependent water source – extraction based on river flow conditions<br>• High energy intensive operation of plant and long pumping distance for outfall<br>• High operation and maintenance costs for plant and transfer pipeline<br>• Construction through environmentally sensitive corridor for reject discharge pipeline (Wang Wauk State Forest) requiring underbore for significant lengths of pipe | • Operation flexible to demand | $93.9 | Not assessed |
| **Desalination of Sea Water** | Construction of a permanent desalination plant near the coastline located adjacent to proposed Pacific Palms STP with treated water pumped from coast to Bulahdelah | Flexible as required | • Approvals and permits<br>• Aquatic ecology – impingement and entrainment<br>• Aquatic ecology – reject discharge<br>• Community acceptance | • Construction through environmentally sensitive corridor (Wang Wauk State Forest) requiring underbore for significant lengths of pipe<br>• Feasible but impractical option for inland community due to significant infrastructure required for small community<br>• High energy intensive operation of plant and long pumping distance<br>• High operation and maintenance costs for plant and transfer pipeline | • Rainfall independent supply | $93.5M | Not assessed |
| **Regional connection (pipeline from Manning via Smiths Lake)** | Connection to Manning Water Supply scheme via pipeline from Smiths Lake, integrating Bulahdelah into the Manning scheme | Entire township supplied from Manning, 2050 ADD 0.49 ML/d | • Increase in risk from impacts of natural disasters<br>• Environmental impacts along pipeline construction corridor<br>• Community acceptance for integrating Bulahdelah with Manning scheme | • Construction through environmentally sensitive corridor (Wang Wauk State Forest) requiring underbore for significant lengths of pipe<br>• Considerable carbon footprint with long pumping distance<br>• Potentially rainfall dependent solution dependent on water security solution for Manning | • Decommission Bulahdelah WTP, which may either reduce or offset operational expenses for new pipeline<br>• Potential to connect new customer along pipeline route such as Bungwahl | $59.0M | Not assessed |
| **Regional connection (pipeline from Manning via Nabiac)** | Connection to Manning Water Supply scheme via pipeline from Nabiac, integrating Bulahdelah into the Manning scheme, supplied from Nabiac Borefield | Entire township supplied from Manning, 2050 ADD 0.49 ML/d | • Increase in risk from impacts of natural disasters<br>• Community acceptance for integrating Bulahdelah with Manning scheme | • Considerable carbon footprint with long pumping distance<br>• Reduces reliance on Nabiac borefield marginally for Manning water security, especially under drought conditions | • Decommission Bulahdelah WTP, which may either reduce or offset operational expenses for new pipeline<br>• Easy integration with Nabiac borefield<br>• Less constrained construction corridor compared with Smiths Lake option<br>• Potential to connect new customer along pipeline route such as Coolongolook | $34.1M | $394K |

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| Option | Description | Additional Yield | Risks | Issues | Opportunities | CAPEX | Annual OPEX |
|---|---|---|---|---|---|---|---|
| **Regional connection (pipeline from Tea Gardens)** | Connection to Tea Gardens Water Supply scheme via pipeline from Tea Gardens, integrating Bulahdelah into the Tea Gardens scheme, supplied from Tea Gardens Borefield | Entire township supplied from Tea Gardens, 2050 ADD 0.49 ML/d | • Potentially insufficient availability of water from borefield – extraction limitations<br>• Increase in risk from impacts of natural disasters<br>• Community acceptance for integrating Bulahdelah with Tea Gardens scheme | • Considerable carbon footprint with long pumping distance<br>• Some underbore required for pipeline | • Decommission Bulahdelah WTP, which may either reduce or offset operational expenses for new pipeline<br>• Potential to connect new customers along pipeline route such as North Arm Cove community | $23.6M | Not assessed |
| **Regional connection (water carting from Tea Gardens)** | Water carting from Tea Gardens approximately 40 km via road, activated during times of emergency only | Required yield as per circumstances and availability at Tea Gardens | • Impact and / or delay of transport from unforeseen circumstances<br>• Dependent on availability of water supply at Tea Garden bores<br>• Freight availability for prolonged periods | • Short-term supply solution<br>• Greenhouse gas emissions from daily use of freight | • Cost-effective short term water security solution until long term solution implemented | Not assessed | |
| **Stormwater Harvesting** | Stormwater collection and transfer to Bulahdelah off-stream storage to supplement extraction of raw water from the Crawford River | High level modelling indicates 1220 ML/y across the entire catchment with assumed 31% imperviousness | • Potentially poor water quality requiring a higher level of treatment<br>• Multiple small catchments | • Rainfall dependent water source<br>• Minimal growth in Bulahdelah for developer driven opportunities<br>• Requires large storage to capture flows during wet weather<br>• Requires reconfiguration of stormwater network to route stormwater to collection basins | • Flow attenuation in low flow events<br>• Reduced pollutants in natural waterways<br>• Potential for localised opportunities | Not assessed | |
| **Groundwater** | Considers potential for groundwater sources in or near Bulahdelah given known private bores in community<br>• 1999 study by PPK found high yields from tested bores at National Park 9 km downstream of Bulahdelah on the eastern side of Myall River | Study concluded potential potable supply yield of 3 to 8 ML/day | • Approvals and permits<br>• Environmental impacts from extraction, specifically on nearby wetlands<br>• Potentially poor water quality requiring a higher level of treatment – high hardness and dissolved iron content identified in 1999 studies | • Long lead time for new borefield from planning and construction to operation<br>• Construction through environmentally sensitive corridor, Myall Lake National Park<br>• Highly likely rainfall dependent source – storage volumes uncertain as bounds of fresh quality aquifer are unknown<br>• Potential for saltwater intrusion south and from tidal sections of river | • Diversification of water supply sources for future generations | Not assessed | |
| **Reticulated Recycled Water** | Dual reticulation network to supply both potable and recycled water for new development areas only requiring upgrade of Bulahdelah STP for effluent treated to unrestricted public access standards | Approximately up to 326 kL/d by 2050 (up to 16% of current effluent used for golf course irrigation in 2017-18, and 95% used in 2019-20 drought) | • Insufficient recycled water demand due to low growth<br>• Cross-contamination<br>• Approvals and permits – specifically for land clearing adjacent to STP required for expansion<br>• Community acceptance | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse<br>• Only suitable for new residential developments (not practical to retrofit existing properties), can be discriminatory<br>• High operation and maintenance costs with dual network | • Effluent management<br>• Maintains aesthetic values during drought | $16,000 per dwelling including cost for treatment and distribution | Not assessed |
| **Recycled Water for Restricted Use** | Option considers expansion of recycle water supply to new users for agricultural purposes with multiple farms and agricultural properties surrounding the township of Bulahdelah | Approximately up to 326 kL/d by 2050 (up to 16% of current effluent used for golf course irrigation in 2017-18, and 95% used in 2019-20 drought) | • Insufficient recycled water demand due to low growth<br>• Users not guaranteed over longer term | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse during drought<br>• May require long pipelines for single users<br>• Rainfall dependent demand | • Effluent management – removes reliance from single user<br>• No upgrades required to treatment | Not assessed | |
| **Recycled Water for Unrestricted Use** | Upgrade of Bulahdelah STP to meet standards for unrestricted use for open space irrigation at sites including Bulahdelah Showground and Jack Ireland Sports Complex | Approximately up to 326 kL/d by 2050 (up to 16% of current effluent used for golf course irrigation in 2017-18, and 95% used in 2019-20 drought) | • Existing uptake of potable water for sites negligible – insufficient for material impact on potable water demand<br>• Approvals and permits – specifically for land clearing adjacent to STP required for expansion | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse during drought<br>• Rainfall dependent demand<br>• Increase in operation and maintenance costs | • Effluent management<br>• Maintains aesthetic values during drought | Not assessed | |

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| Option | Description | Additional Yield | Risks | Issues | Opportunities | CAPEX | Annual OPEX |
|---|---|---|---|---|---|---|---|
| **Recycled Water for Environmental Flows** | Substitution of flows downstream of Crawford River offtake point for Bulahdelah WTP with replacement flows supplied from Bulahdelah STP, potentially enabling increased extraction upstream for storage in future off-stream storage dam | Approximately up to 326 kL/d by 2050 (up to 16% of current effluent used for golf course irrigation in 2017-18, and 95% used in 2019-20 drought) | • Approvals and permits – specifically for land clearing adjacent to STP required for expansion<br>• Impact on river health and ecology from substitution flow<br>• Impact on river health and ecology from increased offtake | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse<br>• Supporting legislation not fully developed<br>• May not improve yield / supply if river extraction limits are reached<br>• Requires additional off-stream storage to enable increased extraction<br>• Rainfall dependent water source for extraction | • Effluent management<br>• Adaptable to growth | Not assessed | |
| **Purified Recycled Water** | Expansion of Bulahdelah STP to advanced level treatment for indirect purified recycled water use with treated water redirected to future off-stream storage to mix with raw water extracted from Crawford River | Approximately up to 326 kL/d by 2050 (up to 16% of current effluent used for golf course irrigation in 2017-18, and 95% used in 2019-20 drought) | • Community acceptance<br>• Failure at critical control points can result in severe public health consequences<br>• Approvals and permits – for purified recycled water plant, land clearing adjacent to STP required for expansion | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse<br>• Supporting legislation not fully developed<br>• High energy intensive operation of recycled water plant<br>• Significant increase in operation and maintenance costs | • Effluent management | Not assessed | |

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**Table 5-3: Long-list of options for Stroud Water Supply Scheme**

| Option | Description | Additional Yield | Risks | Issues | Opportunities | CAPEX | Annual OPEX |
|---|---|---|---|---|---|---|---|
| **Off-Stream Storage** | New additional off-stream storage dams adjacent to existing 50 ML dam at WTP site with raw water supplied from Karuah River | Designed for 2 x 50 ML dam, equating to total additional 100 ML, but can be re-designed to as required | • Approvals and permits – environmental impacts not assessed<br>• Compliance with current legislation | • Rainfall dependent water source – extraction limited to favourable river flow conditions<br>• No allowance for staging – shared dam wall | • Land owned by Council<br>• Operational flexibility with integration with existing dam system | $9.4M | $21K |
| **Additional On-Stream Storage** | Existing natural weir on the Karuah River provides 17 ML storage, option considers raising the weir crest for additional storage | Requires further investigation | • Approvals and permits – environmental impacts to aquatic habitat and river<br>• Aquatic ecology – disruption to fish passage, reduced biodiversity<br>• River ecology – impact on riparian vegetation with likely increased inundation resulting in decreased water quality | • Rainfall dependent water source – extraction limited to favourable river flow conditions<br>• Increased siltation upstream of weir | • Visual amenity creation such as wetlands | Not assessed | |
| **Duralie Mine Dam** | Water from to either:<br>• Transfer directly to Stroud WTP for treatment and distribution<br>• Utilise dam water to inject flow into Karuah River upstream of raw water offtake point for increased extraction | Requires further investigation | • Approvals and permits – requires rigorous testing and investigation to confirm suitability for injecting directly into WTP or river<br>• Replenishment of dam water – availability, duration, source<br>• Acquisition of dam – mine may be planned for continued operations for a long-term | • Highly likely rainfall dependent water source<br>• Stratification of stored water from poor water quality | • Low investment of CAPEX for significant storage and new water source<br>• Consideration for emergency measure if unsuitable for permanent solution | $9.7M for pipeline transfer | Not assessed |
| **Desalination of River Water via Karuah River** | Construction of a permanent packaged desalination plant, located adjacent to existing Stroud WTP with raw water intake via existing offtake point and reject discharge to ocean | Flexible as required | • River not saline – unsuitable for desalination | • N/A | • N/A | Not assessed | |
| **Desalination of Sea Water** | Construction of a permanent desalination plant near the coastline, located adjacent to proposed Pacific Palms STP with treated water pumped from coast to Stroud network for distribution | Flexible as required | • Approvals and permits<br>• Aquatic ecology – impingement and entrainment<br>• Aquatic ecology – reject discharge<br>• Community acceptance | • Construction through environmentally sensitive corridor (Wang Wauk State Forest and Myall River State Forest)<br>• Feasible but impractical option for inland community due to significant infrastructure required for small community<br>• High energy intensive operation of desalination plant and long pumping distance<br>• High operation and maintenance costs for plant and transfer pipeline | • Rainfall independent supply | $78.5M | Not assessed |
| **Regional connection (pipeline from Hunter via Dungog)** | Water sharing between Stroud Water Supply Scheme and adjacent LGA, Hunter Water, activated during times of emergency, via pipeline connection to Dungog | Further investigation required into availability but required yield as per circumstances (2050 ADD 0.38 ML/d) | • Dependent on water security at Dungog and Hunter Water's position for partnership<br>• Increase in risk from impacts of natural disasters<br>• No control over asset or quality of water<br>• Community acceptance for sharing between communities | • Considerable carbon footprint with long pumping distance<br>• Potentially rainfall dependent solution unless Dungog in the future is supplied from Belmont desalination plant<br>• Potential for shared operation and maintenance expenses with Dungog Shire Council | • Potentially increased social and economic benefits as a result of partnership | $16.2M | $163K |
| **Regional connection (water carting from Tea Gardens)** | Water carting from Tea Gardens approximately 60 km via road, activated during times of emergency only | Required yield as per circumstances and availability at Tea Gardens (2050 ADD 0.38 ML/d) | • Impact and / or delay of transport from unforeseen circumstances<br>• Dependent on availability of water supply at Tea Garden bores<br>• Freight availability for prolonged periods | • Short-term supply solution – impractical for prolonged periods<br>• Greenhouse gas emissions from daily use of freight | • Cost-effective short term water security solution until long term solution implemented<br>• Successfully implemented previously<br>• Infrastructure for loading from Tea Gardens and unloading at Stroud in place | Not assessed | |

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| Option | Description | Additional Yield | Risks | Issues | Opportunities | CAPEX | Annual OPEX |
|---|---|---|---|---|---|---|---|
| **Regional connection (water carting from Gloucester)** | Water carting from Gloucester via Stratford Mine Dam, activated during times of emergency only, and depending on quality of water, option considered for either:<br>• dust suppression, roads maintenance and construction activities; or<br>• supplementing flow for potable water by carting to Stroud STP for treatment and distribution | Required yield as per circumstances and availability at Stratford Dam | • Contingent on Stratford Dam option for Gloucester<br>• Dependent on availability of water availability at Stratford Dam<br>• Suitability of dam water quality for purpose<br>• Freight availability for prolonged periods | • Short-term supply solution – impractical for prolonged periods<br>• Greenhouse gas emissions from daily use of freight | • Cost-effective emergency measure<br>• Shorter distance in comparison with Tea Gardens | Not assessed | |
| **Stormwater Harvesting** | Stormwater collection and transfer to Stroud off-stream storage to supplement extraction of raw water from the Karuah River | High level modelling indicates 909 ML/yr across the entire catchment with assumed 29% imperviousness | • Potentially poor water quality requiring a higher level of treatment<br>• Multiple small catchments | • Rainfall dependent water source<br>• Minimal growth in Stroud for developer driven opportunities<br>• Requires large storage to capture flows during wet weather<br>• Requires reconfiguration of stormwater network to route stormwater to collection basins | • Flow attenuation in low flow events<br>• Reduced pollutants in natural waterways<br>• Potential for localised opportunities | Not assessed | |
| **Groundwater** | Considers potential for groundwater sources in or near Stroud<br>• 1999 PPK study did not identify any potential sites in the Stroud area | Requires further investigation | • Approvals and permits<br>• Availability of groundwater<br>• Suitability of groundwater for potable water supply | • No prospective sites have been identified for Stroud region<br>• Long lead time for new borefield from planning and construction to operation | • Diversification of water supply sources for future generations | Not assessed | |
| **Reticulated Recycled Water** | Dual reticulation network to supply both potable and recycled water for new development areas only, requiring upgrade of Stroud STP for effluent treatment to unrestricted public access standards | Approximately up to 12 kL/d by 2050 (up to 90% of current effluent used for pasture irrigation in 2017-18, and 100% used in 2019-20 drought) | • Insufficient recycled water demand due to low growth<br>• Cross-contamination<br>• Community acceptance | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse<br>• Only suitable for new residential developments (not practical to retrofit existing properties), can be discriminatory<br>•<br>• High operation and maintenance costs with dual network | • Effluent management<br>• Maintains aesthetic values during drought | | Not assessed |
| **Recycled Water for Restricted Use** | Option considers expansion of recycle water supply to new users for agricultural purposes | Approximately up to 12 kL/d by 2050 (up to 90% of current effluent used for pasture irrigation in 2017-18, and 100% used in 2019-20 drought) | • Insufficient recycled water demand due to low growth<br>• Users not guaranteed over longer term | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse<br>• May require long pipelines for single users<br>• Rainfall dependent demand | • Effluent management – increases resilience as licence restricts discharge from plant to river on a precautionary basis<br>• No upgrades required to treatment | Not assessed | |
| **Recycled Water for Unrestricted Use** | Upgrade of Stroud STP to meet standards for unrestricted use for open space irrigation at sites including Stroud Showground and Stroud Public School | Approximately up to 12 kL/d by 2050 (up to 90% of current effluent used for pasture irrigation in 2017-18, and 100% used in 2019-20 drought) | • Existing uptake of potable water for sites negligible – insufficient for material impact on potable water demand | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse<br>• Rainfall dependent demand<br>• Increase in operation and maintenance costs | • Effluent management<br>• Maintains aesthetic values during drought | Not assessed | |

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| Option | Description | Additional Yield | Risks | Issues | Opportunities | CAPEX | Annual OPEX |
|---|---|---|---|---|---|---|---|
| **Recycled Water for Environmental Flows** | Substitution of flows downstream of Karuah River offtake point for Stroud WTP with replacement flows supplied from Stroud STP, potentially enabling increased extraction upstream | Approximately up to 12 kL/d by 2050 (up to 90% of current effluent used for pasture irrigation in 2017-18, and 100% used in 2019-20 drought) | • Approvals and permits – specifically for land clearing adjacent to STP required for expansion, pipeline Mill Creek crossing for STP to river discharge<br>• Impact on river health and ecology from substitution flow and increased offtake | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse<br>• Supporting legislation not fully developed<br>• May not improve yield / supply if river extraction limits are reached<br>• Requires additional off-stream storage to enable increased extraction<br>• Rainfall dependent water source for extraction | • Effluent management<br>• Adaptable to growth | Not assessed | |
| **Purified Recycled Water** | Expansion of Stroud STP to advanced level treatment for indirect purified recycled water use with treated water redirected to future off-stream storage to mix with raw water extracted from Karuah River | Approximately up to 12 kL/d by 2050 (up to 90% of current effluent used for pasture irrigation in 2017-18, and 100% used in 2019-20 drought) | • Community acceptance<br>• Failure at critical control points can result in severe public health consequences<br>• Approvals and permits | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse<br>• Supporting legislation not fully developed<br>• High energy intensive operation of recycled water plant<br>• Significant increase in operation and maintenance costs | • Effluent management | Not assessed | |

### 5.1.3 Long-list of Sustainable Effluent Management Options

A wide range of sustainable effluent management options were investigated. A hierarchy in the development of options for each scheme was adopted in the order of reduce, reuse, and discharge; with options developed based on this approach. Therefore, discharge options were only considered where reduce or reuse were not feasible or practical.

The sustainable effluent management options considered at a high-level are listed below. Localised opportunities were also discussed where identified.

- Flow reduction, including:
    - Demand management
    - Inflow and infiltration reduction
- Biosolids management and reuse
- Effluent reuse, including:
    - Recycled water for restricted use
    - Recycled water for unrestricted use
    - Purified recycled water for drinking (not considered if option failed at the water security screening process)
- Discharge to environment, including:
    - Discharge to wetlands
    - Water features i.e., water landscaping
    - Exfiltration
    - River discharge
    - Ocean outfall

These options are summarised in Table 5-4. Risks, issues and opportunities for each option common to all sewerage schemes are included in this table. Table 5-5 to Table 5-17 present the scheme specific options. Average year effluent volumes noted for reuse do not include on-site reuse. Unallocated effluent volumes account for both on-site reuse and customer reuse.

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**Table 5-4: Summary of options for sustainable effluent management**

| Option Type | Option | Description | Risks | Issues | Opportunities |
|---|---|---|---|---|---|
| Flow reduction | Demand management | Demand management programs including smart metering and community education to reduce water used and returned to sewer.<br><br>Demand management is business as usual. | • Requires community to be engaged with the process. | • Community is already quite water conscious, may be limited opportunity for further reductions | • Potential for demand-based pricing or other measures to reduce water usage |
| | Inflow and Infiltration (I/I) Management | I/I management to reduce dry weather baseflow, sea water ingress and wet weather ingress to sewer.<br><br>I/I management is business as usual for areas identified with high I/I. | • N/A | • May require significant effort to pinpoint specific sources of I/I and appropriately target for reduction | • Reducing flow volume to STP would also reduce treatment and pumping costs (energy / chemicals / emissions) |
| Biosolids management and reuse | The Draft Biosolids Framework is currently under review by the NSW EPA, with the final framework and new legislation due for release in September 2023. The STPs currently achieve Grade B stabilisation for 7,800 wet tonnes per annum of biosolids produced and 100% of this volume is transported for agricultural use.<br><br>No biosolids options will be investigated until the new guidelines have been adopted. | | | | |
| Effluent reuse | Recycled water for restricted use | Suitable for agricultural application such as pasture grazing and crop irrigation, as well as open space irrigation with appropriate controls (managed access).<br><br>Current approach at majority of STP's. | • Requires appropriate controls to protect public health | • Current approach for effluent reuse at most MidCoast STP's<br>• Low-cost approach to reuse, no additional treatment required, only transfer infrastructure/cost<br>• Potential inequity if recycled water is supplied at low/no cost to certain (private) customers but not available to all | • Opportunity to expand existing schemes |
| | Recycled water for unrestricted use | Suitable for irrigation for public open spaces, including sports grounds, schools, as well as some industrial and commercial uses, and construction and maintenance activities such as dust suppression, road maintenance and routine sewer main flushing.<br><br>Requires a higher level of treatment along with transfer infrastructure including storage and irrigation infrastructure.<br><br>Can be supplied to dwellings via dual reticulation networks; increased non-rainfall dependent demand and potential drinking water offset. | • Requires appropriate controls to protect public health | • Higher treatment cost compared to unrestricted use<br>• Dual reticulation only appropriate for new development areas due to need for separate distribution network and specific internal plumbing; not appropriate/practical to retrofit in existing areas | • Public open space irrigation can offset drinking water demand during normal conditions and protect community amenity during drought<br>• Opportunity to expand existing schemes at Tuncurry and Hawks Nest |
| | Purified recycled water (PRW) for drinking | Purified recycled water (PRW) from STP / RTP's to augment water supply.<br><br>Can be direct to network or indirect via managed aquifer recharge. | • Risk of significant public health impact; requires stringent controls.<br>• Community acceptance<br>• Regulatory / legislative framework not yet developed to support PRW<br>• Management and operation of small scale plants | • High cost of treatment required to protect public health<br>• Would only consider PRW where already shortlisted as a viable water security option<br>• Cost-benefit ratio not maximised due to economies of scale | • Rainfall-independent water source to provide water security<br>• Potential opportunity for managed aquifer recharge at Nabiac (Tuncurry RTP) and/or Tea Gardens (Hawks Nest RTP) |

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| Option Type | Option | Description | Risks | Issues | Opportunities |
|---|---|---|---|---|---|
| Discharge to environment | Discharge to wetlands | Part of current approach at Harrington STP, opportunity to expand passive treatment of effluent via wetlands and nature-based solutions. | • Environmental impact | | • Provides ecological habitat for water birds, etc.<br>• Low maintenance |
| | Water features i.e., water landscaping | Opportunity to consider incorporating passive treatment via wetlands with water features, nature-based solutions to provide community amenity, maintain water in the landscape to assist with urban greening. | • Requires appropriate controls to protect public health | • Option best suited to new developments with opportunity to incorporate water features into master planning | • Provide community amenity, maintain water in the landscape to assist with urban greening<br>• Provides ecological habitat for water birds, etc. |
| | Exfiltration | Current approach at many of Council's coastal STPs to manage excess flow. | • Some exfiltration bed at risk of erosion / future sea level impacts | | • Opportunities at coastal plants to manage increased flows due to growth<br>• Low-cost approach that avoids discharge to waterways |
| | River discharge | Current approach at many of Council's inland STPs to manage excess flow that cannot be reused for restricted use. | • Environmental impact.<br>• Potential structural risk for outlet during extreme storms / flooding conditions. | | • Opportunity to provide environmental flows |
| | Ocean outfall | Currently only ocean outfall (Forster).<br>May be a consideration for Old Bar where exfiltration beds are at potential risk of erosion and future sea level rise. | • Environmental approvals for new outfall.<br>• Potential structural risk for outfall pipe during extreme storm events. | • Community acceptance; likely require effective community engagement. | • Opportunities at coastal plants to manage increased flows due to growth |

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**Table 5-5: Long-list of options for Hallidays Point Sewerage Scheme**

| Hallidays Point Sewerage Scheme | | | | |
|---|---|---|---|---|
| **Existing Effluent Management** | Effluent from Halliday's Point STP is either directed to exfiltration beds or Tuncurry RTP.<br>• The seven existing exfiltration beds at Hallidays Point have a recharge capacity of 4.5 ML/d and the infiltration bed at Tuncurry RTP has a recharge capacity of 1.5 ML/d, although this bed is not used frequently.<br>• Additional exfiltration beds have been proposed located to the north of Tuncurry Tip, with no impacts identified from 0.9 m rise in sea level or 1-in-100-year flooding. These additional beds have an estimate recharge capacity of 12 ML/d, resulting in a total exfiltration system capacity of 18 ML/d.<br>• Tuncurry RTP uses membrane filtration and chlorination to treat tertiary effluent from Hallidays STP to an unrestricted access standard. The plant, currently operating at a design production capacity of 3.5 ML/d, is upgradeable to 7 ML/d. | | | |
| **Effluent Reuse** | Recycled water is supplied primarily for open space irrigation in Tuncurry. The irrigation sites include:<br>• Tuncurry Golf Course<br>• Tuncurry Cemetery<br>• Great Lakes TAFE<br>• Sporties Tuncurry<br>• South Street Cricket Oval | | | |
| **Average Year Effluent Use** | 303 ML/year | | | |
| **2050 Unallocated Effluent** | 1233 ML/year | | | |
| **Option** | **Description** | **Risks** | **Issues** | **Opportunities** |
| **Recycled Water for Restricted Use – Nabiac STP** | • Provide restricted recycled water to users at Nabiac and reduce load to Hallidays Point STP<br>• Potential users may include Wallamba Football Club, cattle grazing and other agricultural users<br>• Requires at minimum an upgrade of Nabiac STP with disinfection process and infrastructure for distribution to customers | • Reduces availability of recycled water for existing users of Tuncurry RTP | • Nabiac STP unmanned site – will require additional resources | • Eliminate pumping and associated costs for transfer of flow between Nabiac and Hallidays Point sewer system<br>• Reduce inflow to Hallidays Point STP |
| **Recycled Water for Restricted Use – Hallidays STP** | • Provide restricted recycled water to users at Hallidays Point before conveying to Tuncurry RTP<br>• Requires infrastructure for storage and distribution to customers | • No demand for restricted water in the catchment<br>• Reduces availability of recycled water for existing users of Tuncurry RTP | | • Utilises existing treatment infrastructure – no major upgrades required |
| **Recycled Water for Unrestricted Use** | • Expansion of recycled water use to new customers from Tuncurry RTP<br>• Potential users may include:<br>  ○ Tuncurry Skate Park<br>  ○ Tuncurry Golf Driving Range<br>  ○ Tuncurry Lakes Resort<br>  ○ Tuncurry Waste Management Centre<br>• May require expansion of membrane filtration units at Tuncurry RTP and expansion of distribution network | • May require waterway crossings for pipelines | | |
| **Purified Recycled Water – Direct to Network** | • Upgrade of Tuncurry RTP to meet Australian Drinking Water standards for injection into the water supply distribution network via Darawank reservoir<br>• Requires expansion of membrane filtration, new reverse osmosis and UV advanced oxidation units, and additional raw water and treated water storage | • Potential for reputational damage and community dissatisfaction if all effluent is used for PRW and recycled water service to existing customers is eliminated | | • Contributes to water security solution for Manning Water Supply Scheme<br>• Potential to combine and stage management of effluent from Forster STP |
| **Purified Recycled Water – Managed Aquifer Recharge** | • As per option assessed in *Manning Coarse Screening Report*<br>• Managed aquifer recharge of Nabiac borefield for replenishment of groundwater<br>• Requires expansion of membrane filtration, new reverse osmosis and UV advanced oxidation units at Tuncurry RTP (or as required to meet the water quality suitable for aquifers), and approximately 9 km pipeline to Nabiac borefield | • Potential for salinity contamination<br>• Potential for emerging contaminants contamination<br>• Water clogging<br>• Recharge flow impacts on surrounding environment | • Appropriateness of water quality for recharge<br>• Injection points for recharge – required to be strategic for maximum benefit and minimum impacts to wetlands in Minimbah Nature Reserve | • Contributes to water security solution for Manning Water Supply Scheme<br>• Potential for staging<br>• Increases reliability of bore replenishment |

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**Table 5-6: Long-list of options for Forster Sewerage Scheme**

| Forster Sewerage Scheme | | | | |
|---|---|---|---|---|
| **Existing Effluent Management** | All effluent discharged through shoreline outfall at Janie's Corner.<br>• Effluent from Pacific Palms STP proposed for transfer to Forster STP.<br>• Outfall study from 2002 concluded no issues under adverse conditions provided effluent detention time does not exceed 12 hours and with an outflow pumping system capacity between 400 L/s to 470 L/s.<br>• Outfall has access issues resulting in significant risk for maintenance access | | | |
| **Effluent Reuse** | Minor reuse on STP site only | | | |
| **Average Year Effluent Use** | 0 ML/year | | | |
| **2050 Unallocated Effluent** | 1797 ML/year | | | |
| **Option** | **Description** | **Risks** | **Issues** | **Opportunities** |
| **Recycled Water for Restricted Use** | • May require either expansion of distribution network or offtake points. | • No identified potential users of restricted water within Forster township | | |
| **Recycled Water for Unrestricted Use – New RTP** | • Open spaces for irrigation may include Forster Tuncurry Golf Club, Boronia Park, Forster Bowling Club, Forster sports complex, Great Lakes College, Forster Public School, and Forster cemetery.<br>• Requires new RTP with membrane filtration and disinfection process units, treated water storage tanks, and distribution infrastructure | • Potential for contamination trace nutrients runoff to Wallis Lake | • Land acquisition may be required for expansion of site<br>• Environmental approvals may be required for land clearing | • Potential for dual reticulation for new developments |
| **Recycled Water for Unrestricted Use – Expansion of Tuncurry RTP** | • Pump effluent to Tuncurry RTP<br>• Potential users as identified for Hallidays Sewerage Scheme in Table 5-5.<br>• Requires upgrade to Tuncurry RTP with additional membrane filtration and raw and treated water storage tanks, transfer pipeline from Forster STP to RTP, and back to Forster from the RTP | | • Significant capital cost - requires construction across Wallis Lake, either underbore or attached to bridge | |
| **Purified Recycled Water – Direct to Network** | • Pump effluent from STP to Tuncurry RTP and upgrade of Tuncurry RTP to meet Australian Drinking Water standards<br>• Requires upgrade to membrane filtration, new RO and UV advanced oxidation units, additional raw and treated water storage tanks at RTP, transfer pipeline from Forster STP to RTP, and distribution main from RTP to Darawank reservoir. | | • Significant capital cost – requires construction across Wallis Lake, either underbore or attached to bridge in addition to plant upgrade costs | • Combines effluent management of Hallidays Point and Forster STP<br>• Utilises some existing infrastructure. |

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Table 5-7: Long-list of options for Taree (Dawson) Sewerage Scheme

| Taree (Dawson) Sewerage Scheme | | | | |
|---|---|---|---|---|
| **Existing Effluent Management** | Treated water is utilised in the Taree Wingham Effluent Management Scheme (TWEMS) or wet weather flows are discharged to Dawson River or Manning River. | | | |
| **Effluent Reuse** | Effluent is reused for irrigation on farmland under TWEMS.<br>• Recycled water is suitable, in accordance with the relevant standards, for cattle grazing, dairy production, pastures and fodder crop production.<br>• Recycled water is provided to 13 farms, with volumes varying based on amount of usable land present. | | | |
| **Average Year Effluent Use** | 355 ML/year | | | |
| **2050 Unallocated Effluent** | 1230 ML/year | | | |
| **Option** | **Description** | **Risks** | **Issues** | **Opportunities** |
| **Recycled Water for Restricted Use** | • Expansion to new users<br>• Requires expansion of distribution network | | • Opportunistic supply, minimum use under average conditions, while majority used in drought | |
| **Recycled Water for Unrestricted Use** | • Upgrade STP or locate a package RTP plant for unrestricted access effluent water quality suitable for open space irrigation<br>• Potential users include Taree Recreation Grounds, Taree Sports Club, St Clare's High School, Taree Showgrounds, and Taree Croquet Club<br>• Upgrade to STP with membrane filtration, raw and treated water storage tanks, and distribution infrastructure | | | • Potential for dual reticulation for Brimbin developments |
| **Purified Recycled Water** | • Pump effluent from STP to Bootawa Dam<br>• Requires STP upgrade with pre-treatment screening, membrane filtration, reverse osmosis, UV advanced oxidation, raw and treated water storage tanks, and transfer pipeline from STP to Bootawa Dam | • Construction through two waterways | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse and users | |
| **Discharge to wetlands** | • 400 acres natural wetlands adjacent to STP<br>• Expand with constructed wetlands | • Environmental approvals – potential risk / disturbance to biodiversity | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse during dry periods | • Enhance liveability by creating a community amenity |

Table 5-8: Long-list of options for Wingham Sewerage Scheme

| Wingham Sewerage Scheme | | | | |
|---|---|---|---|---|
| **Existing Effluent Management** | Treated water is utilised in TWEMS or wet weather flows are discharged to Manning River.<br>• License to release 1,420 kL/day to the Manning River. | | | |
| **Effluent Reuse** | Treated effluent is pumped from Wingham STP to storage dam located on Wingham Bight.<br>• Recycled water supplied to approximately 60 Ha of local farmland across 4 farms.<br>• Scheme is designed to achieve approximately 70% effluent reuse on an average annual basis. | | | |
| **Average Year Effluent Use** | 151 ML/year | | | |
| **2050 Unallocated Effluent** | 114 ML /year | | | |
| **Option** | **Description** | **Risks** | **Issues** | **Opportunities** |
| **Recycled Water for Restricted Use** | • Expansion to new users such as Wingham Golf Course or abattoirs<br>• Requires expansion of distribution network | | • New users may only require water during dry periods<br>• Abattoirs exporting to EU require use of higher level treated water | |
| **Recycled Water for Unrestricted Use** | • Upgrade STP for unrestricted access effluent water quality suitable for open space irrigation<br>• Potential users include Wingham Town Green<br>• Upgrade STP with minimum membrane filtration and expansion of recycled water pipeline to open space sites | • STP in flood zone - Wingham STP flooded during recent floods | • Majority of recycled water used in 2019-20 drought<br>• Limited space at STP for expansion | |
| **Purified Recycled Water – Direct to Network** | • Pump effluent from STP to Bootawa Dam<br>• Infrastructure required includes STP upgrade with pre-treatment screening, membrane filtration, reverse osmosis, UV advanced oxidation, raw and treated water storage tanks, and transfer pipeline from STP to Bootawa dam | • Construction through two waterways | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse and users | |

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**Table 5-9: Long-list of options for Hawks Nest Sewerage Scheme**

| Hawks Nest Sewerage Scheme | | | | |
|---|---|---|---|---|
| **Existing Effluent Management** | Treated water is directed to exfiltration beds or Hawks Nest RTP.<br>• Two basins are currently used, with a third basin brought on-line when additional exfiltration capacity is required.<br>• Exfiltration beds ponded in recent rain events due to elevated table, requiring consideration for redesign or UV system to manage risk.<br>• RTP has a production capacity of 2 ML/d and is upgradeable to 6 ML/d. | | | |
| **Effluent Reuse** | Effluent is supplied primarily to irrigation schemes at the Hawks Nest golf course and the Myall/Providence Park playing fields. | | | |
| **Average Year Effluent Use** | 120 ML/year | | | |
| **2050 Unallocated Effluent** | 462 ML/year | | | |
| **Option** | **Description** | **Risks** | **Issues** | **Opportunities** |
| **Recycled Water for Unrestricted Use – Expansion of Hawks Nest RTP** | • Expansion of current recycled water to new users<br>• Potential users include holiday parks, Tea Gardens cemetery, Tea Gardens skate park, and Tea Gardens soccer club<br>• Requires expansion of membrane filtration units at RTP, expansion of distribution network | | • Significant capital cost – requires construction across Myall River, either underbore or attached to bridge | • Opportunity to integrate recycled water with caravan park greenfield development area |
| **Purified Recycled Water – Aquifer recharge** | • Managed aquifer recharge of Tea Gardens borefield for replenishment of groundwater<br>• Requires upgrade of Hawks Nest RTP to advanced water treatment plant with membrane filtration, reverse osmosis, and UV advanced oxidation (or as required for water quality suitable for aquifers) and approximately 7 km pipeline to Tea Gardens borefield | • Potential for salinity contamination<br>• Potential for emerging contaminants contamination<br>• Water clogging | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse and users<br>• Appropriateness of water quality for recharge<br>• Increased operational costs | • Increases reliability of bores with replenishment<br>• Adaptable to growth |
| **Purified Recycled Water – Direct to Network** | • Upgrade RTP to meet Australian Drinking Water standards for injection into the water supply network through Tea Gardens reservoir<br>• Requires upgrade to membrane filtration, new reverse osmosis and UV advanced oxidation units, additional raw and treated water storage tanks at the RTP, and pipeline to Tea gardens | | • Significant capital cost – requires construction across Myall River, either underbore or attached to bridge in addition to upgrade costs<br>• Insufficient availability of recycled water whilst maintaining current level of effluent reuse and users | |
| **Discharge to wetlands** | • Source appropriate site for constructed wetlands | • Unfavourable, sandy ground profile | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse and users | |

**Table 5-10: Long-list of options for Gloucester Sewerage Scheme**

| Gloucester Sewerage Scheme | | | | |
|---|---|---|---|---|
| **Existing Effluent Management** | Treated effluent is discharged into Gloucester River from the STP's artificial wetland or reused. | | | |
| **Effluent Reuse** | 25-40% of the treated effluent is directed towards further treatment to be used for irrigation on a nearby property. | | | |
| **Average Year Effluent Use** | 71 ML/year | | | |
| **2050 Unallocated Effluent** | 174 ML/year | | | |
| **Option** | **Description** | **Risks** | **Issues** | **Opportunities** |
| **Recycled Water for Restricted Use** | As per Water Security Option in Table 5-1 and Appendix E | | | |
| **Recycled Water for Unrestricted Use** | As per Water Security Option in Table 5-1 and Appendix E | | | |
| **Purified Recycled Water** | As per Water Security Option in Table 5-1 and Appendix E | | | |

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**Table 5-11: Long-list of options for Stroud Sewerage Scheme**

| Stroud Sewerage Scheme | | | | |
|---|---|---|---|---|
| **Existing Effluent Management** | Effluent is either discharged to the Karuah River or reused.<br>• Effluent from the clarifiers is stored in two 15 ML effluent storage lagoons. These lagoons were designed to limit discharge to the Karuah River to 5% of the average annual inflow to the plant. | | | |
| **Effluent Reuse** | Effluent is filtered, undergoes UV disinfection and is stored in two 22 kL balance tanks.<br>• Recycled water is supplied for irrigation of 25 Ha of land used for dairy cattle grazing on the 'Girrahween' property. | | | |
| **Average Year Effluent Use** | 50 ML/year | | | |
| **2050 Unallocated Effluent** | 4.5 ML/year | | | |
| **Option** | **Description** | **Risks** | **Issues** | **Opportunities** |
| **Recycled Water for Restricted Use** | As per Water Security Option in Table 5-3 and Appendix E | | | |
| **Recycled Water for Unrestricted Use** | As per Water Security Option in Table 5-3 and Appendix E | | | |
| **Purified Recycled Water** | As per Water Security Option in Table 5-3 and Appendix E | | | |

**Table 5-12: Long-list of options for Bulahdelah Sewerage Scheme**

| Bulahdelah Sewerage Scheme | | | | |
|---|---|---|---|---|
| **Existing Effluent Management** | Effluent is discharged into Frys Creek or reused | | | |
| **Effluent Reuse** | Treated effluent is further treated with UV then directed to the nearby golf course for irrigation use. | | | |
| **Average Year Effluent Use** | 21 ML/year | | | |
| **2050 Unallocated Effluent** | 119 ML/year | | | |
| **Option** | **Description** | **Risks** | **Issues** | **Opportunities** |
| **Recycled Water for Restricted Use** | As per Water Security Option in Table 5-2 and Appendix E | | | |
| **Recycled Water for Unrestricted Use** | As per Water Security Option in Table 5-2 and Appendix E | | | |
| **Purified Recycled Water** | As per Water Security Option in Table 5-2 and Appendix E | | | |

**Table 5-13: Long-list of options for Lansdowne Sewerage Scheme**

| Lansdowne Sewerage Scheme | | | | |
|---|---|---|---|---|
| **Existing Effluent Management** | Effluent is stored and reused for irrigation as required or discharged to the Lansdowne River when storage is full under precautionary discharge. | | | |
| **Effluent Reuse** | Effluent is reused for irrigation.<br>• Recycled water is supplied to 3 farmers. | | | |
| **Average Year Effluent Use** | 15 ML/year | | | |
| **2050 Unallocated Effluent** | 8 ML/year | | | |
| **Option** | **Description** | **Risks** | **Issues** | **Opportunities** |
| **Recycled Water for Restricted Use** | • Expansion to new users<br>• Potential new users may include surrounding farms / agricultural properties<br>• May require either expansion of distribution network or offtake points | | | • Increases resilience as licence restricts discharge from plant to river on a precautionary basis |
| **Recycled Water for Unrestricted Use** | • Open spaces for irrigation may include Lansdowne Recreation Reserve and Lansdowne Public School<br>• Requires upgrade to STP with membrane filtration, treated water storage tanks, and transfer infrastructure to end users | • Insufficient demand to offset capital investment | • Significant capital costs for small group of users | |
| **Purified Recycled Water – Direct to Network** | • Pump effluent from STP to either WTP or future off-stream storage dam<br>• Requires WTP upgrade with pre-treatment screening, membrane filtration, reverse osmosis, UV advanced oxidation, raw and treated water storage tanks, and transfer pipeline from STP to WTP or dam | | • Cost-benefit ratio not maximised due to economies of scale | |

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**Table 5-14: Long-list of options for Coopernook Sewerage Scheme**

| Coopernook Sewerage Scheme | | | | |
|---|---|---|---|---|
| **Existing Effluent Management** | Effluent is stored and released to Lansdowne River or reused.<br>• Effluent is released to the Lansdowne River on a precautionary discharge basis during high flows. Unscheduled discharges occur when effluent storages are full and irrigation cannot take place. | | | |
| **Effluent Reuse** | Effluent is pumped to 13 ML effluent storage pond after disinfection.<br>• Recycled water is used by single user on 15 Ha or privately owned irrigated pasture. | | | |
| **Average Year Effluent Use** | 4 ML/year | | | |
| **2050 Unallocated Effluent** | 23 ML/year | | | |
| **Option** | **Description** | **Risks** | **Issues** | **Opportunities** |
| **Recycled Water for Restricted Use** | • Expansion to new users<br>• Potential users may include surrounding farms / agricultural properties<br>• May require either expansion of distribution network or offtake points | | | • Increases resilience as licence restricts discharge from plant to river on a precautionary basis |
| **Recycled Water for Unrestricted Use** | • Open spaces for irrigation may include Coopernook Public School<br>• Requires upgrade to STP with membrane filtration, treated water storage tanks and transfer infrastructure to end users | • Insufficient demand to offset capital investment | • Significant capital costs for small group of users | |
| **Purified Recycled Water – Direct to Network** | • Pump effluent from STP to either WTP or future off-stream storage dam<br>• Infrastructure required includes WTP upgrade with pre-treatment screening, membrane filtration, reverse osmosis, UV advanced oxidation, raw and treated water storage tanks, and transfer pipeline from STP to WTP or dam | | • Cost-benefit ratio not maximised due to economies of scale | |

**Table 5-15: Long-list of options for Old Bar Sewerage Scheme**

| Old Bar Sewerage Scheme | | | | |
|---|---|---|---|---|
| **Existing Effluent Management** | Effluent is discharged through exfiltration.<br>• The exfiltration site is an unconfined sand aquifer located 1.2 km south-east of Old Bar STP.<br>• Effluent percolates from the exfiltration ponds into the groundwater aquifer and ultimately released to the ocean.<br>• Exfiltration beds at risk of sea level rise and erosion, which may be mitigated with coastal stabilisation | | | |
| **Effluent Reuse** | Minor reuse on STP site only. | | | |
| **Average Year Effluent Use** | 0 ML/year | | | |
| **2050 Unallocated Effluent** | 618 ML/year | | | |
| **Option** | **Description** | **Risks** | **Issues** | **Opportunities** |
| **Recycled Water for Restricted Use** | • Current treatment suitable for restricted use<br>• Potential users may include land irrigation at Oxley and Mitchell Islands.<br>• Requires effluent storage tanks and transfer infrastructure | | • Significant capital costs - network expansion at considerable lengths (5-15 km indicative) for potentially small group of users | |
| **Recycled Water for Unrestricted Use** | • Open spaces for irrigation may include Old Bar Beach Rugby Club, Chris Dempsey Cricket Ground, and Old Bar Beach festival grounds<br>• Requires upgrade to STP with membrane filtration, raw and treated water storage tanks, and transfer infrastructure | • Insufficient demand to offset capital investment | • Potentially requires land acquisition for RTP | • Potential for dual reticulation for new development precincts<br>• Opportunity to integrate RTP with plant upgrade |
| **Purified Recycled Water** | • Pump effluent from STP to either WTP or future off-stream storage dam<br>• Infrastructure required includes WTP upgrade with pre-treatment screening, membrane filtration, reverse osmosis, UV advanced oxidation, raw and treated water storage tanks, and transfer pipeline from STP to WTP or dam | | • Cost-benefit ratio not maximised due to economies of scale | • Integrate RTP with plant upgrade |
| **Discharge to wetlands** | • Source appropriate site for constructed wetlands | | • Limited opportunities for wetland site within surrounding vicinity of STP | |
| **Transfer to Dawson STP** | • Transfer sewage to Dawson STP<br>• Requires transfer pipeline and pump station and potentially an upgrade of Dawson STP | • Allowance for additional load discharge in the Dawson Environment Protection Licence | • Significant capital cost – requires construction across Manning River at 2 locations | • Decommission Old Bar STP |
| **Ocean outfall** | • New offshore outfall to ocean<br>• Requires extension of main to ocean with outlet diffuser | • Environmental approvals<br>• Impact to marine life and ecology | • May require additional treatment before discharge | |

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Table 5-16: Long-list of options for Harrington Sewerage Scheme

| Harrington Sewerage Scheme | | | | |
|---|---|---|---|---|
| **Existing Effluent Management** | Effluent is exfiltrated to groundwater or reused.<br>• Exfiltration is via two effluent ponds, 8 ML each, at the STP site<br>• Effluent ponds are designed to overflow to natural wetlands at Harrington Swamp.<br>• Inflow and infiltration management in catchment should reduce effluent volumes in future. | | | |
| **Effluent Reuse** | Effluent is treated with filtration and UV disinfection.<br>• Recycled water is primarily supplied to the nearby Harrington Waters Golf Course. | | | |
| **Average Year Effluent Use** | 36 ML/year | | | |
| **2050 Unallocated Effluent** | 524 ML/year | | | |
| **Option** | **Description** | **Risks** | **Issues** | **Opportunities** |
| **Recycled Water for Restricted Use** | • Expansion of reuse for new users<br>• Requires expansion of distribution network | • No users identified | | |
| **Recycled Water for Unrestricted Use** | • Upgrade of STP for unrestricted use for open space irrigation<br>• Potential sites include Esmund Hogan Park (sports fields), and Harrington Public School<br>• Requires upgrade with membrane filtration, and treated water storage tanks at STP, as well as transfer infrastructure from STP to end users | | • Significant capital cost - requires construction across Cattai Creek and Coopernook Creek | |
| **Purified Recycled Water – Direct to Network** | • Pump effluent from STP to new WTP or off-stream storage dam<br>• Requires WTP with pre-treatment screening, membrane filtration, reverse osmosis, UV advanced oxidation, raw and treated water storage tanks, and pipeline to reservoir for distribution | | • Cost-benefit ratio not maximised due to economies of scale | • Incorporate option into planned future upgrades |
| **Discharge to wetlands** | • Investigation identified in past studies for redirecting recycled water to Cattai Wetlands<br>• May require additional treatment of recycled water and approximately 8 km pipeline for transfer to wetlands | • Environmental approvals – suitability of integrating effluent discharge with natural wetlands with risks to impact on ecology | • Significant capital cost - requires construction across Cattai Creek and Coopernook Creek | |

Table 5-17: Long-list of options for Manning Point Sewerage Scheme

| Manning Point Sewerage Scheme | |
|---|---|
| **Existing Effluent Management** | STP does not require Environment Protection Licence due to the size of plant.<br>Effluent is prioritised for reuse or stored in storage for later use, including wet weather flows. No issues have been identified with this practice to date. |
| **Effluent Reuse** | All effluent is reused within STP site for irrigation. |
| **Average Year Effluent Use** | 24 ML/year |
| **2050 Unallocated Effluent** | 0 ML/year (assuming current practice is maintained) |
| **Option** | **No options were assessed for Manning Point** |

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### 5.1.4 Unserviced Villages

Unserviced villages were not assessed by AECOM in the Options Phase. As noted in Section 2.4.3, a risk assessment of unserviced villages was undertaken separately by Council and was therefore not considered during the coarse screening process.

## 5.2 Coarse Screening Workshops

The coarse screening workshops were held with participation from key stakeholders from Council and DPE. Stakeholders were briefed on each strategic issue and assessed options were presented. The evaluation of each option was undertaken through interactive group discussions or in smaller break out groups and discussed with the wider group to arrive at a concluding assessment. The findings of the coarse screening are discussed in the following sections.

### 5.2.1 Climate Change

The following were identified as key considerations for adapting to climate change:

- Raising of water and sewer electrical assets above the 1-in-100-year flood levels or at risk of sea level rise by 2100 to maintain continuity of operation and reduce risk of asset failure during flooding.
- Consideration for impact of sea level rise on new assets in land planning and development servicing plans.
- Investigation into alternative power supply options to mitigate interruption to services from power failure including regional generator fleet, solar farm, and solar battery opportunities.
- Development of master plan for Taree/Dawson wastewater treatment plant to consider potential to:
    - Divert flows from Wingham STP to mitigate flooding risk
    - Divert flows from Old Bar STP to for sustainable effluent management which is currently positioned to be at inundation risk from sea level rise
    - Consolidate processes and achieve critical mass for energy and resource recovery, establishing a regional resource recovery hub.
- Improvement in business protocols and procedures including a robust approach to emergency response planning to facilitate knowledge sharing and decision making, particularly during emergencies.

A summary of the climate coarse screening is presented in Table 5-18.

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**Table 5-18: Climate Change coarse screening summary**

| Hazard | Impact | Location/asset | Options | Discussion |
|---|---|---|---|---|
| Flooding | Asset under water during 100-year flooding event | Wingham STP | • Bunding around site- not considered practical<br>• Raise electrical assets / switchboards<br>• Relocate or raise key processes, including clarifiers<br>• Relocate STP or divert flow to Dawson- relatively new asset in otherwise good working condition. May be a consideration in longer term (beyond 30 years) | • Wingham STP inundated during recent flooding<br>• Potential for untreated sewage contaminating surrounding environment |
| | Power outages | All sites | • Raise critical electrical assets / switchboards | • Note that it takes time to ensure safety before power supply can be returned after flooding |
| | Pump stations under water | All sites | • Raise critical electrical assets / switchboards | • All pump stations at risk of flooding |
| | Reduced access | Gloucester STP/WTP & Darawank WPS and Reservoir | • Assessing geographical spread of Council resources in line with road / access closure during emergency<br>• Emergency procedures to help manage response<br>• The Gloucester Reservoir and Mains project is currently in construction phase. This will provide around 1-week storage within the network. | |
| Sea Level Rise | Inundation, erosion and wave overtopping | Assets located in Hallidays Point, Tuncurry, Nabiac, Forster, Pacific Palms and Smiths Lake identified at risk of sea level rise by 2100 | • Raise critical assets / switchboards<br>• Vacuum / low pressure systems<br>• Relocated PS to higher elevation (where network reconfiguration is required due to inundation)<br>• Include sea level rise and increased rainfall in modelling | • Sea level rise may have potential to impact Nabiac aquifer<br>• Land use planning to consider climate impact |
| | | Old Bar STP exfiltration beds within 2100 sea level | • Relocate exfiltration ponds<br>• Reuse (limited to dry weather)<br>• Transfer to Dawson<br>• Ocean outfall | • Consider current position of Old Bar break wall, does this provide coastal erosion protection long-term?<br>• Consider options for the Old Bar sewerage scheme in parallel with sustainable effluent management |
| | Sea water intrusion to aquifers / rivers | Nabiac / Tea Gardens Aquifers<br>Manning, Myall, Karuah Rivers | • Sea level rise may have potential impact to aquifers and river tidal zones | • Hydrological modelling needed to understand potential risk<br>• Aquifers may not be reliable long term<br>• May need to relocated river offtakes upstream |
| | General | Manning Point STP | • Manning Point at risk of forecast 2100 sea level | • Whole community is vulnerable from sea level rise<br>• Local reuse at Mitchell Island<br>• Must consider capital costs and impact to environment (during construction/delivery), including footprint of asset, clearing, flora/fauna and heritage impacts |
| Storms | Damage due to extreme storm events (wind, hail, lightning, flooding etc.) | All assets | • Vegetation management / façade audits<br>• Raise switchboards above flood levels<br>• Erosion control / embankment stabilisation<br>• 'Caging' around off-take to protect asset from debris within storm flows | • Is there risk of outfall to river / ocean?<br>• Forster ocean outfall was washed away during storm event shortly after construction, highlighting risk to any future ocean outfall |
| | | Harrington vacuum station & general vacuum network | • Pop-up gullies (note not yet WSAA approved) | • Vacuum networks and stations vulnerable in storm events, prone to high inflow and infiltration<br>• Greatest issue is operational / suction continuity |
| | Power outages | All sites | • Opportunity for solar with battery storage where appropriate to provide emergency power along with baseload / Net Zero benefits | |
| Extreme Temperatures | Reduced WHS conditions and increased worker fatigue | All sites | • Define triggers and protocols<br>• Emergency scenario planning<br>• Capitalise on local employee knowledge<br>• Ensure emergency management plans are ready for adoption when needed. | |
| | Employees occupied in emergency services / volunteering roles and/or defending their homes | All sites | | • Disruption to operations / workforce accessibility<br>• Mental health and wellbeing impacts |

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| Hazard | Impact | Location/asset | Options | Discussion |
|---|---|---|---|---|
| | Staff WHS | All sites | • Council WH&S policy to include appropriate PPE including sunscreen | |
| | Parasites/organisms in water (i.e., increased algal blooms) | All sites | • Increased dosing<br>• Controlled pumping from river to manage nutrients / maintain water quality in dams and avoid toxic algal blooms<br>• Mechanical aeration<br>• Pre-treatment / dissolved air filtration (DAF) | |
| | Mechanical/electrical failure (switchboards overheating and failure resulting in interruption) | All Sites | • Air conditioning to maintain temperatures required for treatment processes and operator safety<br>• Heat shields on switchboards (Council has already adopted this, assets in southern region could adopt this measure when renewed)<br>• Opportunity for solar with battery storage where appropriate to provide emergency power along with baseload / Net Zero benefits | • Air conditioning would need to consider emissions / energy use<br>• Switchboards overheating and failure resulting in interruption has been experienced by Council in the past |
| | Extreme heat | All sites | • Increased tree canopy / carbon heat mitigation | |
| | Increased water use | All sites | • Demand-based pricing models to reduce overall demand | • Consider in parallel with water security |
| | Structural stresses | All sites | • Design and construction for new structures and specifications. | • Cracking and maintenance of joints is of concern |
| Bushfire | Ash in raw water leading to impacts to treatment stations | All sites | • Management plans for water quality (additional backwashing, etc)<br>• Alternative raw water sources and/or selective pumping from existing sources<br>• Catchment management as a means to mitigate bushfire impacts, including:<br>○ Cultural burning and regeneration<br>○ Riparian management<br>○ Regenerative agriculture<br>• Refuge pools aimed at supporting regeneration of ecosystems during and/or following fire events. | • Smaller catchments are more vulnerable<br>• Water quality issues are manageable with appropriate operational protocols. This may require additional backwashing, chemicals. Etc |
| | General damage and safety risks (asset damage, reduced water quality during/after bushfires) | All sites | • Air conditioning to maintain temperatures and air quality required for treatment processes and operator safety<br>• Controlled pumping from river to manage nutrients / maintain water quality in dams and avoid toxic algal blooms<br>• Mechanical aeration<br>• Pre-treatment / DAF<br>• Management plans for water quality | • Hallidays Point was clear of fire in 2019<br>• How did Forster STP fare? Does Forster require greater buffers / easements?<br>• Consider which plants are manned and remote in identifying high risk sites<br>• Need to review bushfire management plans<br>• Need clarification on Council's jurisdiction – do vegetation buffers form part of National Parks jurisdiction; is there the option to extend buffers? |
| | Power supply failure | All sites | • Increased availability of generators<br>• Critical pump station shutdown<br>• Opportunity for solar with battery storage where appropriate to provide emergency power along with baseload / Net Zero benefits | • Interruption to power supply is significant risk, including WHS dangers when responding to power supply issues.<br>• Availability of generators; opportunity for a regional 'fleet' of generators that can be deployed to specific locations across MidCoast and neighbouring LGA's when needed. |
| | Reduced access due to road closures and fire danger | All sites | • Consider automation at STPs and WTPs where risk of road closure | • Increased contractor management requirements for designation filling stations and reduced access via standpipes. |
| | Staff safety and wellbeing i.e., smoke inhalation | All sites | • Manage operation remotely where possible<br>• Appropriate PPE | |
| | Increased Water Demand – (compound effect of drought and bushfire) | All sites | • Identify and use alternative sources of water for firefighting (e.g., Stratford Mine Dam at Gloucester)<br>• Demand-based pricing models to reduce overall demand | • Consider in parallel with water security options |
| | Combination of all bushfire impacts | All sites | • Revise bushfire management plans<br>• Prepare emergency response plans consider bushfires | |
| General | Staff WHS (mental health and wellbeing) | All sites | • Emergency procedures to help response<br>• 2-way radio network to maintain communication when power / mobile unavailable | • Risk of mental health impacts to staff due to repeated extreme events and emergencies. |

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| Hazard | Impact | Location/asset | Options | Discussion |
|---|---|---|---|---|
| | Emissions reduction / Net Zero | All sites | • Potential for solar panels with battery storage and hydroelectricity at various locations across LGA, need to consider available space and balance cost / benefit<br>• Bioreactors- use methane biofuels as alternate energy source<br>• Opportunity to convert $CH_4$ to $CO_2$, reduce emissions<br>• Review STP process efficiency | • Opportunistic approach to renewable energy.<br>• Limited opportunity for other forms of renewable energy; does Council want to be an energy provider?<br>• STP gas capture / reduction |
| | Operational resilience | LGA wide | • 2-way radio network to maintain communication when power / mobile unavailable<br>• Integrated management plan for each site<br>• Workforce resilience (assess geographic spread of resources to assess workforce shortages if access restricted from flood, road closure, fire, etc.)<br>• Response staff wellbeing (greater support, better culture) | |

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### 5.2.2 Water Security

Limitations of some options common to all supply schemes were realised in early discussions. It was agreed these following options will not be progressed to the next stage.

- **All recycled water options** – existing effluent management practices uses effluent for recycled water purposes across the water schemes, and Council is not considering discontinuation of recycled water services to current customers at this stage. In addition, low growth is forecast for Gloucester, Bulahdelah and Stroud based on the current 30-year growth forecasts (Section 4.1.2), limiting the volume of additional effluent available for recycling. Therefore, the remaining unallocated recycled water provides a limited opportunity to offset drinking water demand during dry and average rainfall periods. However, this is believed to not have a material impact on water security. Other constraints for specific recycled water options are noted below.
    - **Recycled water for restricted and unrestricted use** – these options were considered to have greater benefits for sustainable effluent management than for water security. Expansion of recycled water services is considered a supplementary option only due to limited opportunities to offset sufficient potable water demand.
    - **Recycled water for environmental flows** – this option was evaluated to have limited water security benefits under drought or low river flow conditions. Additional flow extraction from the river will remain dependent on the flow conditions of the river. High costs for additional treatment and a legislative framework that is yet to be fully developed were identified as other barriers to this option.
    - **Reticulated recycled water** – this option was considered feasible for new developments only; retrofitting infrastructure, particularly the internal plumbing required for dual reticulation, was not considered due to practicality and cost implications. Dual reticulation supply also poses equity concerns in the community. As noted above, there is a limited opportunity to offset sufficient drinking water demand to resolve the water security issue under this option due to limited growth in the catchments.
      Dual reticulation schemes implemented in other Australian locations have proven to be expensive to operate and maintain based on the existing pricing models for recycled water, with potential cost per dwelling upwards of $16,000 inclusive of full treatment and transfer infrastructure for an average day demand of around 160 L/day (Oran Park and Turner Road DSP, 2016). It is also likely that potable water top-up may still be required for peak day demands.
    - **Purified recycled water** – this option has passed the coarse screening for the Manning scheme. For Bulahdelah, Gloucester and Stroud, existing recycled water schemes limit the availability of effluent for recycling. For the remaining available effluent, capital and operational costs would be prohibitively high to produce less than 0.5 ML/day of purified recycled water for each scheme.
- **Desalination of sea water and river water** – for the Manning scheme, desalination of sea water was shortlisted during the Manning Coarse Screening project. Desalination of river/estuarine water was short-listed only for consideration in emergency desalination in the short term only.
  For Gloucester, Stroud and Bulahdelah, high costs from construction and operation of desalination plant and long pipelines were discussed as the primary failing factors under this option, due to proximity from the coast. Estuarine desalination would require discharge of brine to the ocean. As per the purified recycled water option, economies of scale for small production volumes are also not viable for individual operating plants. Consideration for integration with the larger Manning Water Supply Scheme option was discussed, with potential to service smaller schemes with desalinated water via connection to broader Manning desalination scheme.
- **Water carting** – carting from any of the identified locations will be considered as an emergency response only as it is not a practical solution for the long-term.

Refer to Appendix F for full details on the coarse screening assessment for each scheme.

#### 5.2.2.1 Gloucester Water Supply Scheme

Table 5-19 presents a summary of Gloucester's coarse screening assessment.

The key outcomes for other options from the coarse screening are outlined below.

- **Additional on-stream storage via new weir** – this option was identified during the discussions. The raising of river levels was considered unfavourable for the riparian corridor and would require significant environmental approvals. Furthermore, the option is a rainfall dependent solution and extraction from the river will remain dependent on favourable river conditions. As such, this option was failed and will not be progressed for further assessment.
- **Stormwater harvesting** – secure yield modelling for Gloucester's stormwater option suggests significantly large storage and reconfiguration of the stormwater network will be required to capture the runoff from the local catchment to meet the 5/10/10 LOS rule (refer to Section 6.2 for modelling details). Stormwater harvesting as a standalone does not provide reasonable reliability and would therefore still require sourcing for additional water elsewhere. This, combined with the cost for capturing runoff in storage (8000 ML), was sufficient to fail as a standalone option. Localised opportunities should be considered where feasible.
- The options of **Groundwater** and **Stratford Mine Dam** were progressed to the next stage for further investigation.
  - **Stratford mine dam** – depending on further investigations, water from the dam can either by used for emergency responses or as a supplementary option to enable greater extraction at the offtake point. Investigation into the water profile and source is required to confirm feasibility of the options.
  - **Groundwater** – there are known Water NSW groundwater bores in the Gloucester area. Groundwater investigations will be completed by Council, to identify if there are any potential groundwater resources in the area for future water supply.
- The options of **Regional Connection with Manning via Krambach** and **New Off-Stream Storage** were assessed to pass to scenario development.

#### 5.2.2.2 Bulahdelah Water Supply Scheme

Table 5-20 presents a summary of Bulahdelah's coarse screening assessment.

The key outcomes for other options from the coarse screening are outlined below.

- **Additional on-stream storage via raising Crawford weir** – this option was identified during the discussions. It will provide the opportunity for a greater drawdown which was not accessible in the recent droughts due to level restrictions, however raising the weir level will result in inundation of the surrounding flat plains. Furthermore, the availability of water will remain dependent on favourable river conditions. As such, this option was failed and will not be progressed for further assessment.
- **Stormwater harvesting** – the region of Bulahdelah is identical to Gloucester in its land use. Significantly large storage and reconfiguration of the stormwater network will be required to capture the runoff from the local catchment to meet the 5/10/10 rule for a measurable impact on water security. As a result, this option failed as a standalone option. Localised opportunities however should be considered where feasible.
- **Regional connection to Manning via pipeline from Tea Gardens** – the Tea Gardens water supply scheme is supplied by extraction from the Tea Gardens aquifer. While water security is not currently an issue for the Tea Gardens scheme under current or future growth forecasts, there is a need to manage demand within the scheme in line with licenced extraction limits. Therefore, a pipeline from Tea Gardens to Bulahdelah would only provide additional supply during drought conditions, making it a high-cost option with operational challenges that would rarely be used.
- **Regional connection to Manning via pipeline from Smiths Lake** – this option failed to progress to the next stage due to the constraints identified for construction through

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environmentally sensitive corridors. Trenchless construction will be required for majority of the route, resulting in significantly high capital investment of approximately $59 million.

- The option of **Groundwater** was progressed to the next stage for groundwater investigations to be completed by Council, to determine the potential for a future groundwater supply. Discussions identified private bores supplying water in the area in Bulahdelah.
- The options of **Regional Connection with Manning via Nabiac** (identified during discussions) and **New Off-Stream Storage** were assessed to pass to scenario development.

#### 5.2.2.3 Stroud Water Supply Scheme

Table 5-21 presents a summary of Stroud's coarse screening assessment.

The key outcomes for other options from the coarse screening are outlined below.

- **Additional on-stream storage via raising weir crest** – this option was identified during discussions. Since the weir is natural and is a fish ladder, it was established that significant environmental approvals will be required for this option. Extraction from the river will remain dependent on favourable river conditions. This option was hence failed and will not be progressed for further assessment.
- **Stormwater harvesting** – runoff from the local catchment will require significant storage to meet the 5/10/10 LOS rule for a measurable impact on water security. Due to multiple small sub-catchments, reconfiguration of the network will also be required. As a result, this was failed as a standalone option. The option is suitable for localised opportunities where feasible.
- The option of **Duralie Mine Dam** (identified during discussions) was progressed for further investigations. The underlying dam geology and hydrology, and water quality needs to be determined to ascertain suitability of dam water for either potable or non-potable purposes.
- The option of **Groundwater** was progressed to the next stage for groundwater investigations to be completed by Council, to determine the potential for a future groundwater supply.
- The options of **Regional Connection with Hunter Water via Dungog** and **New Off-Stream Storage** were assessed to pass to scenario development.

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**Table 5-19: Coarse screening of Gloucester Water Security**

| Council Values | Council Risk Category | Indicator | Off-Stream Storage | Stratford Mine Dam | Groundwater | Desalination of Sea Water | Reticulated Recycled Water | Recycled Water for Restricted Use | Recycled Water for Unrestricted Use | Recycled Water for Environmental Flows | Purified Recycled Water for Drinking | Stormwater Harvesting | Regional connection (pipeline from Manning via Krambach) | Regional connection (water carting from Tea Gardens) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Wellbeing** | Worker and public health & wellbeing | Health and wellbeing | Pass | Pass | Unknown | Pass | Pass | Pass | Pass | Pass | Pass | Unknown | Pass | Pass |
| | Service delivery & infrastructure | Availability | Pass | Unknown | Unknown | Pass | Fail –customers used around 90% effluent in 19/20 drought, low growth for additional effluent | Fail –customers used around 90% effluent in 19/20 drought, low growth for additional effluent | Fail –customers used around 90% effluent in 19/20 drought, low growth for additional effluent | Fail –customers used around 90% effluent in 19/20 drought, low growth for additional effluent | Fail –customers used around 90% effluent in 19/20 drought, low growth for additional effluent | Unknown | Pass | Unknown |
| | | Yield / beneficial to pursue / supply | Pass | Pass | Unknown | Pass | Fail – suitable for new developments only, low growth forecast | Fail – insufficient material impact on potable water demand, does not solve water security | Fail – insufficient material impact on potable water demand, does not solve water security | Unknown | Unknown | Unknown | Pass | Fail – does not provide permanent secure yield |
| | | Practically viable | Pass | Pass | Pass | Fail – significant distance from coast (>100km) | Pass | Pass | Pass | Pass | Pass | Pass | Pass | Fail – not viable for a long-term solution |
| | | Integration with existing network | Pass | Pass | Pass | Fail – poor integration with wider MidCoast network | Unknown | Pass | Pass | Pass | Pass | Unknown | Pass | Pass |
| **Integrity** | Compliance | Regulatory and governance | Pass | Unknown | Pass | Unknown | Pass | Pass | Pass | Fail – regulatory framework not fully developed for environmental flow replacement | Fail – no supporting regulatory framework | Pass | Pass | Pass |
| | Project timeline | Timeline for planning and delivery | Pass | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Pass | Pass | Unknown |
| | Financial Project budget | Cost- capital | Pass | Unknown | Unknown | Unknown | Unknown | Pass | Unknown | Unknown | Unknown | Fail – high capital cost to provide sufficient storage | Unknown | Pass |
| | | Cost – O&M | Pass | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Fail – high costs for daily water carting and disinfection as permanent water security solution |
| **Sustainability** | Environment | Environmental impact | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Pass |
| | | Sustainability and resource consumption | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Fail – highly energy intensive treatment; ongoing carbon footprint needs assessing | Unknown | Unknown | Unknown |
| **Respect** | Reputation | Community acceptance | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown |
| **Outcome** | | | **Pass** | **Pass** | **Pass** | **Fail** | **Fail** | **Fail** | **Fail** | **Fail** | **Fail** | **Fail** | **Pass** | **Fail – will progress as an emergency measure only** |

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**Table 5-20: Coarse screening of Bulahdelah Water Security**

| Council Values | Council Risk Category | Indicator | Off-Stream Storage | Desalination of Sea Water | Regional connection (pipeline from Manning via Smiths Lake) | Regional connection (pipeline from Tea Gardens) | Regional connection (water carting from Tea Gardens) | Stormwater Harvesting | Groundwater | Reticulated Recycled Water | Recycled Water for Restricted Use | Recycled Water for Unrestricted Use | Recycled Water for Environmental Flows | Purified Recycled Water |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Wellbeing** | Worker and public health & wellbeing | Health and wellbeing | Pass | Pass | Pass | Pass | Pass | Unknown | Unknown | Pass | Pass | Pass | Pass | Pass |
| | Service delivery & infrastructure | Availability | Pass | Pass | Pass | Fail – decreases reliance of system for local scheme | Unknown | Unknown | Unknown | Fail – customers used around 90% effluent in 19/20 drought, low growth for additional effluent | Fail – customers used around 90% effluent in 19/20 drought, low growth for additional effluent | Fail – customers used around 90% effluent in 19/20 drought, low growth for additional effluent | Fail – customers used around 90% effluent in 19/20 drought, low growth for additional effluent | Fail – customers used around 90% effluent in 19/20 drought, low growth for additional effluent |
| | | Yield / beneficial to pursue / supply | Pass | Pass | Pass | Pass | Fail – does not provide permanent secure yield | Unknown | Unknown | Fail – suitable for new developments only, low growth forecast | Fail – insufficient material impact on potable demand, does not resolve water security | Fail – insufficient material impact on potable demand, does not resolve water security | Unknown | Unknown |
| | | Practically viable | Pass | Fail – long pipeline, limited road corridor via National Park | Fail – long pipeline, limited road corridor via National Park | Pass | Fail – not viable for a long-term solution | Pass | Pass | Pass | Pass | Pass | Pass | Pass |
| | | Integration with existing network | Pass | Fail – poor integration with wider MidCoast network | Fail – poor integration, operational complexity connecting to Smiths Lake | Pass | Pass | Unknown | Pass | Pass | Pass | Pass | Pass | Pass |
| **Integrity** | Compliance | Regulatory and governance | Pass | Unknown | Unknown | Pass | Pass | Pass | Pass | Pass | Pass | Pass | Fail – regulatory framework not fully developed for environmental flow replacement | Fail – no supporting regulatory framework |
| | Project timeline | Timeline for planning and delivery | Pass | Unknown | Unknown | Pass | Unknown | Pass | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown |
| | Financial Project budget | Cost- capital | Unknown | Unknown | Unknown | Unknown | Pass | Fail – high capital cost to provide sufficient storage | Unknown | Unknown | Pass | Unknown | Unknown | Unknown |
| | | Cost – O&M | Unknown | Unknown | Unknown | Unknown | Fail – high costs for daily water carting as permanent water security solution | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown |
| **Sustainability** | Environment | Environmental impact | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown |
| | | Sustainability and resource consumption | Unknown | Unknown | Unknown | Unknown | Fail – does not provide secure yield for intergenerational equity | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Fail – highly energy intensive treatment; ongoing carbon footprint needs assessing |
| **Respect** | Reputation | Community acceptance | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown |
| **Outcome** | | | **Pass** | **Fail** | **Fail** | **Fail** | **Fail – will progress as an emergency measure only** | **Fail** | **Pass** | **Fail** | **Fail** | **Fail** | **Fail** | **Fail** |

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**Table 5-21:Coarse screening of Stroud Water Security**

| Council Values | Council Risk Category | Indicator | Off-Stream Storage | Desalination of Sea Water | Regional connection (pipeline from Hunter via Dungog) | Regional connection (water carting from Tea Gardens) | Stormwater Harvesting | Groundwater | Reticulated Recycled Water | Recycled Water for Restricted Use | Recycled Water for Unrestricted Use | Recycled Water for Environmental Flows | Purified Recycled Water |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wellbeing | Worker and public health & wellbeing | Health and wellbeing | Pass | Pass | Pass | Pass | Unknown | Unknown | Pass | Pass | Pass | Pass | Pass |
| | Service delivery & infrastructure | Availability | Pass | Pass | Unknown | Unknown | Unknown | Unknown | Fail –customer used around 70-80% effluent, low growth for additional effluent | Fail –customer used around 70-80% effluent, low growth for additional effluent | Fail –customer used around 70-80% effluent, low growth for additional effluent | Fail –customer used around 70-80% effluent, low growth for additional effluent | Fail –customer used around 70-80% effluent, low growth for additional effluent |
| | | Yield / beneficial to pursue / supply | Pass | Pass | Unknown | Fail – does not provide permanent secure yield | Unknown | Unknown | Fail – suitable for new developments only, low greenfield development forecast | Fail – insufficient material impact on potable water demand, does not resolve water security | Fail – insufficient material impact on potable water demand, does not resolve water security | Unknown | Unknown |
| | | Practically viable | Pass | Fail – long pipeline, likely requiring underbore for part due to limited road corridor and through National Park | Unknown | Fail – not viable for a long-term solution | Pass | Pass | Pass | Pass | Pass | Pass | Pass |
| | | Integration with existing network | Pass | Fail – poor integration with wider MidCoast network | Unknown | Pass | Unknown | Pass | Pass | Pass | Pass | Pass | Pass |
| Integrity | Compliance | Regulatory and governance | Pass | Unknown | Pass | Pass | Pass | Pass | Pass | Pass | Pass | Fail – regulatory framework not fully developed for environmental flow replacement | Fail – no supporting regulatory framework |
| | Project timeline | Timeline for planning and delivery | Pass | Unknown | Unknown | Unknown | Pass | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown |
| | Financial Project budget | Cost- capital | Pass | Unknown | Unknown | Pass | Fail – high capital cost to provide sufficient storage | Unknown | Unknown | Pass | Unknown | Unknown | Unknown |
| | | Cost – O&M | Pass | Unknown | Unknown | Fail – high costs for daily water carting and disinfection as permanent water security solution | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown |
| Sustainability | Environment | Environmental impact | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown |
| | | Sustainability and resource consumption | Unknown | Unknown | Unknown | Fail – does not provide secure yield for intergenerational equity | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Fail – highly energy intensive treatment; ongoing carbon footprint needs to be assessed |
| Respect | Reputation | Community acceptance | Pass | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown |
| **Outcome** | | | **Pas** | **Fail** | **Pass** | **Fail – will progress in strategy as an emergency measure only** | **Fail** | **Pass** | **Fail** | **Fail** | **Fail** | **Fail** | **Fail** |

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### 5.2.3 Sustainable Effluent Management

Key outcomes from the coarse screening are summarised below.

- **Demand management** and **inflow and infiltration management** are business ans usual activities within Council's operations and will continue to be managed as such in the future.
  - Targeted investigations were specifically identified for inflow management at Coopernook and Bulahdelah, and infiltration management at Harrington.
- **Biosolids management** and reuse will not be pursued beyond the current approach. The NSW EPA are currently reviewing the Biosolids Framework, with the final framework and supporting legislation due for release in September 2023. Management of biosolids across the treatment plants in MidCoast will be subsequently reviewed following release of the new framework.
- **Recycled water for dual reticulation** was not identified as a viable option for Council. As discussed in Section 5.2.2, this option is financially prohibitive, poses equity concerns and is suitable for new developments only. Recycled water will continue to be supplied to existing customers, therefore availability of recycled water is also limited at some plants.
- **Purified recycled water** options failed for most schemes as economies of scale cannot be achieved for smaller sewerage schemes. Sewerage schemes located in Manning Water Supply Scheme area will be considered on the broader scale for Manning water security option with effluent potentially sourced from Forster, Dawson and Wingham STPs and Tuncurry RTP.
- **Recycled water for restricted and unrestricted use**, where failed, was primarily due to:
  - Insufficient users identified in comparison with the scale of infrastructure required to treat the recycled water and distribute to customers; and / or
  - Insufficient supply available due to high demand from existing customers based on usage in the recent drought.
- **Recycled water for restricted use** at Hallidays Point and Harrington is dependent on identification of potential users. At Hallidays Point these could be located within the vicinity of either Hallidays Point or Nabiac STPs (which currently pumps treated effluent to the Hallidays Point STP).
- Options to **discharge to the environment** were placed low in prioritisation if effluent reuse was a viable option for majority of the available flow.
  - **Water features / landscaping** and discharge to wetlands were identified as opportunistic options. Council will only be pursing this for implementation where the opportunity presents, most likely within greenfield developments, to fully benefit from an appropriately planned asset.
  - **Discharge to manufactured wetlands** adjacent to Dawson STP was identified as a potential option.
  - **Exfiltration** and river discharge were only considered as options if they were included in the existing effluent management scheme. Some sewerage schemes are licenced to discharge into the river on a precautionary basis. It was agreed that these specific schemes require additional options for effluent reuse.
  - **Ocean / shoreline outfall** was not considered for most schemes as other viable options were identified. The exceptions were Forster, where it is the current effluent management system and Old Bar due to climate change risks to the existing exfiltration beds and limited effluent reuse opportunities.
- No options were identified for Manning Point beyond the current approach. A broader, strategic plan is required for the township to mitigate future impacts of climate change. It was recognised that current practices are considered sustainable for existing management practices.
- Decommissioning of Wingham STP and diversion of flow to Dawson STP in the longer-term was discussed as a potential climate change option to manage flood risk. This would also remove the need to manage effluent at Wingham STP and potentially provide economy of scale

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for enhanced resource recovery opportunities at Dawson. Similarly, diversion of flow from Old Bar STP was also discussed in the sustainable effluent management workshop to mitigate risk to exfiltration beds from sea level rise and erosion.

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**Table 5-22: Coarse screening summary of Sustainable Effluent Management for all sewerage schemes**

| | Flow reduction | | Resource Recovery | Effluent reuse | | | Discharge to environment | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Demand management | Inflow and infiltration management | Biosolids management and reuse | Recycled water restricted use | Recycled water unrestricted use | Purified recycled water for drinking | Discharge to wetlands | Water features / landscaping | Exfiltration | River discharge | Ocean outfall |
| **Hallidays Point** | Pass | Pass | N/A | Pass – further investigation to identify users | Pass | Pass – Water Security Option for Manning | Fail | Fail | Pass | Fail | Fail |
| **Forster** | Pass | Pass | N/A | Fail | Pass | Pass – Water Security Option for Manning | Fail | Fail | Fail | Fail | Pass |
| **Taree / Dawson** | Pass | Pass | N/A | Pass | Pass | Pass – Water Security Option for Manning | Pass | Fail | Fail | Pass | Fail |
| **Wingham** | Pass | Pass | N/A | Pass | Fail | Pass – Water Security Option for Manning | Fail | Fail | Fail | Pass | Fail |
| **Hawks Nest** | Pass | Pass | N/A | Fail | Pass | Fail | Fail | Fail | Pass | Fail | Fail |
| **Old Bar** | Pass | Pass | N/A | Pass | Pass | Fail | Fail | Fail | Pass | Fail | Pass |
| **Harrington** | Pass | Pass | N/A | Pass – further investigation to identify users | Fail | Fail | Pass | Fail | Pass | Pass | Fail |
| **Gloucester** | Pass | Pass | N/A | Pass | Pass | Fail | Fail | Fail | Fail | Pass | Fail |
| **Stroud** | Pass | Pass | N/A | Pass | Fail | Fail | Fail | Fail | Fail | Pass – highly restricted | Fail |
| **Lansdowne** | Pass | Pass | N/A | Pass | Fail | Fail | Fail | Fail | Fail | Pass – highly restricted | Fail |
| **Coopernook** | Pass | Pass | N/A | Pass | Fail | Fail | Fail | Fail | Fail | Pass – highly restricted | Fail |
| **Bulahdelah** | Pass | Pass | N/A | Pass | Pass | Fail | Fail | Fail | Fail | Pass | Fail |
| **Manning Point** | Pass | Pass | N/A | Fail | Fail | Fail | Fail | Fail | Fail | Fail | Fail |

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## 5.3 Short-list of Strategic Options

### 5.3.1 Climate Change

No option was explicitly ruled out, although some options were likely to be highly location-specific whereas others would apply at a regional scale.

The timing for some risks were outside the planning horizon for this IWCM (i.e. sea level rise by 2100), however these were still considered relevant to future needs. It was also determined that a framework or hierarchy of interventions could be developed to address specific issues at each asset location.

### 5.3.2 Water Security

The table below presents the final list of short-listed options for each water supply scheme. Options that were inconclusive based on limited information available to definitively pass/fail the coarse screening were progressed for further investigation to determine feasibility of the option. These are noted in the table below. Options that progressed to scenario development are highlighted in green. Others were identified as options considered for supplementary or emergency purposes only. The Groundwater-Nabiac option is currently being progressed for delivery by Council.

Impacts of demand management are not included in the table below, but as discussed in Section 4.1.4, there is potential for reduced consumption and consequent delay in capital investment. Demand management is implemented by Council under their BAU operations, which is discussed further in Section 6.1.1.

**Table 5-23: Short-list of options for water security for all water schemes**

| Scheme | Short-listed Options | Consideration |
|---|---|---|
| **Manning (from Manning Coarse Screening Report)** | Increase storage yield via new Peg Leg Creek Dam | Progressed to scenario development |
| | Desalination of estuarine water at Nabiac WTP | Emergency response only |
| | Desalination of sea water at Hallidays Point | Progressed to scenario development |
| | Recycled water for municipal irrigation, agricultural and construction use | |
| | Increased groundwater from Nabiac Aquifer | In delivery |
| | Regional connection – pipeline to Port Macquarie Hastings Supplementary option | Further investigation |
| | Purified recycled water for potable reuse | Progressed to scenario development |
| **Gloucester** | New off-stream storage dam | Progressed to scenario development |
| | Stratford mine dam | Further investigation |
| | Desalination of sea water | Fails as standalone, consideration for integration with Manning desalination option |
| | Recycled water for unrestricted use | Supplementary option |
| | Regional connection – pipeline from Manning via Krambach | Progressed to scenario development |
| | Regional connection – water carting from Tea Gardens | Emergency response only |
| | Groundwater | Progressed to scenario development |
| **Bulahdelah** | New off-stream storage dam | Progressed to scenario development |

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| Scheme | Short-listed Options | Consideration |
|---|---|---|
| | Regional connection – pipeline from Manning via Nabiac | Progressed to scenario development |
| | Regional connection – water carting from Tea Gardens | Emergency response only |
| | Groundwater | Progressed to scenario development |
| **Stroud** | Additional off-stream storage with new dam | Progressed to scenario development |
| | Duralie Mine Dam (considered both for pipeline transfer and emergency measure) | Progressed to scenario development |
| | Regional connection – pipeline from Hunter via Dungog | Further investigation |
| | Regional connection – pipeline from Gloucester via Stratford Dam | Further investigation |
| | Regional connection – water carting from Tea Gardens | Emergency response only |
| | Groundwater | Progressed to scenario development |

### 5.3.3 Sustainable Effluent Management

The following options were shortlisted to progress for all treatment plants. These options are undertaken by Council as business as usual and will continue to be actioned in their day-to-day services.

- Demand management
- Inflow and infiltration management

The table below presents the final list of short-listed options for Council's sewerage schemes.

**Table 5-24: Short-list of options for sustainable effluent management for each sewerage scheme**

| Sewerage Scheme | Options Progressed |
|---|---|
| **Hallidays Point** | Recycled water for restricted use (further investigation to identify users) |
| | Recycled water for unrestricted use |
| | Purified recycled water for drinking (long-term water security solution) |
| | Exfiltration |
| **Forster** | Recycled water for unrestricted use |
| | Purified recycled water for drinking (long-term water security solution) |
| | Ocean/shoreline outfall |
| **Taree/Dawson** | Recycled water for restricted use |
| | Recycled water for unrestricted use |
| | Purified recycled water for drinking (long term water security solution) |
| | Discharge to constructed wetlands |
| | River discharge |
| **Wingham** | Recycled water for restricted use |
| | Purified recycled water for drinking (long-term water security solution) |
| | River discharge |
| | Divert flows to Dawson STP |
| **Hawks Nest** | Recycled water for unrestricted use |
| | Exfiltration |
| **Old Bar** | Recycled water for restricted use |

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| Sewerage Scheme | Options Progressed |
|---|---|
| | Recycled water for unrestricted use |
| | Exfiltration |
| | Ocean outfall |
| | Divert flows to Dawson STP |
| **Harrington** | Recycled water for restricted use (further investigation to identify users) |
| | Discharge to wetlands |
| | Exfiltration |
| | River discharge |
| **Gloucester** | Recycled water for restricted use |
| | Recycled water for unrestricted use |
| | River discharge |
| **Stroud** | Recycled water for restricted use |
| | River discharge |
| **Lansdowne** | Recycled water for restricted use |
| | River discharge |
| **Coopernook** | Recycled water for restricted use |
| | River discharge |
| **Bulahdelah** | Recycled water for restricted use |
| | Recycled water for unrestricted use |
| | River discharge |
| **Manning Point** | N/A |

### 5.3.4 Unserviced Villages

The outcomes from the unserviced villages assessment undertaken by DWC are presented Table 5-25 below. The table summarises the servicing options and provides an indicative high-level cost to service each village.

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**Table 5-25: Outcomes of unserviced villages risk assessment and servicing options**

| Rank | Village | No. Lots | Servicing Option 1 Sewer | Servicing Option 2 Cluster System | Servicing Option 3 Partial On-site | Servicing Option 4 Full on-site | Cost $M |
|---|---|---|---|---|---|---|---|
| 1 | Coomba Park | 670 | Preferred | Unsuitable | Unsuitable | Unsuitable | 20-40 |
| 2 | North Pindimar | 91 | Unsuitable | Alternative | Preferred | Unsuitable | 9-14 |
| | South Pindimar | 137 | Unsuitable | Alternative | Preferred | Unsuitable | |
| | North Arm Cove | 409 | Unsuitable | Preferred | Unsuitable | Unsuitable | 16-25 |
| | Bundabah | 125 | Unsuitable | Preferred | Unsuitable | Unsuitable | 6-10 |
| | Nerong | 168 | Unsuitable | Preferred | Unsuitable | Unsuitable | 8-13 |
| | Seal Rocks | 73 | Unsuitable | Preferred | Unsuitable | Unsuitable | 4-6 |
| | Carrington & Tahlee | 40 | Unsuitable | Alternative | Preferred | Unsuitable | 2-4 |
| 9 | Bungwahl | 74 | Unsuitable | Unsuitable | Preferred | Unsuitable | 4-6 |
| 10 | Croki | 25 + 38 caravan sites | Unsuitable | Preferred | Unsuitable | Unsuitable | 2-4 |
| 11 | Allworth | 92 | Unsuitable | Preferred | Unsuitable | Unsuitable | 4-7 |
| | Copeland | 116 | Unsuitable | Preferred | Unsuitable | Unsuitable | 6-9 |
| 13 | Tea Gardens (Industrial Estate) | 38 | Unsuitable | Preferred | Unsuitable | Unsuitable | Sewer |
| 14 | Coolongolook | 77 | Unsuitable | Alternative | Preferred | Unsuitable | 4-6 |
| 15 | Stroud Road | 91 | Preferred | Unsuitable | Unsuitable | Unsuitable | Sewer |
| 16 | Krambach | 238 | Unsuitable | Preferred | Alternative | Unsuitable | 9-14 |
| 17 | Oxley Island<br>Mitchells Island | 177<br>47 | Unsuitable | Unsuitable | Unsuitable | Preferred | 3-6 |
| | Wards River | 64 | Unsuitable | Preferred | Unsuitable | Unsuitable | 3-5 |
| 19 | Mount George | 97 | Unsuitable | Alternative | Preferred | Unsuitable | 5-8 |
| | Elands | 62 | Unsuitable | Preferred | Alternative | Unsuitable | 3-5 |
| 21 | Johns River | 173 | Unsuitable | Preferred | Alternative | Unsuitable | 8-14 |
| 22 | East Wingham | 65 | Preferred | Unsuitable | Unsuitable | Unsuitable | Sewer |
| 23 | Craven | 23 | Unsuitable | Preferred | Alternative | Unsuitable | 1-2 |
| 24 | Wootton | 23 | Unsuitable | Alternative | Preferred | Unsuitable | 1-2 |
| 25 | Stratford | 100 | Unsuitable | Alternative | Preferred | Unsuitable | 5-8 |
| 26 | Limeburners Creek | 58 | Unsuitable | Preferred | Alternative | Unsuitable | 3-5 |
| 27 | Booral | 53 | Unsuitable | Alternative | Preferred | Unsuitable | 3-4 |
| 28 | Moorland | 120 | Unsuitable | Preferred | Alternative | Unsuitable | 6-10 |
| 29 | Barrington | 91 | Unsuitable | Unsuitable | Unsuitable | Preferred | 2-3 |
| 30 | Bundook | 79 | Unsuitable | Unsuitable | Unsuitable | Preferred | 1-3 |

# 6.0 IWCM Scenarios

## 6.1 Scenario Development

Following the short-listing of options, four alternate IWCM scenarios were developed by the project team.

Unserviced villages were not included in the scenarios, as these will be considered separately. The costs as outlined in Table 5-25 are quite high and therefore greater proportion of external funding is required to service these villages without undue impact to the MidCoast community. Therefore, this strategic issue will be addressed separately in conjunction with funding solutions.

Climate change is included in the scenarios where specifically aligned with the water security solutions. Other climate change responses, including specific asset solutions and progress towards Net Zero emissions, are consistent across the scenarios and therefore have been captured in the Everyday Scenario. Broader Council initiatives, such as a 5MW solar farm located at the Nabiac WTP, will be considered separately under Council's corporate climate change policy.

The 72 operational issues identified informed the development of the Everyday Scenario. The shortlisted options formed the alternate scenarios addressing the strategic issues. As the water security issue for Manning Supply Scheme is considered the most critical by Council, the development of scenarios was centred around the solution for this issue. An overview of the scenarios developed is illustrated in Figure 6-1.

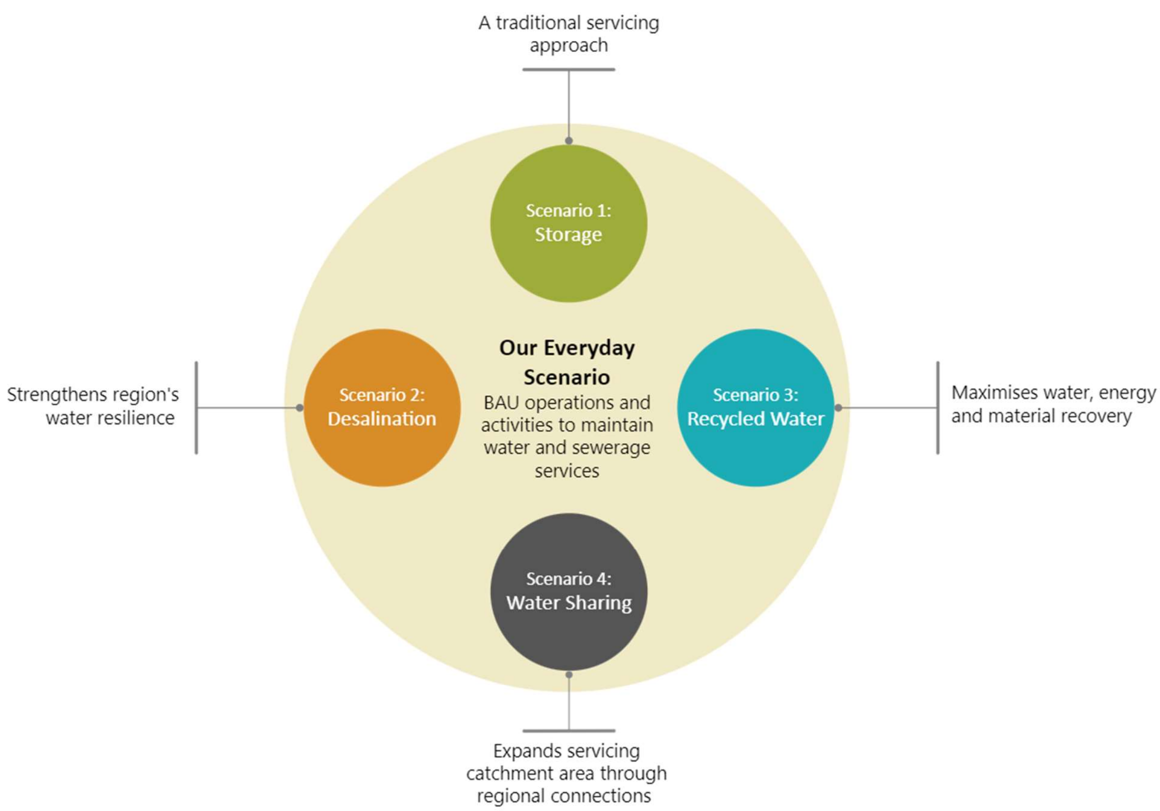


**Figure 6-1: Overview of developed scenarios**

### 6.1.1 Base Scenario – The Everyday Scenario

The Everyday Scenario represents all the business-as-usual programs and upgrade works that Council is committed to deliver to provide effectively functioning water and sewer services to the region. These

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programs and upgrades are required to address the 72 operational issues identified in the Issues Paper. The Everyday Scenario is included in the Long-Term Financial Plan presented in Appendix L and includes the following actions.

**Water efficiency and water education measures**

Council already has a relatively low average usage per person per day. This has been influenced by initiatives including the second step usage charge, previous Smart Water Rebate Program, uptake of more water efficient devices, the requirements for new developments under the Building Sustainability Index (BASIX), including uptake of rainwater tanks, and improvements in water behaviour. However, Council is targeting improvements in water efficiency, both at the customer level and to reduce leakage in the network.

One of the clear messages received from the youth was around increased personal responsibility for water efficiency and doing more at home to use less water. In line with this, a ‘permanent water conservation program’ will be established as part of Council’s water efficiency strategy. Key messaging will include:

- Don’t spray in the middle of the day
    - You won’t lose so much to evaporation and your plants will get more
    - Use sprinklers and irrigation before 9am and after 5pm
- If you can’t avoid watering in the middle of the day, use a handheld hose with trigger nozzle, a watering can or a bucket
- If you must use water on paving, windows and buildings; please use a bucket and mop or a high-pressure low volume cleaner
- Wash your vehicle on the lawn or other porous surface

Council will target reducing leaks in the network by the following, supported by the Regional Leakage Reduction Program:

- Installing smart water meters for large water users and customers with long poly-line connections where there is risk of leaks is high. This is a continuation of the residential smart meter rollout that was undertaken at Stroud Road
- Installation of bulk flow meters
- Pressure reduction, including identification of high-pressure zones and use of pressure reducing valves
- Active leakage control
- Non-revenue water reduction, including awareness training for staff
- Reducing losses at Council sites. This includes:
    - Installing smart meters at treatment plants
    - Installing smart meters at swimming pools

Council is committed to working with the MidCoast community to reduce water use via an ongoing water education and behaviour change program. This program has the following goals:

1. To foster a sense of pride and ownership in the MidCoast’s natural water sources
2. To reduce water use across the LGA
3. To increase understanding among stakeholders of Council’s water and sewer services
4. To establish an informed conversation about the need to consider climate-independent water supply options on the MidCoast

These goals will be achieved with the following objectives:

- To educate stakeholders about the source of their water

- To build stakeholder understanding of fundamental water-related terms and concepts
- To inspire stakeholder appreciation for the MidCoast's natural water sources
- To promote water-efficient behaviour
- To promote water-efficiency measures
- To educate stakeholders about emerging water-efficient technology
- To educate stakeholders about the connection between their properties and MidCoast Council's water and sewer networks
- To educate stakeholders about what their water and sewer accounts pay for and build confidence in MidCoast Council's ability to manage their water and sewer services
- To inform and educate stakeholders about MidCoast Council infrastructure projects
- To educate stakeholders about the need to protect the sewer system
- To educate stakeholders about climate-independent water sources
- To inform stakeholders of the increasing need to explore climate-independent water sources
- To address natural bias when considering recycled water supplies and the opportunities for potable reuse

This will be achieved through a range of actions, including:

- Council's roles of Water Education and Communication Officer and Water Resilience Officer
- Ongoing social media education program, including Facebook and Instagram
- Water source information on customer accounts and quarterly billing newsletter items
- Natural water source signage on public water assets
- Water-saving signage for hotels, motels and resorts
- Information on Council website
- Promote MidCoast as water-conscious area through Barrington Coast tourism
- E-newsletters to subscribers
- Educational videos
- Working with schools
- National Water Week events
- Downloadable online learning material
- Colouring-in competitions
- Displays and pop-up information at community events
- Community tours of treatment plants
- Student art competitions
- Schools Clean Up Day activities
- Fridge magnets
- Whizzy visits to early primary school groups, including giveaways with Whizzy visits
- Working with large water users and non-residential customers, including providing advice on how to be more efficient in different types of businesses
- Promote initiatives via internal media releases and staff newsletter

- Share water-saving tips on display screens in Council offices

Council is also targeting reducing the amount of water used at Council sites and operations, including:

- Using recycled water at treatment plants for potable substitution, where available
- Identifying efficiencies in water use, such as more efficient irrigation systems and irrigation programs and water mains flushing
- Disinfection of repaired and new water mains using ozone rather than chlorination.

Council has also been involved in initial workshopping of the NSW Department of Planning and Environment 'Valuation of costs and benefits of water conservation initiative project'. The NSW Government is setting aspirations for water conservation to form a large part of the response to water security issues in NSW (Frontier Economics, 2023). *"The role of water efficiency should have equal standing with additional supply side options when balancing supply and demand to ensure water is being used efficiently before imposing costs on the community for additional water infrastructure"* (NSW Department of Planning, Industry and Environment, 2021).

This program is focused on identifying focus on 'cost effective' and socially optimal water efficiency measures. Council will be involved in the evaluation of a range of conservation measures with different costs and benefits, focusing on three main areas:

- Demand management (grey infrastructure (efficient appliances), green infrastructure (open space), education programs, water restrictions and waterwise rules)
- Leakage management
- Rainwater tanks

Where it is identified that the measures are cost effective, Council would adopt those water efficiency measures. This may include the reintroduction of Council's Water Smart rebate program, including to promote the retrofit of rainwater tanks to existing properties. This program was originally introduced to the community in 2008 and allowed customers to claim points for water efficient appliances including rainwater tanks, which were then converted to cash rebates. The scheme was active between 2008 and 2016, and only a small portion of applications received from 2008 to 2016 claimed points for installation of rainwater tanks. Currently, rainwater tanks are incorporated in new developments through the BASIX model. The use of rainwater for gardening, flushing and laundry can significantly offset potable water use.

**Net Zero strategy**

Council will continue to transition to green energy generation to reach Net Zero greenhouse gas emissions by 2040. The delivery of safe and effective water and sewer services requires access to energy with these services responsible for much of Councils energy demand. There are different opportunities that Council will be investigating and/or pursuing to achieve Net Zero. Energy efficiency of assets will be reviewed and upgraded where possible.

This will be achieved through a range of projects:

- Council is planning for a 5 MW solar panel system at Nabiac WTP which would generate just over one third of the current yearly electricity requirements for water and sewer operations
- Council is investigating a permanent pilot project for solar powered hydrogen generation of up to 150 kW and fuel celled power supply. Dawson STP has been identified as potential site that could use this green power however this is still yet to be confirmed
- Onsite solar and batteries at some Council sites
- Review of pumping efficiencies across the water and sewer networks
- Sustainable procurement and project design, including carbon footprint as a criterion when comparing purchasing options

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- Fuel reduction and electrification of Council's passenger and light commercial vehicles, and expand to its heavy vehicle fleet as electric and other low-emission technologies become viable (in line with MidCoast Council's Climate Change Strategy Phase 1, 2021)
- Investing in local carbon sequestration, such as wetland restoration and tree planting
- Purchase of green energy

**Climate change resilience**

Climate change forecasts indicate risk of significant rise in sea level by 2100, with potential to impact water and sewer assets and operation. An increase in extreme climate events including floods is also forecast.

Actions Council will implement in response to climate change risks include:

- Assets that are likely to be affected by increases to flood levels will be raised. This includes raising pump station switchboards and electrical components out of flood / sea level rise levels
- Future asset planning will consider the rising sea level for current and future assets
- Water security solutions will include changes in climate
- Identifying critical sites for permanent generators

**Asset renewals and upgrades including WTPs and STPs**

A suite of asset renewals will be completed, including:

- Treatment plant assets, such as membranes, filtration systems and monitoring equipment to maintain quality drinking water and effluent quality
- Sewer rising and gravity main renewals, including CCTV programs
- Water main renewals
- Sewer and water pump renewals
- Sewer manhole renewals
- Sewer vacuum system renewals
- SCADA and electrical renewals

Water and sewage treatment plant upgrades include:

- The Nabiac WTP and borefield will be upgraded as a short-term solution before a long-term solution can be implemented for the Manning scheme
- Gloucester WTP will be upgraded with newer treatment technology
- The Hawks Nest, Gloucester, Harrington, Dawson and Old Bar STPs will be upgraded to meet growth and license requirements

**Catchment management initiatives**

Council's aim is to restore the riparian zone in the catchments upstream of drinking water offtakes to maintain healthy waterways and to reduce the treatment required to meet Australian Drinking Water Standards.

Council's Water and Natural Systems teams are responsible for a suite of catchment management initiatives. These include:

- Undertaking catchment management programs, which help maintain clean and healthy waterways and include riverbank restoration programs
- Working farmers to properly manage catchments and improve water quality, including keeping cattle out of rivers
- Water quality testing for rivers

- Prepare annual report cards which outline the ecological health of waterways
- Investigating new schemes such as plating in riparian zones and landscape rehydration.

Council is a part of the W-Lab (WSAA) Natural Solutions Technology Advisory Panel (TAP). This panel will investigate how might organisations integrate natural systems and solutions for adaptation in improved water management. This aims to identify and evaluate opportunities that integrate natural solutions to improve water management through technological innovation. The core focus areas include:

- Integrated water management
- Blue green infrastructure to handle run-off
- Tools to prioritise where to undertake blue green infrastructure

Based on the outcomes of the panel, Council will consider implementation of pilot projects for catchment management and integrated water cycle management.

**Inflow and Infiltration reduction**

Council has an inflow and infiltration reduction program, which includes two dedicated crews that undertake smoke testing, CCTV and inspections. Council aims to reduce the volume of inflow and infiltration by 35% over the five-year period of the program. This will be achieved by an ongoing dedicated suite of inflow and infiltration activities.

If the defect is within a Council asset, they will be rectified. If the defect is located on private property, Council will ask property owners to fix the issues that are their responsibility.

### 6.1.2 Scenario 1 – Dam

Scenario 1 adopts a traditional approach to water security. Increased storage is the primary water security solution adopted in this scenario for all water supply schemes. The Manning scheme will be serviced by Peg Leg Creek dam and off-stream storages will be constructed at Gloucester, Bulahdelah, and Stroud.

Water from the Manning River will be pumped to the Peg Leg Creek Dam and back to Bootawa WTP for treatment. The extra storage will sufficiently sustain the demands of the region under the 5/10/10 LOS rule. Floating solar and pumped hydropower will be explored to partially offset the power used by Bootawa WTP, assisting with Council's Net Zero targets.

For Bulahdelah, Gloucester and Stroud, off-stream storage dams would be constructed, at locations to be confirmed during options and concept phase.

This scenario does not increase use of recycled water, however recycled water will continue to be supplied to existing customers.

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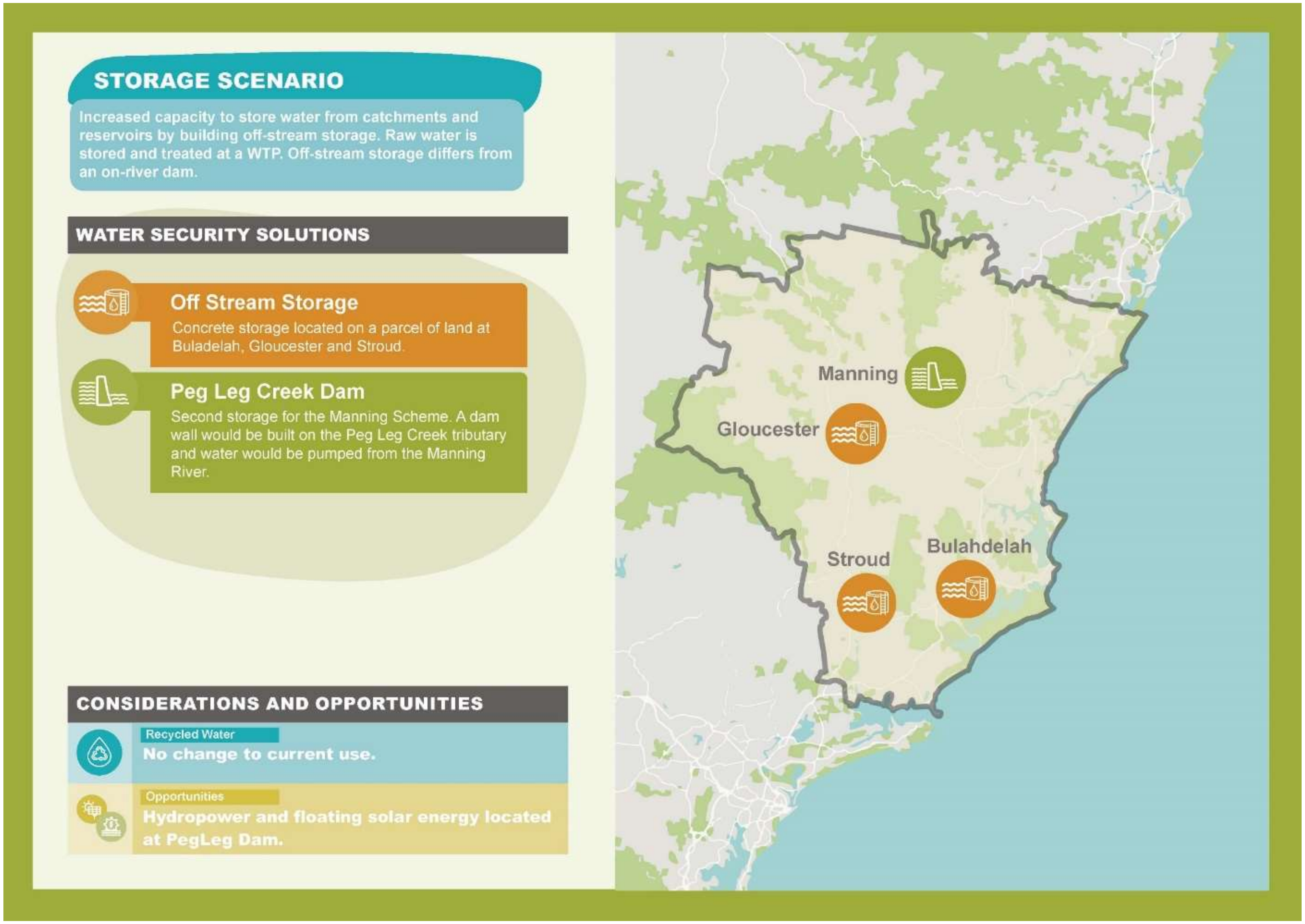


**Figure 6-2: 'Scenario 1 – Dam' plan on a page**

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### 6.1.3 Scenario 2 – Desalination

Scenario 2 was developed to increase water resilience of the region.

The Manning scheme will include the construction of a desalination plant, located at Hallidays Point, maximising water security of the region. The plant will be supplementary to the existing Manning Water Supply Scheme with extraction from Nabiac aquifer and Manning River and storage at Bootawa Dam. The 30ML/day desalination plant will operate at low levels during normal periods for the purposes of maintaining assets and functionality of equipment. Production will be ramped up during periods of water scarcity. Solar panels will be installed at the site to offset some of the energy cost of the plant and further considerations will be made for green energy supply in line with meeting Net Zero targets.

Off-stream storages will be constructed in Gloucester, Bulahdelah and Stroud, like Scenario 1. In addition, potential groundwater sources will also be investigated for Gloucester, Stroud and Bulahdelah. Due to the long planning and approvals pathway associated with groundwater, off-stream storages will need to be constructed to secure water for the catchments in the short-term. These groundwater investigations are to determine the feasibility of diversifying these water supplies with groundwater in the long term (beyond 30-years).

Additional use of recycled water is included in this scenario with a target to maintain current levels of reuse with growth. This will include supplying recycled water to the Taree Recreation Grounds. Effluent will be sourced from the Taree (Dawson) STP and conveyed to the sporting fields. A packaged RTP located adjacent on the Taree Recreation Grounds will treat the effluent to levels suitable for unrestricted use before the fields are irrigated.

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Figure 6-3: 'Scenario 2 – Desalination' plan on a page

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### 6.1.4 Scenario 3 – Recycled Water

Scenario 3 adopts a regenerative approach by maximising water recovery for the Manning Supply Scheme.

This scenario has the long-term solution of the addition of purified recycled water to provide climate independent supply to supplement supply from Peg Leg Creek Dam, which would be delivered in the short-term. Development of the legislative and regulatory framework for purified recycled water is still in its infancy in Australia, and this will need time to mature before implementation. It will also need to be supported by continued community education and engagement.

Purified recycled water will be a key component of the Manning scheme. Effluent from Forster STP will be transferred to the Tuncurry RTP and treated alongside the Hallidays Point STP with advanced water treatment. This purified recycled water will then be utilised to recharge the Nabiac Inland Dune Aquifer. The aquifer will both store and further treat the injected purified recycled water. The extracted water will be treated at the existing Nabiac WTP before it is distributed into the network. Water quality will be a critical factor in this process for a successful managed aquifer recharge scheme. Over time, as the use of purified recycled water becomes standard practice, there may be an opportunity to bypass the aquifer and return the purified recycled water to the system directly upstream of the Nabiac WTP.

The Manning supply region includes numerous sewerage schemes, and due to distance and flow volume it is not economically viable to transfer effluent to Tuncurry RTP from many of these STPs. The volume of water recovered from the process, accounting for losses in the purified recycled water treatment and aquifer recovery, yields approximately 5.3 ML/d at 2050, which is an estimated 17 percent of the 2050 average daily demand. Therefore, purified recycled water alone will not resolve Manning's water supply requirements. However, combined with an additional off-stream storage at Peg Leg Creek dam, it will significantly increase the water security for the region beyond the dam alone.

Council's Net Zero targets will be progressed by installing solar panels at Tuncurry RTP and Nabiac WTP to offset some of the energy requirements. Floating solar at Peg Leg Creek dam and pumped hydropower from the dam will be considered, to partially offset the power used by Bootawa WTP.

For Gloucester, Bulahdelah and Stroud, purified recycled water were not shortlisted as feasible solutions. Off-stream storages will be constructed in these as per the previous scenarios. Groundwater investigations will be completed to identify potential sources for long term future supply diversification in the three schemes.

Similar to Scenario 2, this scenario includes an increase in recycled water use. In addition to Taree Recreation Grounds, reuse will increase in the town of Gloucester. The existing recycled water scheme will be extended to new users for agricultural irrigation. Upgrades to Gloucester STP will provide additional opportunities to irrigate open spaces for community, thereby allowing Council to increase liveability targets. The recycled water scheme for open space irrigation includes the following sites: Gloucester District Park Cricket Ovals, Billabong Park, Gloucester Showgrounds and Minimbah Native Gardens.

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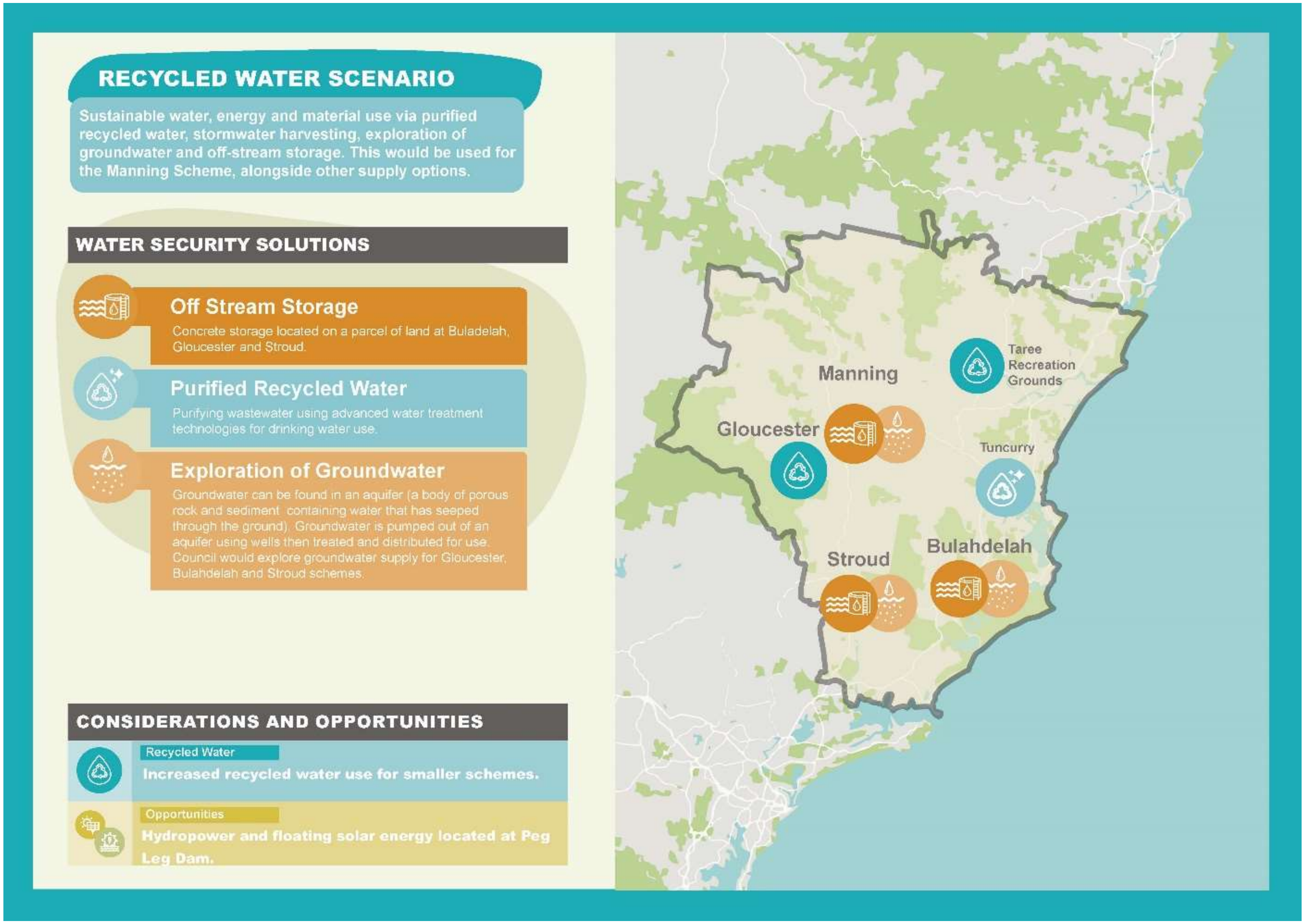


**Figure 6-4: 'Scenario 3 – Recycled Water' plan on a page**

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### 6.1.5 Scenario 4 – Water Sharing

Scenario 4 involves the expansion of the Manning Water Supply Scheme servicing area.

Peg Leg Creek Dam will be constructed for the Manning Supply Scheme to meet water security requirements with inclusion of Gloucester and Bulahdelah demand requirements. Gloucester will be connected to the Manning scheme via Krambach and Bulahdelah will be connected via Nabiac. The township of Stroud will be considered for a regional connection with Hunter Water via Dungog. As a result of the connections, Gloucester, Bulahdelah and Stroud WTPs would no longer be in use and will be decommissioned.

Opportunities to service other smaller unserviced villages between the connection regions can also be explored.

As a result of long pipelines over hilly terrains, options can be explored for pumped hydropower including along transfer pipeline from Peg Leg Creek Dam.

Scenario 4 also includes the initiation of discussions with neighbouring water utilities (Hunter Water and Port Macquarie Hastings Council) around water security and potential climate-independent / desalination water sharing opportunities.

This scenario proposes the largest increase in recycled water use amongst the developed scenarios, enhancing liveability for the community. In addition to the recycled water opportunities discussed in Scenario 3 for Taree Recreation Grounds and Gloucester, recycled water under this scenario will include expansion to Forster and Old Bar. Forster STP and Old Bar STP will need to be upgraded with additional treatment for unrestricted recycled water quality suitable for open space irrigation. Sites considered for irrigation in Forster include: Forster Tuncurry Golf Club, Great Lakes College Forster Campus, Boronia Park, Forster Bowling Club, Forster Sports Complex, Forster Public School and Forster Cemetery. In Old Bar, recycled water will be provided to the EG Trad Playing fields.

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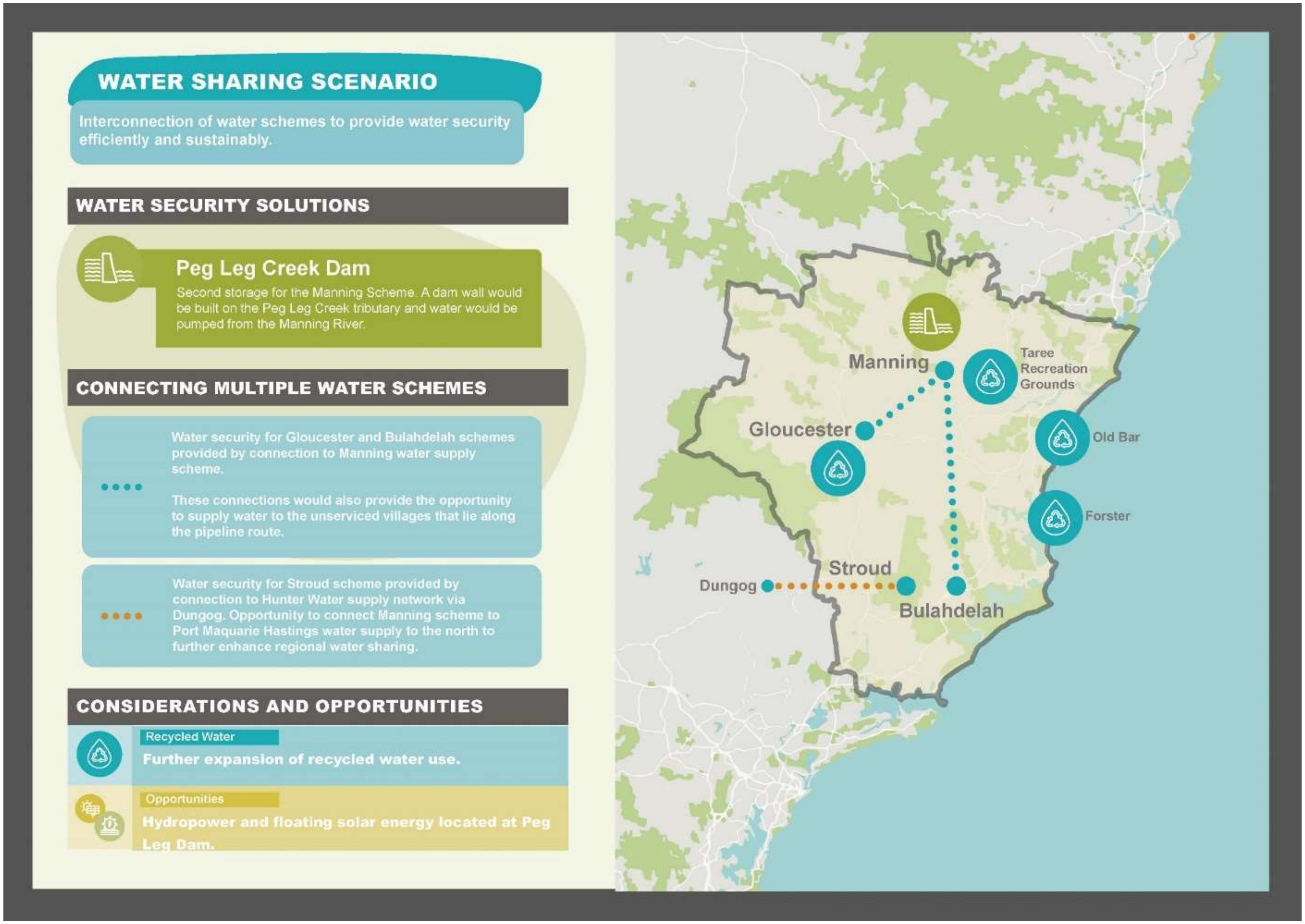


**Figure 6-5: 'Scenario 4 – Water Sharing' plan on a page**

## 6.2 Scenario Yield Modelling

The secure yield assessment undertaken focussed on 'Scenario 1 – Dam' (Section 6.1.2). The water yield assessment report in Appendix I provides details of the supply deficits used as inputs for the other scenarios. Table 6-1 provides a list of the water supply augmentation scenarios evaluated by the water yield assessment.

**Table 6-1: Water Yield Assessment Scenarios**

| Town | Scenario ID | Demand Configuration |
|---|---|---|
| Manning | M1 – New Storage via Peg Leg Creek Dam (Scenario 1) | • 2051 Demands<br>+ 1 ML/d truck fill allowance |
| | M3 – New Storage via Peg Leg Creek Dam plus regional connection to Gloucester and Bulahdelah (Scenario 4) | • Combined 2051 Demands:<br>- Local Scheme<br>- Bulahdelah<br>- Gloucester<br>+ 1 ML/d truck fill allowance |
| | PRWM1 – New Storage via Peg Leg Creek Dam plus Purified Recycled Water (Scenario 3) | • 2051 Demands<br>+ 1 ML/d truck fill allowance<br>• Purified Recycled Water (PRW) recovery |
| | PRWM3 – New Storage via Peg Leg Creek Dam plus Purified Recycled Water plus regional connection to Gloucester and Bulahdelah (Scenario 3 + 4) | • Combined 2051 Demands:<br>- Local Scheme<br>- Bulahdelah<br>- Gloucester<br>+ 1 ML/d truck fill allowance<br>• PRW recovery |
| Gloucester | G1 – New Storage (Scenario 1) | • 2051 Demands |
| Bulahdelah | B1 – New Storage (Scenario 1) | • 2051 Demands |
| Stroud | S1 – New Storage (Scenario 1) | • 2051 Demands |

A summary of the secure yield assessment is provided in Table 6-2.

**Table 6-2: Secure Yield Assessment Results for Storage Options**

| Town | Scenario ID | Streamflow Sequence* | Storage | Secure Yield (ML/y) | Restrictions | | | Critical Deficit Period |
|---|---|---|---|---|---|---|---|---|
| | | | | | Applied at storage (% full) | Duration (%) | % of years | |
| Manning | M1 | HC | Bootawa Dam: 2,275 ML<br>Peg Leg Dam: 5,430 ML | 12,571 | 70 | 1.1 | 10.5 | 19/04/2019<br>28/03/2020 |
| | | CC | Bootawa Dam: 2,275 ML<br>Peg Leg Dam: 4,660 ML | 17,853 | 65 | 0.8 | 9.0 | 20/10/2019<br>11/04/2020 |
| | M3 | HC | Bootawa Dam: 2,275 ML<br>Peg Leg Dam: 5,430 ML | 13,258 | 68 | 1.2 | 9.8 | 30/12/2019<br>04/04/2020 |
| | | CC | Bootawa Dam: 2,275 ML<br>Peg Leg Dam: 5,045 ML | 18,302 | 65 | 0.9 | 9.8 | 20/10/2019<br>18/04/2019 |
| | PRW M1 | HC | Bootawa Dam: 2,275 ML<br>Peg Leg Dam: 4,660 ML | 12,571 | 67 | 1.1 | 9.8 | 20/07/2019<br>23/03/2020 |
| | | CC | Bootawa Dam: 2,275 ML<br>Peg Leg Dam: 3,542 ML | 12,571 | 68 | 0.9 | 9.8 | 19/10/2019<br>09/03/2020 |

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| Town | Scenario ID | Streamflow Sequence* | Storage | Secure Yield (ML/y) | Restrictions | | | Critical Deficit Period |
|---|---|---|---|---|---|---|---|---|
| | | | | | Applied at storage (% full) | Duration (%) | % of years | |
| | PRW M3 | HC | Bootawa Dam: 2,275 ML<br>Peg Leg Dam: 3,398 ML | 13,258 | 67 | 0.8 | 9.8 | 20/07/2019<br>14/03/2020 |
| | | CC | Bootawa Dam: 2,275 ML<br>Peg Leg Dam: 3,542 ML | 17,111 | 65 | 0.9 | 9.8 | 20/10/2019<br>02/032020 |
| Gloucester | G1 | HC | New Storage 180 ML | 479 | 65 | 3.0 | 9.0 | 10/11/2019<br>06/10/2020 |
| | | CC | New Storage 260 ML | 463 | 65 | 6.4** | 9.8 | 01/12/2019<br>15/11/2022 |
| Bulahdelah | B1 | HC | Crawford Weir: 228 ML<br>New Storage: 360 ML | 329 | 65 | 1.9 | 9.8 | 09/08/1964<br>09/12/1965 |
| | | CC | Crawford Weir: 228 ML<br>New Storage: 390 ML | 321 | 65 | 2.0 | 10.5 | 09/08/1964<br>05/05/1966 |
| Stroud | S1 | HC | Existing storage: 50 ML<br>New Storage: 190 ML | 237 | 65 | 3.6 | 9.7 | 03/09/1964<br>10/05/1966 |
| | | CC | Existing storage: 50 ML<br>New Storage: 400 ML | 267 | 65 | 3.2 | 9.0 | 23/11/1900<br>05/12/1903 |

*HC = historic climate conditions, CC = climate change conditions

** The 5/10/10 secure yield rule cannot be satisfied for a restriction volume of 65% under climate change conditions regardless of the maximum storage size. This is associated with the 3,000 ML/d maximum offtake flow threshold assumption for turbidity in the GoldSim WBM. In the GoldSim WBM, the modelled wet periods under climate change conditions have larger peak discharges compared to the same periods under historical climate conditions. This means that there are longer periods under climate change conditions where the modelled streamflow in the Barrington River is greater than the maximum turbidity flow threshold assumption during the wet season compared to historical climate conditions.

## 6.3 Quadruple Bottom Line Assessment

The quadruple bottom line (QBL) assessment was undertaken by the core project team for each of the four scenarios developed. Both cost and non-cost criteria were included in the assessment. Based on the feedback received from the community in the Our Water Our Future Workshop 1, the themes of environment and economic were weighted higher than social and governance. Results from the assessment are presented in Figure 6-6. The complete assessment is available in Appendix H.

The QBL assessment narrowly identified Scenario 2 as the best performing option against the defined criteria with a score of 3.04, indicating a small overall positive impact relative to the reference case (Scenario 1) with score of 3.00. Scenario 3 and Scenario 4 produced overall scores of 2.64 and 2.54 respectively.

The QBL assessment indicated that Scenario 1 and Scenario 2 very have similar, albeit different impacts and benefits. Scenario 2 had a particularly strong positive emphasis on the social criteria, while Scenario 1 scored highest for the environment and economic criteria.

Whilst the QBL scores for Scenario 1 and Scenario 2 are essentially the same, the net present cost of Scenario 1 (approximately $160M) is significantly lower than that for Scenario 2 (approximately $214M).

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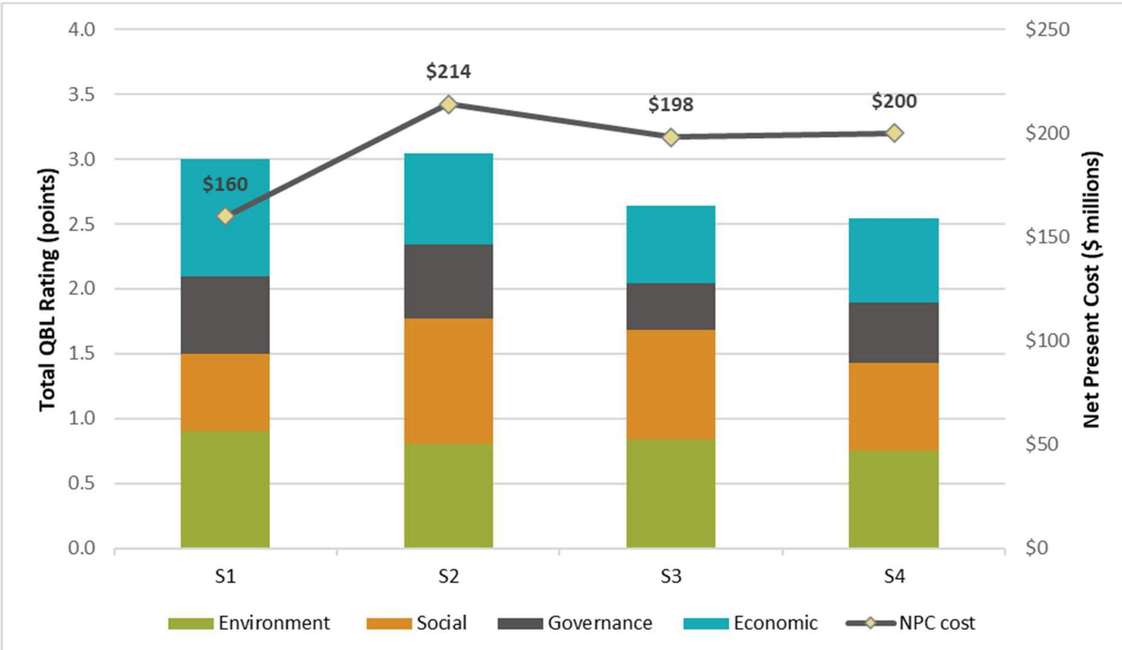


**Figure 6-6: QBL assessment results**

Note that while the QBL assessment considers a broad range of project priorities and impacts, it was limited to criteria which could be readily captured, measured and compared. It may consequently exclude factors which are important to determining the overall success of a project. The intention and scope of the QBL assessment is therefore limited to identifying the best performing scenario using only these measurable criteria and available evidence. For this reason, the QBL assessment results will be considered alongside other information sources and recommendations to determine the preferred scenario for Council's IWCM Strategy.

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# 7.0 Community Engagement

Public consultation is a key component for the development of the IWCM strategy. The community has been involved throughout the process since its commencement. Section 3.2.2 provides an overview of the engagement completed to date. The sections below highlight the outcomes of the engagement undertaken as part of the scenario assessment to better understand the needs of the community.

The complete community engagement report will be provided upon completion.

## 7.1 Our Water Our Future 2

The Our Water Our Future Workshop 2 was held on 28 February 2023. The objectives of the workshop were to:

- Present the four scenarios that were developed including the key opportunities and challenges
- Receive feedback on each of the scenarios to better understand the community's values, concerns and priorities
- Utilise the feedback received to select a preferred scenario for the IWCM strategy.

The winner teams from the Youth Hackathon also presented at the workshop. A key message from the youth demographic was regarding the personal responsibility of individual members of the community for water efficiency in their daily lives. This message clearly highlighted the importance of educating the community on water conservation and implementing conservation measures where they are economically effective.

The preference for scenarios as voted by the participants of the workshop is shown in Figure 7-1. Overall, the feedback from the workshop did not indicate a strong preference for a preferred scenario. Feedback on the scenarios was largely centred on cost, for both the rate payer and return on investment. Consideration for recycled water opportunities under Scenario 1 was recommended. Concerns were raised for energy requirements and operating and maintenance costs for desalination plant for Scenario 2. Scenario 3 discussions around purified recycled water indicated readiness for acceptance of this solution but raised concern for public perception and lack of regulatory framework. For Scenario 4, It was suggested that the scenarios be reassessed to consider centralised and decentralised options for the region.

Full details on the workshop and outcomes can be found in Appendix K.


**Figure 7-1: Our Water Our Future 2 ranking of scenarios**

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## 7.2 Community Consultation

Following the feedback received from the workshop, consultation was undertaken with the wider community. The sections below discuss the key outcomes of the consultation.

### 7.2.1 Have Your Say Engagement

As no single scenario was strongly preferred in the community workshop, it highlighted the need to understand the community's views on the major components of the scenarios. The following questions were based on the Workshop 2 feedback and posted on the 'Have Your Say' page for voting by public.

In addition to the online engagement, Council hosted community pop-up kiosks at eight local events across the region. The information presented on the 'Have Your Say' page was made available and members of the public were given the opportunity to ask questions and discuss their concerns with the options presented.

The Have Your Say engagement began on 17 March 2023 and closed on 16 April 2023.

- **Water security for Manning Scheme:** The community were asked to indicate preference for either a new off-stream storage dam or a new desalination plant
- **Water security for Gloucester and Bulahdelah:** The community were asked to indicate preference for either a new off-stream storage dams or to connect Gloucester and Bulahdelah to the Manning scheme
- **Recycled water increases:** The community were asked to indicate preference regarding level of recycled water, including no increase in current recycling (currently approximately 25%), increase to 30% of annual wastewater recycled or increase to 40% of annual wastewater recycled
- **Purified recycled water:** The community were asked to indicate whether they would consider drinking purified recycled water
- **Water bill impact:** The community were asked to indicate what they felt was an acceptable increase to their water bill, based on their selection to the above questions

Results from the survey are presented in Figure 7-2.

The community indicated a strong preference for dams both for the Manning scheme and the smaller schemes. Desalination for the Manning scheme received only 30 percent of the votes compared to the off-stream storage dam, while interconnection of Bulahdelah and Gloucester with the Manning Scheme received only 25% of votes compared to local storages.

The community also indicated a considerable desire to see an increase in recycled water use in the community. The public perception around the use of purified recycled water for drinking was also noteworthy, with a 60 percent of responses indicating they would consider drinking purified recycled water.

Around 60 percent of voters indicated a willingness to pay more for their water and sewer services. Of this 60 percent, 32 percent were willing to pay more than $100 for their annual bill.

The response from the Council's Values Survey, launched in October 2022, indicated around half of the voters considered environmental impacts as the key consideration for decision-making.

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**Figure 7-2: Results of 'Have Your Say' engagement**

## 7.3 Public Exhibition

The final draft IWCM Strategy Report will be placed on public exhibition for a period of five weeks (25 working days), to provide the MidCoast community with the opportunity to provide comments to the draft final strategy.

This section will be updated with the outcomes of this engagement once available.

# 8.0 IWCM Strategy

## 8.1 QBL Re-evaluation

The results from the community engagement showed a clear preference for a dam solution at Manning along with a considerable increase in the level of water recycling. Based on the outcomes of the community engagement and DPE feedback, the QBL assessment was revised to include three additional scenarios. The following scenarios were assessed:

- Dam – same as Scenario 1 from the original QBL assessment
- Dam + recycling (Scenario 1A) – based on Scenario 1, but with the addition of recycling scheme at Taree Recreation Grounds
- Desalination (Scenario 2A) – based on Scenario 2, but excludes the recycling scheme at Taree Recreation Grounds
- Desalination + recycling – same as Scenario 2 from the original QBL assessment
- Smaller desalination + recycling (Scenario 2B) – based on Scenario 2, but with desalination plant size reduced to 12 ML/day continuous operation to meet 5/10/10 LOS rule.

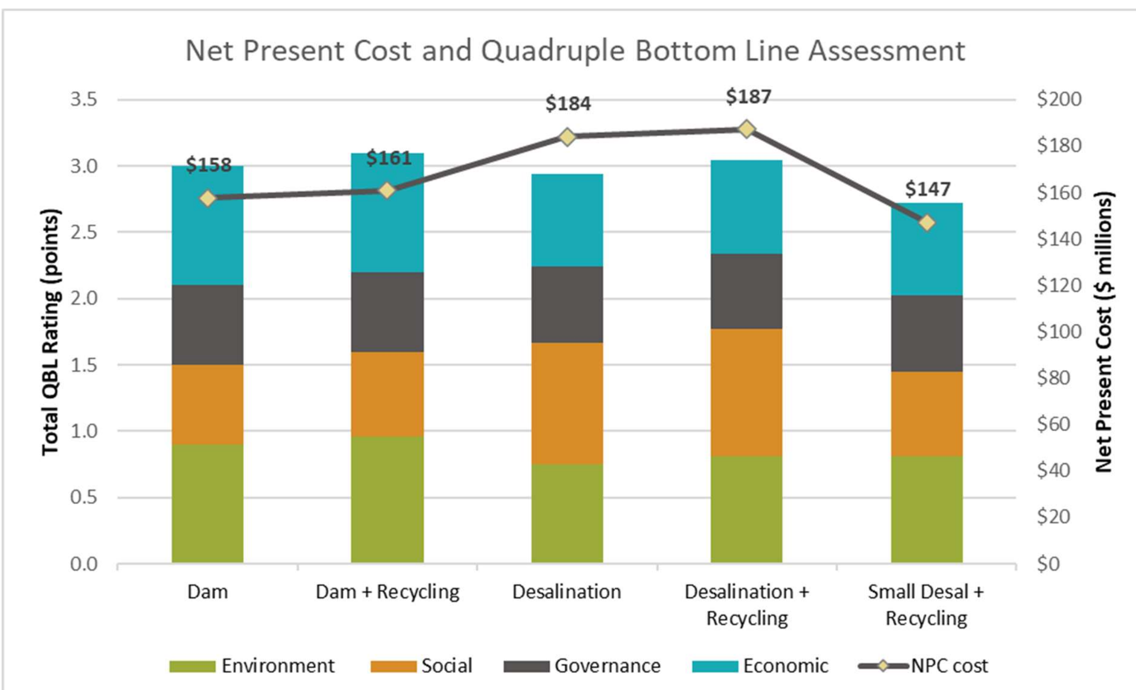


**Figure 8-1: QBL re-evaluation of scenarios**

The results of the assessment are show in Figure 8-1 and summarised below:

- The assessment identified 'Dam + recycling' was the best performing option against the defined QBL criteria with a score of 3.10. This scenario ranked particularly highly for economic criteria based on the dam having significantly lower operating costs compared to the desalination plant scenarios.
- The second highest scoring scenario was 'Desalination + recycling' with an overall score 3.04, however this option had the highest overall cost.  This scenario ranked particularly highly for

social criteria due to the water security solution being fully climate independent, with the larger desalination plant capable of providing full (restricted) supply for Manning if needed.

- The Dam only scenario was the third ranked scenario, with an overall score of 3.00. This scenario scored lower than the 'Dam + recycling' scenario due to the lower social and environmental scores associated with not including recycling, noting that this also reduced the overall cost.
- The Desalination only scenario was the fourth ranked scenario an overall score of 2.94. This scenario scored lower than the 'Desalination + recycling' scenario due to the lower social and environmental scores associated with not including recycling, noting this also reduced the overall cost.
- The 'Small Desalination + Recycling' scenario had the lowest score overall due to environmental impacts and costs associated with continuous operation, however this scenario did have the lowest overall cost due to lower capital cost for the smaller desalination plant.

## 8.2 Preferred IWCM Strategy

The preferred IWCM strategy was refined based on the feedback received through all modes of community engagement and the results of the re-evaluated QBL assessment. The outcome of the re-evaluated QBL for the 'Dam + recycling' and 'Desalination + recycling' scenario were very close, and therefore Council has two strong, feasible options to provide water security for the Manning Water Supply Scheme.

Council identified Peg Leg Creek Dam as the preferred water security solution for the Manning water scheme, due to:

- Lower operating costs, due to low complexity and low additional energy requirements. This is an important consideration given 35 percent of the demographic are categorised in the low household income bracket, compared to the regional NSW average of 26 percent in 2021 (.id, 2023)
- Maximising use of existing assets, including Bootawa Water Treatment Plant
- Provides resilience and redundancy for Bootawa Dam and the wider Manning scheme with a much larger storage, as Bootawa Dam currently has a limited storage capacity

The dam solution was also ranked as most preferred by the community compared to the desalination plant.

While the dam is preferred, there are still several unknowns around dam feasibility. The area is within a known koala habitat and may also contain Aboriginal heritage sites. Achieving the appropriate environmental approvals is therefore critical to the successful delivery of Peg Leg Creek Dam. If these approvals are not forthcoming, the IWCM Strategy will need to consider the alternative strategy of a desalination plant to provide water security for the Manning scheme.

The preferred strategy is described in Table 8-1 and presented in Figure 8-2. Timings noted for delivery of solutions was established based on Council's resourcing capabilities and criticality of strategic issue. As a priority, planning and environmental approvals are the critical tasks identified for Peg Leg Creek dam and off-stream storages. Completion of Environmental Impact Statements for each site will help establish the critical pathway for delivery.

**Table 8-1: Preferred strategy for strategic issues**

| Approach | Description |
|---|---|
| **Our Everyday Scenario** | Continued delivery of water and sewer services. This includes a focus on water conservation and demand management initiatives. |
| **Water Security** | |
| **Manning Scheme**<br>Short-term<br>Peg Leg Creek Dam | Peg Leg Creek Dam is the preferred water security strategy for the Manning Scheme. It will be a short-term solution with planning, design and construction of the dam proposed to be completed by FY 2031-32, with planning commencing in FY 2023-24. |

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| Approach | Description |
|---|---|
| Long-term<br>Purified Recycled Water + Dam | Filling of the dam will then take further time depending on weather and river flow conditions.<br><br>The long-term solution includes the potential addition of purified recycled water to provide climate independent supply to supplement supply from Peg Leg Creek Dam, if or when required.  Development of the legislative and regulatory framework for purified recycled water is still in its infancy in Australia, and this will need time to mature before implementation. It will also need to be supported by continued community education and engagement. |
| **Gloucester Scheme**<br>Off-stream storage | Off-stream storage is the preferred strategy for securing Gloucester's water supply. The storage will be located either across the river from the WTP or east of Thunderbolts Way. Planning will commence in FY 2023-24, with construction proposed to complete by FY 2032-33. |
| **Bulahdelah Scheme**<br>Off-stream storage | Off-stream storage is the preferred strategy for securing Bulahdelah's water supply. Further investigations need to be completed to determine a suitable site for the storage. Planning will commence in FY 2023-24, with construction proposed to complete by FY 2033-34. |
| **Stroud Scheme**<br>Off-stream storage | Off-stream storage is the preferred strategy for securing Stroud's water supply. The storage will be located at the WTP adjacent to the existing storage dams. Planning will commence after completion of planning for the Manning, Gloucester and Bulahdelah water security solutions. Construction is proposed to be completed by FY 2047-48. |
| **Gloucester, Bulahdelah and Stroud Schemes**<br>Groundwater Investigations | Investigation into potential groundwater sources will be undertaken in the short-term. Due to the longer delivery timeframe for off-stream storages, there is flexibility in the program schedule to account for new groundwater sources if identified. |
| For discussions<br>Water Sharing with neighbouring water utilities | Council will engage with Hunter Water and Port Macquarie Hastings Council around water security and potential climate-independent / desalination water sharing opportunities.<br>With all considering options for long-term water security, there is an opportunity to consider solutions with shared benefits to achieve optimum outcomes for all communities |
| **Sustainable Effluent Management** | |
| Increase water recycling | The preferred approach for sustainable effluent management across the MidCoast region is to increase the level of water recycling for public open space irrigation to improve community amenity and liveability, as well as increasing agricultural reuse where appropriate.<br>Further investigation is required to identify and prioritise specific recycled water opportunities to meet these objectives. |
| **Climate Change** | |
| Progress towards Net Zero | Opportunities for solar and hydropower will be explored and investigated further to help achieve Net Zero targets by 2040. |
| **Unserviced Villages** | |
| No medium-term change to unserviced villages | Seek and review funding mechanisms to support delivery of sewerage services to high-risk villages. Coomba Park has been identified as the highest priority. The planning timeframe for servicing would be beyond 20 years.<br>Council's process for prioritising unserviced villages focuses on the public health and environmental risk associated with on-site wastewater systems.  There is no current driver to provide water services, although where wastewater is provided, this would be an opportunity to consider water servicing also. |

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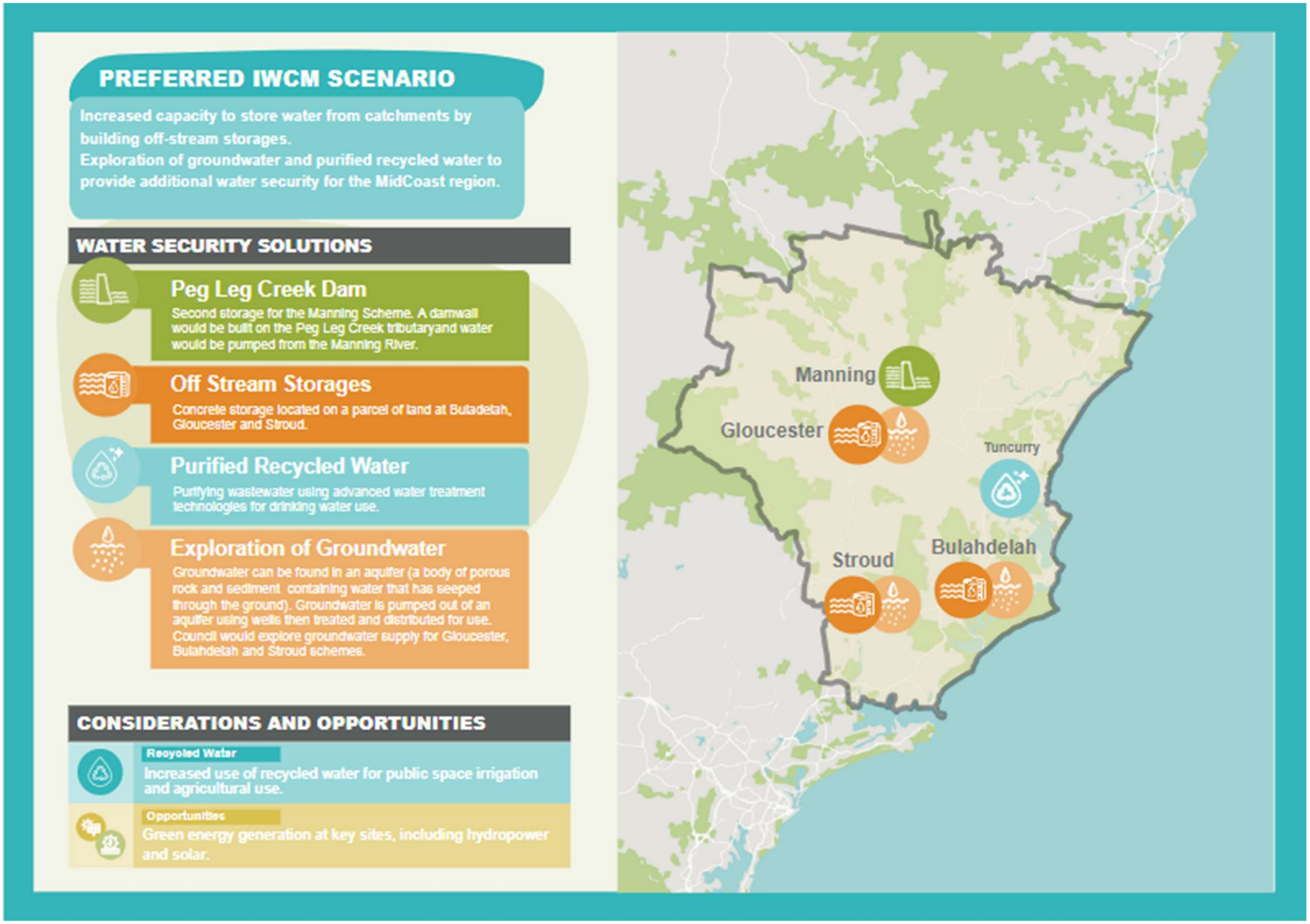


**Figure 8-2: Preferred scenario plan on a page**

## 8.3 Financial Modelling

The preferred strategy for water and sewer has been financially modelled considering capital, operating, and funding for the new assets. This includes all capital and operating expenditure under the Everyday Scenario. The full financial report is available in Appendix J and includes further detail on all assumptions and inputs into FINMOD, along with the sensitivity analysis completed on the inputs and influence on the price path. This sensitivity analysis informed the identification of the preferred price path for water and sewer.

The financial modelling has been completed to achieve sustainable financial performance indicators over the long term:

- Net operating result for the year before grants and contributions provided for capital purposes
- Net operating result for the year
- Operating performance ratio
- Debt equity ratio

The future water developer charge figure of $9,570 was calculated by totalling the growth component of planned water capital works over the 30 years and dividing by the total number of new assessments over the 30 years. However, $9,570 is an estimate only and any new water developer charges would be calculated as part of a revised Development Servicing Plan (DSP). Revision and update of the water servicing strategies has recently been initiated which will feed into a revised DSP. The sewer developer charge has been kept constant with the current amount.

Council has assumed that no dividends will be paid from the water and sewer funds within the life of the strategy.

### 8.3.1 Water Price Path

This is Council's financial position for the water business for the preferred water scenario. This includes:

- Spending for the Everyday Scenario
- Peg Leg Creek Dam for the Manning scheme with 66% government funding
- Off-stream storages for Gloucester, Stroud and Bulahdelah with 25% government funding
- Delivery of an $80 million purified recycled water scheme in years 2050/51 to 2051/52
- Operational cost increases of up to $500,000 per year after 2026/27. These increases in operational spending may be required due to the need for additional resources, increased chemical or energy costs, etc.

This price path has increases of 3% above inflation to the water fees and charges in the short term for seven consecutive years (years 2024/25 to 2030/31 as shown in Table 8-2). It should be noted that these increases can be partially offset by decreases in the sewer fees and charges (refer to Section 8.3.3 Sewer price path and Table 13 - Comparison of TRB in Appendix J). The price path holds water TRB steady for four consecutive years to remove inflation, from 2037-38.

This demonstrates that an increase to the water developer charges is required in the short term (once the Developer Servicing Plan for the Manning Supply Scheme is adopted) but that it will not need to be increased in line with inflation beyond 2038/39, based on current capital works estimates for growth projects over the 30 years. This is shown in Table 8-3. Servicing Strategies and Developer Servicing Plan reviews to be undertaken to confirm developer charges.

The preferred IWCM strategy includes the long-term potential addition of purified recycled water to provide a climate-independent supply to supplement supply from the dam. The preferred water price path can sustain this additional option at the latter end of the 30-years planning horizon.

FINMOD outputs for the preferred water price path are presented in Figure 8-3 and Appendix J.

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**Table 8-2: TRB price path - water**

| Year | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **TRB ($22/23)** | 795.5 | 795.50 | 819.37 | 843.95 | 869.26 | 895.34 | 922.20 | 949.87 | 978.36 | 978.36 | 978.36 | 978.36 | 978.36 | 978.36 | 978.36 |
| **Increase (%)** | - | - | 3.0% | 3.0% | 3.0% | 3.0% | 3.0% | 3.0% | 3.0% | - | - | - | - | - | - |
| **2038** | **2039** | **2040** | **2041** | **2042** | **2043** | **2044** | **2045** | **2046** | **2047** | **2048** | **2049** | **2050** | **2051** | **2052** | **2053** |
| **949.01** | 920.54 | 892.93 | 866.14 | 866.14 | 866.14 | 866.14 | 866.14 | 866.14 | 866.14 | 866.14 | 866.14 | 866.14 | 866.14 | 866.14 | 866.14 |
| **-3.0%** | -3.0% | -3.0% | -3.0% | - | - | - | - | - | - | - | - | - | - | - | - |

**Table 8-3: Water developer charges**

| Year | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Charge ($ 22/23)** | 6,645 | 6,977 | 9,570 | 9,570 | 9,570 | 9,570 | 9,570 | 9,570 | 9,570 | 9,570 | 9,570 | 9,570 | 9,570 | 9,570 | 9,570 |
| **Decrease (%)** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **2038** | **2039** | **2040** | **2041** | **2042** | **2043** | **2044** | **2045** | **2046** | **2047** | **2048** | **2049** | **2050** | **2051** | **2052** | **2053** |
| 9,570 | 9,283 | 9,004 | 8,734 | 8,472 | 8,218 | 7,972 | 7,732 | 7,500 | 7,275 | 7,057 | 6,845 | 6,640 | 6,441 | 6,248 | 6,060 |
| - | -3.0% | -3.0% | -3.0% | -3.0% | -3.0% | -3.0% | -3.0% | -3.0% | -3.0% | -3.0% | -3.0% | -3.0% | -3.0% | -3.0% | -3.0% |

| 31 Final preferred no. 2 31 | 22/23 | 23/24 | 24/25 | 25/26 | 26/27 | 27/28 | 28/29 | 29/30 | 30/31 | 31/32 | 32/33 | 33/34 | 34/35 | 35/36 | 36/37 | 37/38 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cash and Investments ($'000) | 18876 | 1990 | 1977 | 2100 | 2019 | 2182 | 2205 | 2255 | 2086 | 2096 | 2315 | 2006 | 9981 | 22008 | 34233 | 44124 |
| New Works less Cap. Works Grants ($'000) | 13904 | 17783 | 2401 | 11250 | 11919 | 10912 | 23330 | 20029 | 19682 | 26830 | 15301 | 9677 | 4535 | 1285 | 1685 | 3725 |
| Internal Funding for New Works ($'000) | 13904 | 16500 | 2401 | 5000 | 8700 | 7900 | 9400 | 12000 | 12800 | 10000 | 6000 | 6000 | 4535 | 1285 | 1685 | 3725 |
| Renewals ($'000) | 11101 | 7821 | 7907 | 6799 | 5881 | 8279 | 7546 | 6246 | 7074 | 7462 | 11195 | 11679 | 6629 | 6529 | 6529 | 6579 |
| Internal Funding for Renewals ($'000) | 11101 | 7821 | 7907 | 6799 | 5881 | 8279 | 7546 | 6246 | 7074 | 7462 | 11195 | 11679 | 6629 | 6529 | 6529 | 6579 |
| Total New Loans Required ($'000) | 0 | 1283 | 0 | 6250 | 3219 | 3012 | 13930 | 8029 | 6882 | 16830 | 9301 | 3677 | 0 | 0 | 0 | 0 |
| Average Residential Bills ($) | 760 | 761 | 784 | 809 | 834 | 862 | 889 | 916 | 945 | 946 | 946 | 947 | 947 | 948 | 948 | 921 |
| Typical Residential Bills ($) | 796 | 796 | 819 | 844 | 869 | 895 | 922 | 950 | 978 | 978 | 978 | 978 | 978 | 978 | 978 | 949 |

| 31 Final preferred no. 2 31 | 38/39 | 39/40 | 40/41 | 41/42 | 42/43 | 43/44 | 44/45 | 45/46 | 46/47 | 47/48 | 48/49 | 49/50 | 50/51 | 51/52 | 52/53 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cash and Investments ($'000) | 52020 | 61272 | 72483 | 73513 | 74700 | 87045 | 99936 | 97174 | 94928 | 105045 | 112979 | 125527 | 98621 | 54181 | 48718 |
| New Works less Cap. Works Grants ($'000) | 5935 | 3965 | 885 | 885 | 885 | 885 | 885 | 16885 | 16885 | 5272 | 8372 | 4485 | 43585 | 51465 | 11465 |
| Internal Funding for New Works ($'000) | 5935 | 3965 | 885 | 885 | 885 | 885 | 885 | 16885 | 16885 | 5272 | 8372 | 4485 | 43585 | 51465 | 11465 |
| Renewals ($'000) | 6529 | 6529 | 6529 | 17169 | 17369 | 6879 | 6629 | 6529 | 6529 | 6579 | 6529 | 6529 | 6529 | 17169 | 17319 |
| Internal Funding for Renewals ($'000) | 6529 | 6529 | 6529 | 17169 | 17369 | 6879 | 6629 | 6529 | 6529 | 6579 | 6529 | 6529 | 6529 | 17169 | 17319 |
| Total New Loans Required ($'000) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Average Residential Bills ($) | 894 | 866 | 840 | 841 | 842 | 842 | 842 | 843 | 843 | 843 | 844 | 845 | 845 | 845 | 846 |
| Typical Residential Bills ($) | 921 | 893 | 866 | 866 | 866 | 866 | 866 | 866 | 866 | 866 | 866 | 866 | 866 | 866 | 866 |

**Figure 8-3: FINMOD water output of TRB path, cash and investments, level of capital works and renewals, level of funding and amount of borrowings**

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### 8.3.2 Alternate Water Price Path - Desalination Plant for the Manning

The sensitivity analysis for the financial modelling also identified the water price path if the Peg Leg Creek Dam option for the Manning water security issue is unable to proceed and a desalination plant is pursued instead (adaptive pathway 1 adopted). The purpose of this analysis was to determine the increase to the TRB if a desalination plant was adopted for the Manning.

This includes:

- Spending for the Everyday Scenario
- Peg Leg Creek Dam for the Manning scheme with 66% government funding
- Off-stream storages for Gloucester, Stroud and Bulahdelah with 25% government funding
- Delivery of an $80 million purified recycled water scheme in years 2050/51 to 2051/52
- Operational cost increases of up to $500,000 per year after 2026/27. These increases in operational spending may be required due to the need for additional resources, increased chemical or energy costs, etc.
- Developer charges at $9,570 reduced by 3 percent yearly (to take out inflation) from 2038-39 onwards

TRB rises for water of 3% in the preferred path from years 2024/25 to 2029/30 were increased by 0.1 of a percentage until the cash and investments line were positive and close to the cash and investments from Section 8.3.1. This was achieved with a 1.0 percent increase on top of each TRB step. This is shown in Table 8-4.

FINMOD outputs for the water price path for desalination is shown in Appendix J (refer Water: run 14).

Over the 30-year period, each connection would pay an extra $1,648.00 (in 2022-23 dollars) for desalination. The uplift in TRB for each year is shown in Table 8-5.

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**Table 8-4: TRB price path - water with desalination plant for the Manning**

| Year | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **TRB ($22/23)** | 795.5 | 795.50 | 827.32 | 860.41 | 894.83 | 930.62 | 967.85 | 1006.56 | 1046.82 | 1046.82 | 1046.82 | 1046.82 | 1046.82 | 1046.82 | 1046.82 |
| **Increase (%)** | - | **4.0%** | **4.0%** | **4.0%** | **4.0%** | **4.0%** | **4.0%** | **4.0%** | - | - | - | - | - | - | - |
| **2038** | **2039** | **2040** | **2041** | **2042** | **2043** | **2044** | **2045** | **2046** | **2047** | **2048** | **2049** | **2050** | **2051** | **2052** | **2053** |
| 1015.42 | 984.96 | 955.41 | 926.75 | 926.75 | 926.75 | 926.75 | 926.75 | 926.75 | 926.75 | 926.75 | 926.75 | 926.75 | 926.75 | 926.75 | 926.75 |
| -3% | -3% | -3% | -3% | - | - | - | - | - | - | - | - | - | - | - | - |

**Table 8-5: Uplift in TRB per year for a Desalination Plant (instead of Peg Leg Creek Dam)**

| Year | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Uplift in TRB ($22/23)** | - | - | 7.96 | 16.47 | 25.56 | 35.28 | 45.64 | 56.69 | 68.46 | 68.46 | 68.46 | 68.46 | 68.46 | 68.46 | 68.46 |
| **2038** | **2039** | **2040** | **2041** | **2042** | **2043** | **2044** | **2045** | **2046** | **2047** | **2048** | **2049** | **2050** | **2051** | **2052** | **2053** |
| 66.41 | 64.41 | 62.48 | 60.61 | 60.61 | 60.61 | 60.61 | 60.61 | 60.61 | 60.61 | 60.61 | 60.61 | 60.61 | 60.61 | 60.61 | 60.61 |

### 8.3.3 Sewer Price Path

This is Council's financial position for the water business for the preferred sewer scenario. This includes:

- Spending for the Everyday Scenario
- Expansion of recycled water for unrestricted public access at Taree Recreation Grounds
- Operational cost increases of up to $500,000 per year from 2026/27.
- Provision of sewerage services to Coomba Park and construction of Pacific Palms STP during the last 5 years (commissioning in 2051-52)
- Sewer developer charges remain constant at $8280 (increase with inflation only)
- No new loans

The purpose of this was to model Council's preferred price path for sewer. This scenario has decreases of 3% to sewer fees and charges in the short term for four consecutive years (years 2024/25 to 2027/28). This demonstrates that holding sewer fees and charges steady (not increasing with inflation) during four consecutive years that water fees and charges will be increased is affordable. The sewer TRB is kept constant for the remainder of the 30 years. Table 8-6 presents the sewer TRB price path.

This scenario demonstrates that Council can keep sewer developer charges constant for the 30 years, increasing them in line with inflation. Servicing Strategies and Developer Servicing Plan reviews to be undertaken to confirm developer charges.

This scenario demonstrates that operational cost increases of up to $500,000 per year are affordable after year 2026/27. These increases in operational spending may be required due to the need for additional resources, increased chemical or energy costs, etc.

FINMOD outputs for the preferred sewer price path is shown in Figure 8-4.

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**Table 8-6: TRB price path sewer**

| Year | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **TRB ($22/23)** | 1096.00 | 1096.00 | 1063.12 | 1031.23 | 1000.29 | 970.28 | 970.28 | 970.28 | 970.28 | 970.28 | 970.28 | 970.28 | 970.28 | 970.28 | 970.28 |
| **Decrease (%)** | - | - | -3.0% | -3.0% | -3.0% | -3.0% | - | - | - | - | - | - | - | - | - |
| **2038** | **2039** | **2040** | **2041** | **2042** | **2043** | **2044** | **2045** | **2046** | **2047** | **2048** | **2049** | **2050** | **2051** | **2052** | **2053** |
| 970.28 | 970.28 | 970.28 | 970.28 | 970.28 | 970.28 | 970.28 | 970.28 | 970.28 | 970.28 | 970.28 | 970.28 | 970.28 | 970.28 | 970.28 | 970.28 |
| - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

| 16 Preferred final- sewer 31 | 22/23 | 23/24 | 24/25 | 25/26 | 26/27 | 27/28 | 28/29 | 29/30 | 30/31 | 31/32 | 32/33 | 33/34 | 34/35 | 35/36 | 36/37 | 37/38 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cash and Investments ($'000) | 95322 | 90394 | 61677 | 35180 | 25561 | 27622 | 29979 | 28496 | 23251 | 22447 | 22045 | 21691 | 27113 | 24820 | 26363 | 34475 |
| New Works less Cap. Works Grants ($'000) | 6743 | 7606 | 25926 | 24452 | 9385 | 2350 | 2865 | 6800 | 11250 | 1450 | 1250 | 5550 | 2250 | 3250 | 500 | 1450 |
| Internal Funding for New Works ($'000) | 6743 | 7606 | 25926 | 24453 | 9385 | 2350 | 2865 | 6800 | 11250 | 1450 | 1250 | 5550 | 2250 | 3250 | 500 | 1450 |
| Renewals ($'000) | 8678 | 13035 | 16458 | 17548 | 14987 | 9855 | 9245 | 9645 | 9845 | 15525 | 15575 | 11545 | 9645 | 16565 | 16565 | 9708 |
| Internal Funding for Renewals ($'000) | 8678 | 13035 | 16458 | 17548 | 14987 | 9855 | 9245 | 9645 | 9845 | 15525 | 15575 | 11545 | 9645 | 16565 | 16565 | 9708 |
| Total New Loans Required ($'000) | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Average Residential Bills ($) | 1042 | 1044 | 1012 | 982 | 953 | 924 | 925 | 926 | 927 | 928 | 929 | 929 | 930 | 930 | 931 | 932 |
| Typical Residential Bills ($) | 1096 | 1096 | 1063 | 1031 | 1000 | 970 | 970 | 970 | 970 | 970 | 970 | 970 | 970 | 970 | 970 | 970 |

| 16 Preferred final- sewer 31 | 38/39 | 39/40 | 40/41 | 41/42 | 42/43 | 43/44 | 44/45 | 45/46 | 46/47 | 47/48 | 48/49 | 49/50 | 50/51 | 51/52 | 52/53 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cash and Investments ($'000) | 41514 | 42917 | 42666 | 48608 | 59061 | 60194 | 63500 | 72488 | 76865 | 72977 | 69382 | 67912 | 66661 | 56646 | 58068 |
| New Works less Cap. Works Grants ($'000) | 2750 | 330 | 2050 | 4450 | 250 | 250 | 250 | 2250 | 6916 | 6916 | 6916 | 13583 | 13583 | 13583 | 250 |
| Internal Funding for New Works ($'000) | 2750 | 330 | 2050 | 4450 | 250 | 250 | 250 | 2250 | 6916 | 6916 | 6916 | 13583 | 13583 | 13583 | 250 |
| Renewals ($'000) | 9671 | 17871 | 17965 | 9725 | 9695 | 18945 | 17045 | 9645 | 9645 | 17895 | 17845 | 9645 | 9645 | 18205 | 18205 |
| Internal Funding for Renewals ($'000) | 9671 | 17871 | 17965 | 9725 | 9695 | 18945 | 17045 | 9645 | 9645 | 17895 | 17845 | 9645 | 9645 | 18205 | 18205 |
| Total New Loans Required ($'000) | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Average Residential Bills ($) | 933 | 933 | 933 | 935 | 935 | 935 | 936 | 936 | 938 | 938 | 939 | 939 | 939 | 940 | 940 |
| Typical Residential Bills ($) | 970 | 970 | 970 | 970 | 970 | 970 | 970 | 970 | 970 | 970 | 970 | 970 | 970 | 970 | 970 |

**Figure 8-4: FINMOD sewer output of sewer TRB path, cash and investments, level of capital works and renewals, level of funding and amount of borrowings**

## 8.4 Adaptive Plan

The assessed scenarios and preferred strategy were developed into an adaptive plan. This is presented in Figure 8-5. The plan highlights the key risks identified through the process and provides a response pathway based on the potential outcome.

Five pathways were identified for the adaptive plan based on the scenarios developed. These are as follows:

**Base case:** The Everyday Scenario, including climate adaptations, no change to unserviced villages and no additional users of recycled water

**Pathway 1:** Peg Leg Creek Dam for Manning scheme and local storages at Gloucester, Bulahdelah and Stroud.

**Pathway 2:** Desalination plant for Manning scheme and local storages at Gloucester, Bulahdelah and Stroud

**Pathway 3:** Peg Leg Creek Dam supplemented by Purified Recycled Water for Manning scheme and local storages at Gloucester, Bulahdelah and Stroud

**Pathway 4:** Peg Leg Creek Dam for Manning with connections to Gloucester and Bulahdelah and local storage at Stroud.

Key risks, issues or events that may arise in the future may be significant enough to trigger a deviation from preferred to an alternative pathway. Triggers that may lead to a change in the strategy or pathway are listed in Table 8-7 along with the resulting pathway. Triggers are generally external and will be in most instances beyond Council's influence.

**Table 8-7: Adaptive planning triggers for potential change in strategy or pathway**

| Trigger | Planning Actions | Trigger Decision Makers | Pathway |
|---|---|---|---|
| Environmental approval for Peg Leg Creek Dam | Complete Environmental Impact Statement (EIS) and investigate implications of environmental offsets | DPE Water | Yes: Stay on Pathway 1 – Dam<br>No: Move from Pathway 1 to Pathway 2 – Desalination |
| Environmental approval for off-stream storages at Bulahdelah, Gloucester and Stroud | Investigate options for suitable dam sites and complete EIS for each scheme | DPE Water | Yes: Stay on Pathway 1 – Dam<br>No: Move from Pathway 1 to Pathway 4 – Water Sharing |
| Regulatory framework for Purified Recycled Water | Track progress of purified recycled water schemes by other utilities, continue with community education | DCCEEW<br>DPE Water | Yes: Move from Pathway 1 to Pathway 3 – Dam + PRW<br>No: Stay on Pathway 1 – Dam |
| Growth earlier/higher than current forecast<br>Climate change more extreme than current forecast<br>(Shown outside 30-year horizon) | Monitor and review growth projection assumptions<br>Monitor and review climate change projection assumptions | Council | Yes: Consider raising dam wall – stay on Pathway 1<br>Yes: Consider move to Pathway 2 – Desalination<br>No: No change |

Enablers are similar to triggers in that they are events or decisions that may arise in the future. Enablers do not result in a change in overall strategy direction however they may enable specific local opportunities or responses. These may include:

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- Investigation into local groundwater opportunities at Bulahdelah, Gloucester and Stroud may lead to alternate/supplementary water supply
- Funding for local upgrade or connection of unserviced villages
- Funding for local recycled water schemes to provide community amenity leads to increased water recycling (unrestricted use)
- Additional agricultural reuse customers identified leads to increased water recycling (restricted use)
- Developer prioritising integrated water management or recycled water to differentiate may lead to increased water recycling
- Extreme drought event before delivery of Peg Leg Creek Dam and/or other storages requires emergency response such as temporary desalination and/or water carting
- Adjacent or nearby water utility has a climate independent supply and is willing to enter into water sharing arrangement
- Increase in renewables makes desalination and recycled water more attractive (i.e., the energy concern for these solutions are reduced)
- The outcome from involvement in the NSW State Government *'Valuation of costs and benefits of Water conservation initiative'* project is that it is cost effective to pursue water efficiency method of rainwater tank subsidy

Mapping of the key triggers and localised enablers enhances the robustness of the preferred strategy and ensures it can adapt to future change and uncertainty. The plan will perform as an adaptive roadmap of key decision points for the preferred strategy, highlighting how the alternative pathways are likely to interact into the future.

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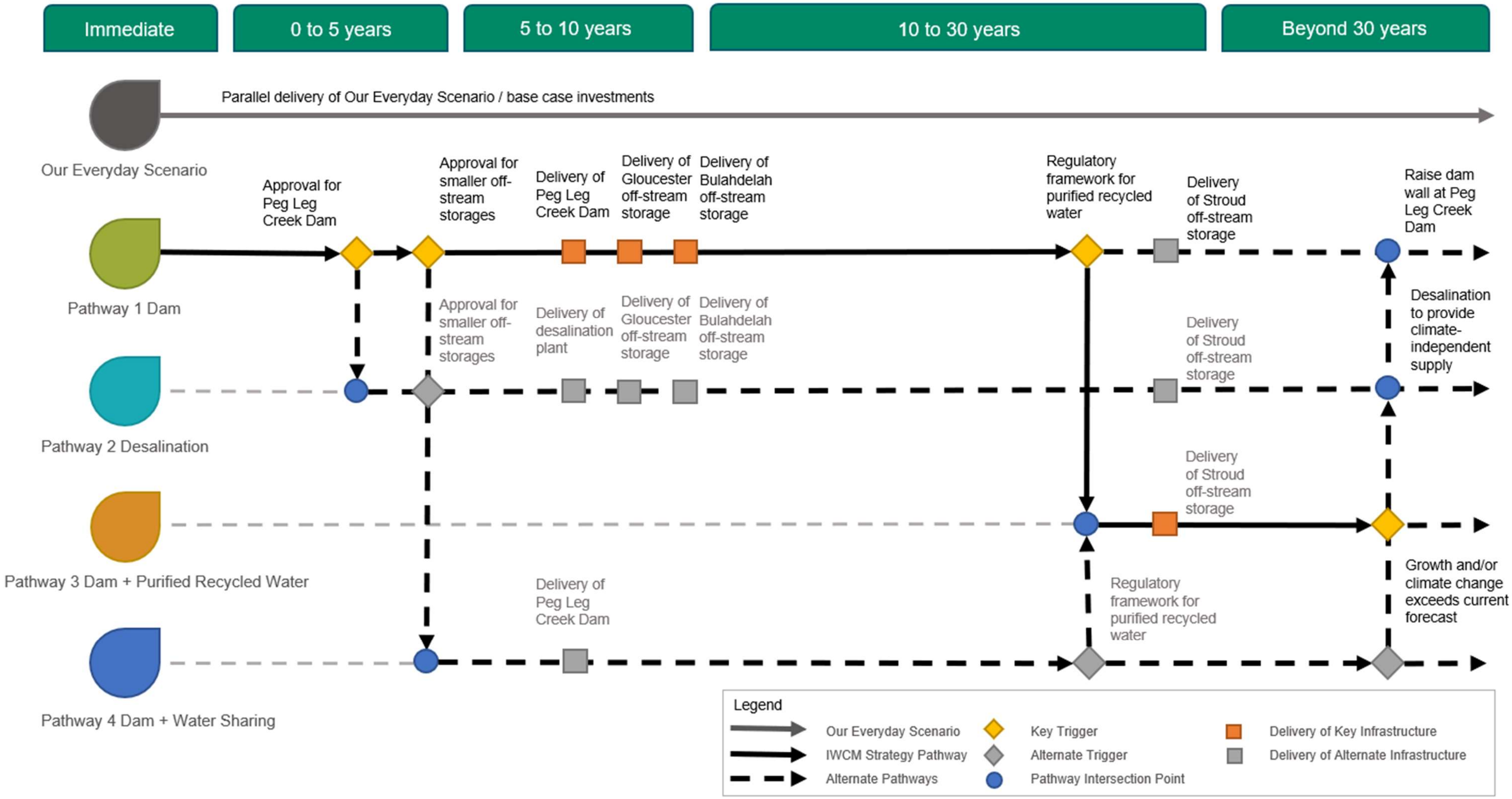


**Figure 8-5: Adaptive plan for identified pathways**

## 8.5 30-year Capital and Operating Plan

The 30-year capital and operating plan (Appendix L) covers all the work that Council will undertake over the 30-year period for the preferred IWCM strategy.

Each of the projects, including renewals, new assets and upgrades, were ranked based on the risk of not proceeding with the project. Each project was also allocated a priority ranking, based on Council's Capital Prioritisation Framework. This framework considers regulatory requirements, projects required for growth, asset criticality and condition and benefits and efficiency improvements. These risks and priorities are reviewed at least annually.

The large water capital projects currently planned for the next 10 years have a water security focus. Council has invested significantly in water quality over the last 20 years. Council is currently upgrading Nabiac Borefield to increase water security in the short-term, until the Manning scheme water security solution is implemented. The first ten years of the plan focuses on the planning, approvals and delivery of Peg Leg Creek Dam. This is followed by delivery of Gloucester off-stream storage dam and Gloucester WTP replacement; followed by delivery of Bulahdelah off-stream storage dam. Stroud off-stream storage is planned for the latter 30-year horizon. Council is planning a 5 MW solar farm located at the Nabiac WTP, as well as solar rollout across water and sewerage sites.

The sewer capital projects focus on upgrades to treatment plants, pumping station and rising mains to accommodate growth. Council will be upgrading Hawks Nest, Gloucester, Harrington, Dawson and Old Bar STPs. New pumping stations and rising mains to reduce overloading and accommodate growth will be constructed in Tea Gardens, Cundletown and Hallidays Point.

Additional water capital includes several water distribution and trunk main projects due to growth, additional reservoirs at Kolodong, Lantana, Krambach and Wingham and a new reservoir at Four Mile Hill.

Ongoing renewals programs target assets including water and sewer pumps, water mains, sewer rising and gravity mains, manholes, filtration media, blowers, membranes, sewer vacuum systems, SCADA and electrical and chemical systems. There is also a focus on raising critical switchboards and electrical above flood levels to manage operational risk.

Ongoing investment targets water efficiency and demand management, including water education and behaviour programs, smart meter and bulk flow meter installations, pressure reduction, inflow and infiltration, catchment management and actions to meet Net Zero.

## 8.6 Drought Contingency and Emergency Response Plan

**Table 8-8: Drought contingency and emergency response action plan**

| Scheme | Emergency response |
|---|---|
| All | Community engagement and education program around water conservation, with ambitious water efficiency targets tied to each restriction level |
| Manning | Temporary increase in extraction yield from Nabiac Borefield to enable maximum extraction of 18 ML/day, in service during emergency periods only |
| | Emergency desalination plant, located either at Nabiac WTP or east of Darawank, such as at Hallidays Point STP<br>Water drawn from Wallamba River with brine pipeline to ocean discharge, or water drawn from the ocean |
| Gloucester | Water carting from Tea Gardens |
| Bulahdelah | Water carting from Tea Gardens |
| Stroud | Water carting from Tea Gardens |

The IWCM Strategy includes long-term plan to improve the water security of the MidCoast region, however there will be a period of time between implementation of the strategy and the delivery of key infrastructure. This is due to the need to secure environmental and planning approvals, as well as

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design, construction and commissioning. The drought contingency plan addresses the water security challenge in the intervening years before the delivery of Peg Leg Creek Dam and the off-stream storages at Gloucester, Bulahdelah and Stroud. Table 8-8 presents the emergency drought response action plan. Full details of the plan can be found in Appendix M.

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# Appendices

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# Appendix A

# Issues Paper

# Appendix B

# Manning Water Security Coarse Screening Report

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# Appendix C

# Unsewered Villages Wastewater Risk Assessment Report

# Appendix D

## Water Demand and Sewer Loading Forecasts

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# Appendix E

# Bulahdelah, Gloucester and Stroud Water Security Options Long List

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## Long-list of options for Gloucester Water Supply Scheme

| Option | Description | Key Infrastructure | Additional Yield | Risks | Issues | Opportunities | CAPEX | OPEX | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| **Off-Stream Storage** | • New off-stream storage<br>• Pumping from river unavoidable even under less ideal circumstances as there is no existing off-stream storage<br>• Raw water supplied from Barrington River and pumped to Gloucester WTP for treatment<br>• Options for six sites investigated and two deemed feasible for storage above 250 ML – across the river from the WTP (Site 2) and east of Thunderbolts Way (Site 5) respectively | • Zoned embankment<br>• Spillway<br>• Transfer pumping infrastructure including pipelines from river offtake to storage site, and storage site to WTP | Designed to as required | • Approvals and permits – pipeline crossing across Gloucester River and rail track (Site 2)<br>• Land acquisition for storage site<br>• Potential for cultural heritage sites<br>• Impact to environment including local ecology<br>• Low resilience option with no additional supply sources<br>• Community acceptance based on current socio-political sentiment towards dam projects<br>• Impact from potential spillway or dam flows – on rail infrastructure due to close proximity to storage site (Site 2), or neighbouring cottages (Site 5)<br>• Suitability of water quality as a result of impacts from Gloucester Landfill Facility on run-off and groundwater (Site 5) | • Rainfall dependent water source – extraction limited to favourable river flow conditions<br>• Potential for long lead times on negotiations with Australian Rail Track Corporation for boring under rail track (Site 2)<br>• Availability of fill materials<br>• Large construction carbon footprint<br>• Potential for complex geology resulting in increased CAPEX – fractured rock (Site 2)<br>• Stratification from poor water quality<br>• May require easements for sections of pipeline | • Flexibility in staging<br>• Enhanced raw water quality management with availability of alternative water source when Barrington River conditions are unfavourable | $20.8M | $530K | Medium – some preliminary investigations and preliminary concept design completed, further investigation required into stakeholders, water quality and geological conditions |
| **On-Stream Storage** | • Construction of on-stream storage for additional Barrington River<br>• Option considers either raising existing weir crest or creation of new weir for additional storage | • Foundation excavation and weir construction to required level | Requires further investigation | • Approvals and permits – environmental impacts to aquatic habitat and river<br>• Low resilience option with no additional supply sources<br>• Environmental impacts to aquatic and river ecology – disruption to fish passage, reduced biodiversity, increased erosion and sedimentation, decrease in water quality | • Rainfall dependent water source – extraction limited to favourable river flow conditions<br>• Increased siltation upstream of weir | • Significantly less infrastructure required | Not assessed | | Low – no investigations undertaken, requires investigation into feasibility of option based on river hydrology and environmental constraints |
| **Stratford Mine Dam** | • Potential new water source<br>• Return Water Dam at the mine site holds approximately 1000 ML of water<br>• Considered as an option in 2019-20 drought for discharging into Avon River and for dust suppression and stock watering<br>• Water quality testing identified water suitable for drinking water with pH correction required<br>• Option to either:<br>  ○ Transfer directly to Gloucester WTP for treatment and distribution<br>  ○ Utilise dam water to inject flow into Barrington River upstream of raw water | • Acquisition of dam from Stratford Coal<br>• Transfer pumping infrastructure including pipeline from mine dam to either Gloucester WTP or river discharge point (approximately 20 km)<br>• Upgrade to treatment as required for additional treatment either at the WTP or before discharging to river based on further testing | 1000 ML but requires further investigation into source | • Approvals and permits – may require rigorous testing and investigation to confirm suitability for injecting directly into WTP or river<br>• Replenishment of dam water – availability, duration, source<br>• Aquatic ecology – impacts of dam water quality on receiving waterbody<br>• Suitability of dam water for drinking water standards<br>• Acquisition of dam – (coal mine near end of life)<br>• Community acceptance based on current socio-political sentiment towards dam projects | • Highly likely rainfall dependent water source – replenishment potentially dependent on rainfall<br>• Stratification of stored water from poor water quality<br>• May require easements for sections of pipeline | • Enhanced raw water quality management with availability of alternative water source when Barrington River conditions are unfavourable<br>• Low investment of CAPEX for significant storage and new water source<br>• Consideration for emergency measure if unsuitable for permanent solution | $19.1M for pipeline transfer | Not assessed | Low – requires feasibility investigations for conversion of dam to off-stream storage, water quality testing, water profiling for source of water through hydrological and geological investigations |

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| Option | Description | Key Infrastructure | Additional Yield | Risks | Issues | Opportunities | CAPEX | OPEX | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| | offtake point for increased extraction | | | | | | | | |
| **Desalination of River Water via Gloucester River** | • Construction of a permanent packaged desalination plant<br>• Proposed location adjacent to existing Gloucester WTP<br>• Raw water intake via new offtake point from Gloucester River<br>• Reject discharge to ocean towards Hallidays Point<br>• Treated water pumped for distribution from desalination plant via Gloucester WTP | • Potential land acquisition near WTP<br>• Packaged desalination plant including river water intake and pumping infrastructure, storage tanks for flow attenuation, screening and microfiltration units, reverse osmosis units, and treated water storage tanks<br>• Brine pumping system and discharge line to ocean outfall (approximately 70 km) | Flexible to as required | • River not saline – unsuitable for desalination | N/A | N/A | Not assessed | | Low – no planning investigations completed but constrained by river flow conditions and requires outfall pipeline to ocean |
| **Desalination of Sea Water** | • Construction of a permanent desalination plant near the coastline<br>• Located adjacent to Hallidays Point STP<br>• Raw water intake and reject discharge via ocean<br>• Treated water pumped from coast to Gloucester network for distribution | • Desalination plant including sea water intake and pumping infrastructure, screening and microfiltration units, reverse osmosis units, brine pumping system and discharge line to ocean outfall, and storage tanks<br>• Pipeline from desalination plant to Gloucester (approximately 70 km inland from coast depending on route)<br>• Lift pump stations and balance tanks | Flexible to as required | • Approvals and permits – pipeline crossing across creeks and Avon River, and rail track<br>• Aquatic ecology – impingement and entrainment<br>• Aquatic ecology – reject discharge<br>• Community acceptance | • Potential for long lead times on negotiations with Australian Rail Track Corporation for boring under rail track<br>• Feasible but impractical option for inland community due to significant infrastructure required for small community<br>• Large carbon footprint with high energy intensive operation of desalination plant and long pumping distance<br>• High operation and maintenance costs for desalination plant and transfer pipeline<br>• Requires upskilling and additional labour for plant operation<br>• Long lead time from planning and construction to operation<br>• May require easements for sections of pipeline | • Rainfall independent supply<br>• Reliable source of supply<br>• Potential for pumped hydropower<br>• Proven technology<br>• Operation flexible to demand | $90.5M | Not assessed | Low – not considered a practical water security solution as significant distance from the coast |
| **Regional connection (pipeline from Manning via Krambach)** | • Connection to Manning Water Supply scheme<br>• Scheme connects via pipeline from Krambach<br>• Gloucester is integrated into the Manning scheme, supplied from Bootawa WTP and Nabiac Borefield<br>• Interconnection would allow Gloucester WTP to be decommissioned | • Approximately 38 km pipeline connecting Krambach and Gloucester<br>• Lift pump stations and balance tanks<br>• Chlorine booster station<br>• Upgrades to network infrastructure in Manning scheme including trunk mains, pump stations, and Krambach reservoir | Entire township supplied from Manning, 2050 ADD 1.27 ML/d | • Approvals and permits – pipeline crossing across creeks and Avon River, and rail track<br>• Increase in risk from impacts of natural disasters (such as bushfires leading to loss of power at pump stations)<br>• Environmental impacts along pipeline construction corridor<br>• Community acceptance for integrating Gloucester with Manning scheme | • Potential for long lead times on negotiations with Australian Rail Track Corporation for boring under rail track<br>• Considerable carbon footprint with long pumping distance<br>• Potentially rainfall dependent solution dependent on water security solution for Manning<br>• Requires easements for sections of pipeline | • Decommission Gloucester WTP, which may either reduce or offset operational expenses for new pipeline<br>• Potential for pumped hydropower<br>• Reduced risk of water quality incidents as need for raw water extraction eliminated from Barrington River<br>• Potential to connect new customers along pipeline route<br>• Road widening along The Bucketts Way for pipe easement | $41.2M | $1.0M | Medium – preliminary investigations and concept design completed, requires investigation into environmental impacts, landowner consultation for easements, and community consultation for connecting schemes |

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| Option | Description | Key Infrastructure | Additional Yield | Risks | Issues | Opportunities | CAPEX | OPEX | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| **Regional connection (water carting from Tea Gardens)** | • Water carting from Tea Gardens approximately 120 km via road<br>• Activated during times of emergency only, i.e., when river flow conditions are not ideal and dam storage level is low<br>• Option was implemented previously in the 2019-20 drought | • No additional infrastructure required | Required yield as per circumstances and availability at Tea Gardens (2019-20 Level 4 restrictions 538 kL/d) | • Impact and / or delay of transport from unforeseen circumstances such as traffic accident, bushfire, etc.<br>• Dependent on availability of water supply at Tea Garden bores<br>• Potential for water contamination requiring additional disinfection<br>• Freight availability for prolonged periods | • Short-term supply solution – impractical for prolonged periods, continuous operation of freight required with carting delivered over 24 hr period daily in 2019-20 drought for Level 4 restrictions<br>• Greenhouse gas emissions from daily use of freight | • Some flexibility in scaling yield to as required<br>• Cost-effective short term water security solution until long term solution implemented<br>• Successfully implemented previously<br>• Infrastructure for loading from Tea Gardens and unloading at Gloucester in place | Not assessed | | High – based on investigations undertaken by Council in the recent droughts |
| **Stormwater Harvesting** | • Stormwater collection and transfer to Gloucester off-stream storage to supplement extraction of raw water from the Barrington River<br>• Investigations completed identified Gloucester split across the north-to-south ridge through centre of township with multiple smaller catchments draining towards Barrington River<br>• Investigations concluded sufficient yield to meet current demand in typical rainfall year, but reduces significantly in a low rainfall period<br>• Investigation sampling undertaken following a rainfall event indicates relatively good quality stormwater with metals, nutrients and suspended solids falling within or below thresholds for acceptable stormwater pollutants – pathogens, viruses and hydrocarbons were however not tested | • Multiple collection basins for each catchment<br>• New off-stream storage<br>• Pumping and transfer infrastructure from each collection basin to new off-stream storage<br>• Potentially upgrade of WTP dependent on stormwater quality | Investigation of 20ha catchment with 25% soil capacity found an approximate yield of 114 ML/yr in a typical rainfall year, and 30 ML/yr during lowest rainfall period | • Potentially poor water quality requiring a higher level of treatment<br>• Multiple small catchments<br>• Mosquito breeding at collection points and storage basins<br>• Catchment is predominantly environmental conservation and low density residential with large lots, favourable for pervious ground profile | • Rainfall dependent water source<br>• High operation and maintenance costs<br>• Minimal growth in Gloucester for developer driven opportunities<br>• Significant infrastructure required for collection of stormwater<br>• Requires large storage to capture flows during wet weather<br>• Requires reconfiguration of stormwater network to route stormwater to collection basins | • Utilisation of some existing stormwater network<br>• Flow attenuation in low flow events<br>• Reduced pollutants in natural waterways | $191.5M (based on capturing all local runoff with 8000 ML storage) | Not assessed | Low – preliminary investigations indicate potential for sufficient yield for material impact, but significant infrastructure required for a centralised harvesting scheme |
| **Groundwater** | • Considers potential for groundwater sources in or near Gloucester<br>• Current water source for Gloucester, Barrington River, falls within the Gloucester Basin groundwater source as per the Water Sharing Plan for the Lower North Coast<br>• 1999 PPK study did not identify any potential sites in the Gloucester area | If investigations deem option is feasible:<br>• Borefield<br>• Potentially new WTP depending on location<br>• Groundwater transfer pipeline to Gloucester WTP or supply reservoir | Requires further investigation | • Approvals and permits<br>• Availability of groundwater<br>• Suitability of groundwater for potable water supply<br>• Environmental impacts from extraction<br>• Potentially poor water quality requiring a higher level of treatment | • No prospective sites have been identified for Gloucester region<br>• Long lead time for new borefield from planning and construction to operation | | Not assessed | | Low – requires an updated investigation into availability of groundwater in region |
| **Reticulated Recycled Water** | • Dual reticulation network to supply both potable and recycled water for new development areas only<br>• Recycled water could be utilised for outdoor uses, toilet flushing and laundry purposes (i.e., for hot water) offsetting potable | • Advanced water treatment process including membrane filtration<br>• Transfer pumping infrastructure including pipelines to developments<br>• Additional storage for recycled water storage | Approximately up to 478 kL/d by 2050 (up to 30% of current effluent used for irrigation in 2017-18, and 70% used in | • Insufficient recycled water demand due to low growth<br>• Cross-contamination<br>• Public health risk due to potential for misuse of recycled water by customer<br>• Approvals and permits<br>• Community acceptance | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse<br>• Only suitable for new residential developments (not practical to retrofit existing | • Rainfall independent yield<br>• Promotes community education and acceptance<br>• Effluent management<br>• Maintains aesthetic values during drought | $16,000 per dwelling including cost for treatment and distribution | Not assessed | Medium – not considered viable due to insufficient availability of effluent for recycled water use, both as a result of low |

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| Option | Description | Key Infrastructure | Additional Yield | Risks | Issues | Opportunities | CAPEX | OPEX | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| | water demand for domestic uses<br>• Upgrade of Gloucester STP will be required with advanced water treatment for effluent treated to unrestricted public access standards in accordance with the Australian Guidelines for Water Recycling | | 2019-20 drought) | | properties), can be discriminatory<br>• Partially rainfall dependent demand (outdoor use driven by day-to-day weather conditions)<br>• Developer driven, beyond Council's influence for implementation<br>• Increase in greenhouse gas emissions with increased level of treatment<br>• High operation and maintenance costs with dual network | | | | growth and existing user intake during drought period |
| **Recycled Water for Restricted Use** | • Existing effluent management consists of supplying restricted recycled water for pasture irrigation to a nearby property<br>• Option considers expansion of existing scheme to new users<br>• Investigations completed identified four potential agricultural users in near vicinity to STP<br>• Two identified sites would require consideration for buffer zones due to close proximity to Gloucester River<br>• No major infrastructure upgrades are required | • Expansion of recycled water distribution network to new users | Approximately up to 478 kL/d by 2050 (up to 30% of current effluent used for irrigation in 2017-18, and 70% used in 2019-20 drought) | • Insufficient recycled water demand for material impact on potable water demand<br>• Users not guaranteed over longer term | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse during drought<br>• Rainfall dependent demand<br>• Requires buffer zones to reduce impact on waterways for sites located adjacent to Gloucester River | • Rainfall independent yield<br>• Effluent management<br>• No upgrades required to treatment<br>• Increases reliability with increased number of users | Not assessed | | Medium – effluent available for new users, but low impact in offsetting potable water demand |
| **Recycled Water for Unrestricted Use** | • Upgrade of Gloucester STP to Australian Guidelines for Water Recycling for unrestricted use for open space irrigation<br>• Investigations completed identified given open spaces for irrigation including Gloucester Showground, Gloucester District Park, Billabong Native Park, Minimbah Native Garden and Gloucester Golf Course | • New RTP with membrane filtration, chlorination and treated water storage tanks<br>• Transfer pumping infrastructure including pipelines<br>• Storage and recycled water irrigation infrastructure at end user sites (if Council owned and operated) | Approximately up to 478 kL/d by 2050 (up to 30% of current effluent used for irrigation in 2017-18, and 70% used in 2019-20 drought) | • Existing uptake of potable water for sites negligible – insufficient for material impact on potable water demand<br>• Approvals and permits<br>• Community acceptance | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse during drought<br>• Significant infrastructure required to maximise use<br>• Rainfall dependent demand<br>• Increase in operation and maintenance costs<br>• Increase in greenhouse gas emissions with increased level of treatment | • Rainfall independent yield<br>• Promotes community education and acceptance<br>• Effluent management<br>• Maintains aesthetic values during drought<br>• Increases reliability with increased number of users | Not assessed | | Medium – practical solution but low impact in offsetting potable water demand |
| **Recycled Water for Environmental Flows** | • Substitution of flows downstream of Barrington River offtake point for Gloucester WTP to enable greater extraction upstream<br>• Replacement flows supplied from Gloucester STP<br>• Replacement of flows to potentially enable increased extraction rates under normal conditions for storage in future off-stream storage dam<br>• Further studies will be required to determine the limitations on increased extraction and to | • Upgrade of Gloucester STP to achieve water quality required to a level appropriate for the ecosystem of the Barrington River<br>• Transfer pumping infrastructure including pipeline to river discharge<br>• Construction of additional off-stream storage as per 'Off-Stream Storage' option | Approximately up to 478 kL/d by 2050 (up to 30% of current effluent used for irrigation in 2017-18, and 70% used in 2019-20 drought) | • Approvals and permits – specifically for land clearing adjacent to STP required for expansion<br>• Community acceptance<br>• Impact on river health and ecology from substitution flow<br>• Impact on river health and ecology from increased offtake | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse<br>• May not improve yield / supply if river extraction limits are reached<br>• Potential high increase in operation and maintenance costs with increased level of treatment<br>• Requires additional off-stream storage to enable increased extraction | • Effluent management<br>• May improve river flow<br>• Adaptable to growth | Not assessed | | Low – no feasibility investigations completed |

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| Option | Description | Key Infrastructure | Additional Yield | Risks | Issues | Opportunities | CAPEX | OPEX | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| | determine the required substitution water quality for maintaining a healthy river system | | | | • Rainfall dependent water source for extraction<br>• Supporting legislation not fully developed | | | | |
| **Purified Recycled Water** | • Expansion of Gloucester STP to advanced level treatment for indirect purified recycled water use<br>• Recycled water from STP redirected to future off-stream storage to mix with raw water extracted from Barrington River | • Upgrade of Gloucester STP to achieve advanced water quality including membrane filtration, reverse osmosis, UV advanced oxidation, and treated water storage tanks<br>• Transfer pumping infrastructure including pipeline to off-stream storage<br>• Construction of additional off-stream storage as per ‘Off-Stream Storage’ option | Approximately up to 478 kL/d by 2050 (up to 30% of current effluent used for irrigation in 2017-18, and 70% used in 2019-20 drought) | • Community acceptance<br>• Failure at critical control points can result in severe public health consequences<br>• Approvals and permits | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse<br>• Supporting legislation not fully developed<br>• Large carbon footprint with high energy intensive operation of recycled water plant<br>• Significant increase in operation and maintenance costs | • Can be aligned with delivery of new WTP required within next 5 to 10 years<br>• Effluent management<br>• Rainfall independent yield<br>• Increase in reliability of supply | Not assessed | | Medium – advanced treatment technically viable, but option is long-term solution requiring significant engagement with community for acceptance |

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## Long-list of options for Bulahdelah Water Supply Scheme

| Option | Description | Key Infrastructure | Additional Yield | Risks | Issues | Opportunities | CAPEX | OPEX | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| **Off-Stream Storage** | • New off-stream storage<br>• Pumping from river unavoidable even under less ideal circumstances as there is no existing off-stream storage<br>• Raw water supplied from Crawford River and pumped to Bulahdelah WTP for treatment<br>• Limited selection for storage site, ideally located close to raw water pump station | • Foundation excavation and storage construction – may potentially be a Turkey's Nest dam if site is located within a flood zone (specifically adjacent to existing raw water pumping station)<br>• Transfer pumping infrastructure including pipelines from river offtake and to WTP | Designed to as required | • Approvals and permits<br>• Highly likely land acquisition required for storage site<br>• Potential for cultural heritage sites<br>• Impact to environment including local ecology dependent on site<br>• Low resilience option with no additional supply sources<br>• Community acceptance based on current socio-political sentiment towards dam projects | • Rainfall dependent water source – extraction limited to favourable river flow conditions<br>• Availability of fill materials<br>• Large construction carbon footprint<br>• Limited options for storage site<br>• Potential for complex geology resulting in increased CAPEX<br>• Stratification from poor water quality | • Flexibility in staging<br>• Enhanced raw water quality management with availability of alternative water source when Crawford River conditions are unfavourable | $17.6M | Not assessed | Low – no preliminary planning completed, investigation required to determine geotechnical conditions, hydrological aspects, approvals, material availability, and environmental impacts |
| **Additional On-Stream Storage** | • Existing weir on the Crawford River provides 163 ML live storage, and a total storage of 228 ML including dead storage<br>• Option considers either raising existing weir crest or creation of new weir for additional storage | • Foundation excavation and weir construction to required level | Requires further investigation | • Approvals and permits – environmental impacts to aquatic habitat and river<br>• Low resilience option with no additional supply sources<br>• Environmental impacts to aquatic and river ecology – disruption to fish passage, reduced biodiversity, increased erosion and sedimentation, decrease in water quality<br>• Climate change impact – high confidence scenario predicted inundation of +0.84 m | • Rainfall dependent water source – extraction limited to favourable river flow conditions<br>• Increased siltation upstream of weir | • Significantly less infrastructure required | Not assessed | | Low – no investigations undertaken, requires investigation into feasibility of option based on river hydrology and environmental constraints |
| **Desalination of River Water via Myall River** | • Construction of a permanent packaged desalination plant<br>• Proposed location adjacent to existing Bulahdelah raw water offtake point adjacent to confluence of Myall River and Crawford River<br>• Raw water intake via existing offtake point at Myall River<br>• Reject discharge to ocean towards Pacific Palms<br>• Treated water pumped from desalination plant to Bulahdelah reservoirs for distribution | • Land acquisition near Bulahdelah WTP raw water offtake point<br>• Packaged desalination plant including river water intake and pumping infrastructure, storage tanks for flow attenuation, screening and microfiltration units, reverse osmosis units, and treated water storage tanks<br>• Brine pumping system and discharge line to ocean outfall (28 – 40 km depending on route)<br>• Transfer pumping infrastructure from desalination plant to reservoir including (approximately 2.5 km) | Flexible to as required | • Approvals and permits – pipeline crossing across Myall River, extraction licence, ocean discharge<br>• Aquatic ecology – impingement and entrainment<br>• Aquatic ecology – reject discharge<br>• Community acceptance – impact to local industries dependent on river water from increased extraction<br>• Land acquisition for desalination plant | • Rainfall dependent water source – extraction based on river flow conditions<br>• Large carbon footprint with high energy intensive operation of desalination plant and long pumping distance for outfall<br>• High operation and maintenance costs for desalination plant and transfer pipeline<br>• Construction through environmentally sensitive corridor for reject discharge pipeline (Wang Wauk State Forest) requiring underbore for significant lengths of pipe<br>• Requires upskilling and additional labour for plant operation<br>• Long lead time from planning and construction to operation<br>• May require easements for sections of pipeline | • Easy integration into existing water supply system<br>• Proven technology<br>• Operation flexible to demand | $93.9 | Not assessed | Low – no planning investigations completed but constrained by river flow conditions and requires outfall pipeline to ocean |

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| Option | Description | Key Infrastructure | Additional Yield | Risks | Issues | Opportunities | CAPEX | OPEX | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| **Desalination of Sea Water** | • Construction of a permanent desalination plant near the coastline<br>• Located adjacent to proposed Pacific Palms STP<br>• Raw water intake and reject discharge via ocean<br>• Treated water pumped from coast to Bulahdelah network for distribution | • Land acquisition nearby coast<br>• Desalination plant including sea water intake and pumping infrastructure, screening and microfiltration units, reverse osmosis units, brine pumping system and discharge line to ocean outfall, and storage tanks<br>• Pipeline from desalination plant to Bulahdelah (28 – 40 km inland from coast depending on route)<br>• Lift pump stations and balance tanks | Flexible to as required | • Approvals and permits<br>• Aquatic ecology – impingement and entrainment<br>• Aquatic ecology – reject discharge<br>• Community acceptance<br>• Land acquisition for desalination plant | • Construction through environmentally sensitive corridor (Wang Wauk State Forest) requiring underbore for significant lengths of pipe<br>• Feasible but impractical option for inland community due to significant infrastructure required for small community<br>• Large carbon footprint with high energy intensive operation of desalination plant and long pumping distance<br>• High operation and maintenance costs for desalination plant and transfer pipeline<br>• Requires upskilling and additional labour for plant operation<br>• Long lead time from planning and construction to operation<br>• May require easements for sections of pipeline | • Rainfall independent supply<br>• Reliable source of supply<br>• Proven technology<br>• Operation flexible to demand | $93.5M | Not assessed | Low – not considered a practical water security solution as significant distance from the coast |
| **Regional connection (pipeline from Manning via Smiths Lake)** | • Connection to Manning Water Supply scheme<br>• Scheme connects via pipeline from Smiths Lake<br>• Bulahdelah is integrated into the Manning scheme, supplied from Bootawa WTP and Nabiac Borefield<br>• Interconnection would allow Bulahdelah WTP to be decommissioned | • Approximately 35 km pipeline connecting Smiths Lake and Bulahdelah<br>• Lift pump stations and balance tanks<br>• Chlorine booster station<br>• Potential upgrades to trunk mains in southern Manning scheme and / or Smiths Lake reservoir | Entire township supplied from Manning, 2050 ADD 0.49 ML/d | • Increase in risk from impacts of natural disasters (such as bushfires leading to loss of power at pump stations)<br>• Environmental impacts along pipeline construction corridor<br>• Community acceptance for integrating Bulahdelah with Manning scheme | • Construction through environmentally sensitive corridor (Wang Wauk State Forest) requiring underbore for significant lengths of pipe<br>• Considerable carbon footprint with long pumping distance<br>• Potentially rainfall dependent solution dependent on water security solution for Manning<br>• May require easements for sections of pipeline | • Decommission Bulahdelah WTP, which may either reduce or offset operational expenses for new pipeline<br>• Reduced risk of water quality incidents as need for raw water extraction eliminated from Crawford River<br>• Potential to connect new customer along pipeline route such as Bungwahl | $59.0M | Not assessed | Low – no feasibility investigations completed, requires investigation of impact on network from increased demand in southern Manning |
| **Regional connection (pipeline from Manning via Nabiac)** | • Connection to Manning Water Supply scheme<br>• Scheme connects via pipeline from Nabiac<br>• Bulahdelah is integrated into the Manning scheme, supplied from Nabiac Borefield<br>• Interconnection would allow Bulahdelah WTP to be decommissioned | • Approximately 50 km pipeline connecting Smiths Lake and Bulahdelah<br>• Lift pump stations and balance tanks<br>• Chlorine booster station<br>• Potential upgrades Nabiac reservoir | Entire township supplied from Manning, 2050 ADD 0.49 ML/d | • Increase in risk from impacts of natural disasters (such as bushfires leading to loss of power at pump stations)<br>• Community acceptance for integrating Bulahdelah with Manning scheme | • Considerable carbon footprint with long pumping distance<br>• Reduces reliance on Nabiac borefield marginally for Manning water security, especially under drought conditions<br>• May require easements for sections of pipeline | • Decommission Bulahdelah WTP, which may either reduce or offset operational expenses for new pipeline<br>• Easy integration with Nabiac borefield due to low demand for Bulahdelah catchment<br>• Less constrained construction corridor with wider road reserves and flatter terrain in comparison with Smiths Lake connection<br>• Reduced risk of water quality incidents as need for raw water extraction eliminated from Crawford River<br>• Potential to connect new customer along pipeline route such as Coolongolook | $34.1M | $394K | Medium – no feasibility investigations completed, requires investigation of impact on Manning Scheme but 2050 ADD is relatively low |

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| Option | Description | Key Infrastructure | Additional Yield | Risks | Issues | Opportunities | CAPEX | OPEX | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| **Regional connection (pipeline from Tea Gardens)** | • Connection to Tea Gardens Water Supply scheme<br>• Scheme connects via pipeline from Tea Gardens<br>• Bulahdelah is integrated into the Tea Gardens scheme, supplied from Tea Gardens Borefield<br>• Interconnection would allow Bulahdelah WTP to be decommissioned | • Approximately 40 km pipeline connecting Tea Gardens and Bulahdelah<br>• Lift pump stations and balance tanks<br>• Chlorine booster station<br>• Potential upgrade to Tea Gardens reservoir and / or network | Entire township supplied from Tea Gardens, 2050 ADD 0.49 ML/d | • Potentially insufficient availability of water from borefield – extraction limitations<br>• Increase in risk from impacts of natural disasters (such as bushfires leading to loss of power at pump stations)<br>• Community acceptance for integrating Bulahdelah with Tea Gardens scheme | • Considerable carbon footprint with long pumping distance<br>• Some underbore required for pipeline | • Decommission Bulahdelah WTP, which may either reduce or offset operational expenses for new pipeline<br>• Reduced risk of water quality incidents as need for raw water extraction eliminated from Crawford River<br>• Potential to connect new customers along pipeline route such as North Arm Cove community | $23.6M | Not assessed | Low – no feasibility investigations completed, requires investigation of water security for Tea Gardens scheme with permanent additional demand from Bulahdelah |
| **Regional connection (water carting from Tea Gardens)** | • Water carting from Tea Gardens approximately 40 km via road<br>• Activated during times of emergency only, i.e., when river flow conditions are not ideal | • Infrastructure for receiving and unloading tankers at Bulahdelah | Required yield as per circumstances and availability at Tea Gardens | • Impact and / or delay of transport from unforeseen circumstances such as traffic accident, bushfire, etc.<br>• Dependent on availability of water supply at Tea Garden bores<br>• Potential for water contamination requiring additional disinfection<br>• Freight availability for prolonged periods | • Short-term supply solution<br>• Greenhouse gas emissions from daily use of freight | • Some flexibility in scaling yield to as required<br>• Cost-effective short term water security solution until long term solution implemented | Not assessed | | High – based on past implementation at Gloucester and Stroud in the 2019-20 drought |
| **Stormwater Harvesting** | • Stormwater collection and transfer to Bulahdelah off-stream storage to supplement extraction of raw water from the Crawford River<br>• Township of Bulahdelah bound by Myall River in the west, merging with Crawford River in the south, and highest elevation to east of town, falling towards the river. Existing stormwater infrastructure and topography indicate multiple small stormwater catchments that direct stormwater to the river via various routes. | • Multiple collection basins for each catchment<br>• New off-stream storage<br>• Pumping and transfer infrastructure from each collection basin to off-stream storage<br>• Potentially upgrade of WTP dependent on stormwater quality | High level modelling indicates 1220 ML/yr across the entire catchment with assumed 31% imperviousness | • Potentially poor water quality requiring a higher level of treatment<br>• Multiple small catchments<br>• Impact on receiving waterbodies from reduced flows<br>• Mosquito breeding at collection points and storage basins<br>• Catchment is predominantly rural and village residential with large lots, favourable for pervious ground profile | • Rainfall dependent water source<br>• High operation and maintenance costs<br>• Minimal growth in Bulahdelah for developer driven opportunities<br>• Significant infrastructure required for collection of stormwater<br>• Potentially requires large storage to capture flows during wet weather<br>• Requires reconfiguration of stormwater network to route stormwater to collection basins | • Utilisation of some existing stormwater network<br>• Flow attenuation in low flow events<br>• Reduced pollutants in natural waterways<br>• Potential for localised opportunities | Not assessed | | Low – very high-level investigation undertaken for stormwater yield |
| **Groundwater** | • Considers potential for groundwater sources in or near Bulahdelah<br>• Known private bores in community<br>• Sites identified in 1999 by PPK included drilling along the alluvial floodplain of the Myall River, upstream and downstream of Bulahdelah<br>• Of the three sites investigated, one of the sites included three test bores drilled in National Park 9 km downstream of Bulahdelah on the eastern side of Myall River which produced | If investigations deem option is feasible:<br>• Borefield<br>• Groundwater transfer pipeline to Bulahdelah WTP | Study concluded potential potable supply yield of 3 to 8 ML/day | • Approvals and permits<br>• Suitability of groundwater for potable water supply – impacts of farming and waste activities in the surrounding area<br>• Environmental impacts from extraction, specifically on nearby wetlands<br>• Potentially poor water quality requiring a higher level of treatment – high hardness and dissolved iron content identified in 1999 studies | • Long lead time for new borefield from planning and construction to operation<br>• Construction through environmentally sensitive corridor, Myall Lake National Park<br>• Highly likely rainfall dependent source – storage volumes uncertain as the bounds of fresh quality aquifer are unknown. Under non pumping conditions groundwater flows downvalley and towards Myall River. Recharge likely to be | | Not assessed | | Low – potential for groundwater identified, but studies are outdated and need to be reinvestigated to confirm source, yield, geotechnical conditions and hydrological aspects |

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| Option | Description | Key Infrastructure | Additional Yield | Risks | Issues | Opportunities | CAPEX | OPEX | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| | high yields from deeper fluviatile sand and gravel aquifers | | | | from upstream alluvial areas and from direct rainfall recharge through permeable dune sand cover across area.<br>• Potential for saltwater intrusion south and from tidal sections of river | | | | |
| **Reticulated Recycled Water** | • Dual reticulation network to supply both potable and recycled water for new development areas only<br>• Recycled water could be utilised for outdoor uses, toilet flushing and laundry purposes (i.e., for hot water) offsetting potable water demand for domestic uses<br>• Upgrade of Bulahdelah STP will be required with advanced water treatment for effluent treated to unrestricted public access standards in accordance with the Australian Guidelines for Water Recycling | • Advanced water treatment process including membrane filtration<br>• Transfer pumping infrastructure including pipelines to developments<br>• Additional storage for recycled water storage | Approximately up to 326 kL/d by 2050 (up to 16% of current effluent used for golf course irrigation in 2017-18, and 95% used in 2019-20 drought) | • Insufficient recycled water demand due to low growth<br>• Cross-contamination<br>• Public health risk due to potential for misuse of recycled water by customer<br>• Approvals and permits – specifically for land clearing adjacent to STP required for expansion<br>• Community acceptance | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse<br>• Only suitable for new residential developments (not practical to retrofit existing properties), can be discriminatory<br>• Partially rainfall dependent demand (outdoor use driven by day-to-day weather conditions)<br>• Developer driven, beyond Council's influence for implementation<br>• Increase in greenhouse gas emissions with increased level of treatment<br>• High operation and maintenance costs with dual network | • Rainfall independent yield<br>• Promotes community education and acceptance<br>• Effluent management<br>• Maintains aesthetic values during drought | $16,000 per dwelling including cost for treatment and distribution | Not assessed | Medium – not considered viable due to insufficient availability of effluent for recycled water use, both as a result of low growth and existing user intake during drought period |
| **Recycled Water for Restricted Use** | • Existing effluent management consists of supplying restricted recycled water to Bulahdelah Golf Course<br>• Option considers expansion of recycle water supply to new users for agricultural purposes with multiple farms and agricultural properties surrounding the township of Bulahdelah<br>• No major infrastructure upgrades are required | • Expansion of recycled water distribution network to new users | Approximately up to 326 kL/d by 2050 (up to 16% of current effluent used for golf course irrigation in 2017-18, and 95% used in 2019-20 drought) | • Insufficient recycled water demand due to low growth<br>• Users not guaranteed over longer term | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse during drought<br>• May require long pipelines for single users<br>• Rainfall dependent demand | • Rainfall independent yield<br>• Effluent management<br>• No upgrades required to treatment<br>• Increases reliability with increased number of users | Not assessed | | Medium – effluent available for new users, but insufficient availability during drought period based on existing user intake |
| **Recycled Water for Unrestricted Use** | • Upgrade of Bulahdelah STP to Australian Guidelines for Water Recycling for unrestricted use for open space irrigation<br>• Open spaces for irrigation may include Bulahdelah Showground and Jack Ireland Sports Complex | • New RTP with membrane filtration, chlorination and treated water storage tanks<br>• Transfer pumping infrastructure including pipelines<br>• Storage and recycled water irrigation infrastructure at end user sites (if Council owned and operated) | Approximately up to 326 kL/d by 2050 (up to 16% of current effluent used for golf course irrigation in 2017-18, and 95% used in 2019-20 drought) | • Existing uptake of potable water for sites negligible – insufficient for material impact on potable water demand<br>• Approvals and permits – specifically for land clearing adjacent to STP required for expansion<br>• Community acceptance | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse during drought<br>• Significant infrastructure required to maximise use<br>• Rainfall dependent demand<br>• Increase in operation and maintenance costs<br>• Increase in greenhouse gas emissions with increased level of treatment | • Rainfall independent yield<br>• Promotes community education and acceptance<br>• Effluent management<br>• Maintains aesthetic values during drought | Not assessed | | Medium – practical solution but low impact in offsetting potable water demand |
| **Recycled Water for** | • Substitution of flows downstream of Crawford River offtake point | • Upgrade of Bulahdelah STP to achieve water quality required to a level | Approximately up to 326 kL/d by 2050 (up to | • Approvals and permits – specifically for land clearing | • Insufficient availability of recycled water whilst | • Effluent management<br>• May improve river flow<br>• Adaptable to growth | Not assessed | | Low – no feasibility |

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| Option | Description | Key Infrastructure | Additional Yield | Risks | Issues | Opportunities | CAPEX | OPEX | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| **Environmental Flows** | for Bulahdelah WTP to enable greater extraction upstream<br>• Replacement flows supplied from Bulahdelah STP<br>• Replacement of flows to potentially enable increased extraction rates under normal conditions for storage in future off-stream storage dam<br>• Further studies will be required to determine the limitations on increased extraction and to determine the required substitution water quality for maintaining a healthy river system | appropriate for the ecosystem of the Crawford River<br>• Transfer pumping infrastructure including pipeline to river discharge<br>• Construction of additional off-stream storage as per 'Off-Stream Storage' option | 16% of current effluent used for golf course irrigation in 2017-18, and 95% used in 2019-20 drought) | adjacent to STP required for expansion<br>• Community acceptance<br>• Impact on river health and ecology from substitution flow<br>• Impact on river health and ecology from increased offtake | maintaining current level of effluent reuse<br>• May not improve yield / supply if river extraction limits are reached<br>• Potential high increase in operation and maintenance costs with increased level of treatment<br>• Requires additional off-stream storage to enable increased extraction<br>• Rainfall dependent water source for extraction<br>• Supporting legislation not fully developed | | | | investigations completed |
| **Purified Recycled Water** | • Expansion of Bulahdelah STP to advanced level treatment for indirect purified recycled water use<br>• Recycled water from STP redirected to future off-stream storage to mix with raw water extracted from Crawford River | • Upgrade of Bulahdelah STP to achieve advanced water quality including membrane filtration, reverse osmosis, UV advanced oxidation, and treated water storage tanks<br>• Transfer pumping infrastructure including pipeline to off-stream storage<br>• Construction of additional off-stream storage as per 'Off-Stream Storage' option | Approximately up to 326 kL/d by 2050 (up to 16% of current effluent used for golf course irrigation in 2017-18, and 95% used in 2019-20 drought) | • Community acceptance<br>• Failure at critical control points can result in severe public health consequences<br>• Approvals and permits – for purified recycled water plant, land clearing adjacent to STP required for expansion | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse<br>• Supporting legislation not fully developed<br>• Large carbon footprint with high energy intensive operation of recycled water plant<br>• Significant increase in operation and maintenance costs | • Effluent management<br>• Rainfall independent yield<br>• Increase in reliability of supply | Not assessed | | Medium – advanced treatment technically viable, but option is long-term solution requiring significant engagement with community for acceptance |

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## Long-list of options for Stroud Water Supply Scheme

| Option | Description | Key Infrastructure | Additional Yield | Risks | Issues | Opportunities | CAPEX | OPEX | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| **Off-Stream Storage** | • New additional off-stream storage dams adjacent to existing 50 ML dam at WTP site<br>• Based on 2009 concept design by NSW Dams & Civil<br>• Raw water supplied from Karuah River transported to existing sedimentation system<br>• Overflow from existing dam to new dams through interconnected dam system | • 2 x in-ground storage dams<br>• Valve pit arrangement or small pump station for each dam<br>• Upgrade of DN150 transfer pipe from river pump station to DN200 | Designed for 2 x 50 ML dam, equating to total additional 100 ML, but can be re-designed to as required | • Approvals and permits – environmental impacts not assessed<br>• Potential for severe consequences with dam failure<br>• Compliance with current legislation<br>• Low resilience option with no additional supply sources | • Rainfall dependent water source – extraction limited to favourable river flow conditions Stratification from poor water quality<br>• No allowance for staging – shared dam wall | • Land owned by Council<br>• Operational flexibility with integration with existing dam system | $9.4M | $21K | High – option developed to concept design stage by Dams & Civil in 2009 |
| **Additional On-Stream Storage** | • Existing natural weir on the Karuah River provides 17 ML storage<br>• Option considers raising the weir crest for additional storage | • Foundation excavation and weir construction to required level<br>• Modifications to fish passage structures | Requires further investigation | • Approvals and permits – environmental impacts to aquatic habitat and river<br>• Low resilience option with no additional supply sources<br>• Aquatic ecology – disruption to fish passage, reduced biodiversity<br>• River ecology – impact on riparian vegetation with likely increased inundation resulting in increased erosion and sedimentation, decrease in water quality<br>• | • Rainfall dependent water source – extraction limited to favourable river flow conditions<br>• Increased siltation upstream of weir | • Visual amenity creation such as wetlands | | Not assessed | Low – no investigations undertaken but has considerable potential for environmental impacts |
| **Duralie Mine Dam** | • Potential new water source<br>• Option to either:<br>○ Transfer directly to Stroud WTP for treatment and distribution<br>○ Utilise dam water to inject flow into Karuah River upstream of raw water offtake point for increased extraction | • Acquisition of dam from Duralie Coal<br>• Transfer pumping infrastructure including pipeline from mine dam to either Stroud WTP or river discharge point (approximately 17 km)<br>• Upgrade to treatment as required for additional treatment either at the WTP or before discharging to river based on further testing | Requires further investigation | • Approvals and permits – requires rigorous testing and investigation to confirm suitability for injecting directly into WTP or river<br>• Replenishment of dam water – availability, duration, source<br>• Aquatic ecology – impacts of dam water quality on receiving waterbody<br>• Suitability of dam water for drinking water standards<br>• Acquisition of dam – mine may be planned for continued operations for a long-term<br>• Community acceptance based on current socio-political sentiment towards dam projects | • Highly likely rainfall dependent water source – replenishment potentially dependent on rainfall<br>• Stratification of stored water from poor water quality<br>• May require easements for sections of pipeline | • Enhanced raw water quality management with availability of alternative water source when Karuah River conditions are unfavourable<br>• Low investment of CAPEX for significant storage and new water source<br>• Consideration for emergency measure if unsuitable for permanent solution | $9.7M for pipeline transfer | Not assessed | Low – no investigations undertaken, requires investigation into feasibility for conversion of dam to off-stream storage, water quality testing, water profiling for source of water through hydrological and geological investigations |
| **Desalination of River Water via Karuah River** | • Construction of a permanent packaged desalination plant<br>• Proposed location adjacent to existing Stroud WTP<br>• Raw water intake via existing offtake point<br>• Reject discharge to ocean towards Pacific Palms<br>• Treated water pumped for distribution from desalination plant via Stroud WTP | • Potential land acquisition near WTP<br>• Packaged desalination plant including river water intake and pumping infrastructure, storage tanks for flow attenuation, screening and microfiltration units, reverse osmosis units, | Flexible to as required | • Approvals and permits – extraction licence, ocean discharge<br>• Aquatic ecology – impingement and entrainment<br>• Aquatic ecology – reject discharge<br>• Community acceptance – impact to local industries dependent on river water from increased extraction | • Rainfall dependent water source – extraction based on river flow conditions<br>• Large carbon footprint with high energy intensive operation of desalination plant and long pumping distance for outfall<br>• High operation and maintenance costs for | • Easy integration into existing water supply system<br>• Proven technology<br>• Operation flexible to demand | | Not assessed | Low – no planning investigations completed but constrained by river flow conditions and requires outfall pipeline to ocean |

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| Option | Description | Key Infrastructure | Additional Yield | Risks | Issues | Opportunities | CAPEX | OPEX | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| | | and treated water storage tanks<br>• Brine pumping system and discharge line to ocean outfall (50 – 80 km depending on route) | | • Land acquisition for desalination plant | desalination plant and transfer pipeline<br>• Construction through environmentally sensitive corridor for reject discharge pipeline (Wang Wauk State Forest and Myall River State Forest)<br>• Requires upskilling and additional labour for plant operation<br>• Long lead time from planning and construction to operation<br>• May require easements for sections of pipeline | | | | |
| **Desalination of Sea Water** | • Construction of a permanent desalination plant near the coastline<br>• Located adjacent to proposed Pacific Palms STP<br>• Raw water intake and reject discharge via ocean<br>• Treated water pumped from coast to Stroud network for distribution | • Land acquisition nearby coast<br>• Desalination plant including sea water intake and pumping infrastructure, screening and microfiltration units, reverse osmosis units, brine pumping system and discharge line to ocean outfall, and storage tanks<br>• Pipeline from desalination plant to Stroud (50 – 80 km inland from coast depending on route)<br>• Lift pump stations and balance tanks | Flexible to as required | • Approvals and permits<br>• Aquatic ecology – impingement and entrainment<br>• Aquatic ecology – reject discharge<br>• Community acceptance<br>• Land acquisition for desalination plant | • Construction through environmentally sensitive corridor (Wang Wauk State Forest and Myall River State Forest)<br>• Feasible but impractical option for inland community due to significant infrastructure required for small community<br>• Large carbon footprint with high energy intensive operation of desalination plant and long pumping distance<br>• High operation and maintenance costs for desalination plant and transfer pipeline<br>• Requires upskilling and additional labour for plant operation<br>• Long lead time from planning and construction to operation<br>• May require easements for sections of pipeline | • Rainfall independent supply<br>• Reliable source of supply<br>• Proven technology<br>• Operation flexible to demand<br>• Can be extension of Bulahdelah Desalination option | $78.5M | Not assessed | Low – not considered a practical water security solution as significant distance from the coast |
| **Regional connection (pipeline from Hunter via Dungog)** | • Water sharing between Stroud Water Supply Scheme and adjacent LGA, Hunter Water<br>• Activated during times of emergency only and not for daily operation<br>• Scheme connects to Dungog via pipeline<br>• Further investigation required to determine feasibility of option along with consultation with Dungog Shire Council | • Approximately 24 km pipeline from Dungog to Stroud<br>• Lift pump stations and balance tanks<br>• Chlorine booster station<br>• Modifications to Stroud Road reservoir for flexibility to pump both to Stroud Road and Stroud water supply zones | Further investigation required into availability but required yield as per circumstances (2050 ADD 0.38 ML/d) | • Requires partnership with another regional Council<br>• Dependent on water security at Dungog, especially under drought conditions<br>• Increase in risk from impacts of natural disasters (such as bushfires leading to loss of power at pump stations)<br>• No control over asset or quality of water<br>• Environmental impacts along pipeline construction corridor<br>• Community acceptance for sharing between communities | • Considerable carbon footprint with long pumping distance<br>• Potentially rainfall dependent solution unless Dungog in the future is supplied from Belmont desalination plant<br>• Potential for shared operation and maintenance expenses with Dungog Shire Council for collection and / or treatment of water<br>• May require easements for sections of pipeline | • Potential to connect new customer along pipeline route<br>• Potentially increased social and economic benefits as a result of partnership | $16.2M | $163K | Low – no investigations undertaken; engagement required to determine viability of option |

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| Option | Description | Key Infrastructure | Additional Yield | Risks | Issues | Opportunities | CAPEX | OPEX | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| **Regional connection (water carting from Tea Gardens)** | • Water carting from Tea Gardens approximately 60 km via road<br>• Activated during times of emergency only, i.e., when river flow conditions are not ideal and dam storage level is low<br>• Option was implemented previously in the 2019-20 drought | • No additional infrastructure required | Required yield as per circumstances and availability at Tea Gardens (2050 ADD 0.38 ML/d) | • Impact and / or delay of transport from unforeseen circumstances such as traffic accident, bushfire, etc.<br>• Dependent on availability of water supply at Tea Garden bores<br>• Potential for water contamination requiring additional disinfection<br>• Freight availability for prolonged periods | • Short-term supply solution – impractical for prolonged periods<br>• Greenhouse gas emissions from daily use of freight | • Some flexibility in scaling yield to as required<br>• Cost-effective short term water security solution until long term solution implemented<br>• Successfully implemented previously<br>• Infrastructure for loading from Tea Gardens and unloading at Stroud in place | | Not assessed | High – based on investigations undertaken by Council in the recent droughts |
| **Regional connection (water carting from Gloucester)** | • Water carting from Gloucester via Stratford Mine Dam<br>• Activated during times of emergency only, i.e., when river flow conditions are not ideal and dam storage level is low<br>• Depending on quality of water, option considered for either:<br>  ○ dust suppression, roads maintenance and construction activities; or<br>  ○ supplementing flow for potable water by carting to Stroud STP for treatment and distribution | • Upgrade to treatment as required for additional treatment either at the WTP or before discharging to river based on further testing | Required yield as per circumstances and availability at Stratford Dam | • Approvals and permits – requires rigorous testing and investigation to confirm suitability for injecting directly into WTP or for non-potable use<br>• Impact and / or delay of transport from unforeseen circumstances such as traffic accident, bushfire, etc.<br>• Dependent on availability of water availability at Stratford Dam<br>• Suitability of dam water quality for purpose<br>• Freight availability for prolonged periods | • Short-term supply solution – impractical for prolonged periods<br>• Greenhouse gas emissions from daily use of freight | • Some flexibility in scaling yield to as required<br>• Cost-effective emergency measure<br>• Shorter distance in comparison with Tea Gardens | | Not assessed | Low – requires further investigation into Stratford Mine Dam as per Gloucester “Stratford Mine Dam” option |
| **Stormwater Harvesting** | • Stormwater collection and transfer to Stroud off-stream storage to supplement extraction of raw water from the Karuah River<br>• Township of Stroud bound by Karuah River on the western side and highest elevation to east of town, falling towards the river. Existing stormwater infrastructure and topography indicate multiple small stormwater catchments that direct stormwater to the river via various routes. | • Multiple collection basins for each catchment<br>• Pumping and transfer infrastructure from each collection basin to current off-stream storage (may require additional off-stream storage to be constructed to store stormwater when available)<br>• Potentially upgrade of WTP dependent on stormwater quality | High level modelling indicates 909 ML/yr across the entire catchment with assumed 29% imperviousness | • Potentially poor water quality requiring a higher level of treatment<br>• Multiple small catchments<br>• Mosquito breeding at collection points and storage basins<br>• Catchment is predominantly rural and village residential with large lots, favourable for pervious ground profile | • Rainfall dependent water source<br>• High operation and maintenance costs<br>• Minimal growth in Stroud for developer driven opportunities<br>• Significant infrastructure required for collection of stormwater<br>• Potentially requires large storage to capture flows during wet weather<br>• Requires reconfiguration of stormwater network to route stormwater to collection basins | • Utilisation of some existing stormwater network<br>• Flow attenuation in low flow events<br>• Reduced pollutants in natural waterways<br>• Potential for localised opportunities | | Not assessed | Low – very high-level investigation undertaken for stormwater yield, but requires either or both of significant storage and collection basins |
| **Groundwater** | • Considers potential for groundwater sources in or near Stroud<br>• Current water source for Stroud, Karuah River, falls within the Gloucester Basin groundwater source as per the Water Sharing Plan for the Lower North Coast<br>• 1999 PPK study did not identify any potential sites in the Stroud area | If investigations deem option is feasible:<br>• Borefield<br>• Potentially new WTP depending on location<br>• Groundwater transfer pipeline to Stroud WTP or supply reservoir | Requires further investigation | • Approvals and permits<br>• Availability of groundwater<br>• Suitability of groundwater for potable water supply<br>• Environmental impacts from extraction<br>• Potentially poor water quality requiring a higher level of treatment | • No prospective sites have been identified for Stroud region<br>• Long lead time for new borefield from planning and construction to operation | | | Not assessed | Low – requires an updated investigation into availability of groundwater in region |

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| Option | Description | Key Infrastructure | Additional Yield | Risks | Issues | Opportunities | CAPEX | OPEX | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| **Reticulated Recycled Water** | • Dual reticulation network to supply both potable and recycled water for new development areas only<br>• Recycled water could be utilised for outdoor uses, toilet flushing and laundry purposes (i.e., for hot water) offsetting potable water demand for domestic uses<br>• Upgrade of Stroud STP will be required with advanced water treatment for effluent treated to unrestricted public access standards in accordance with the Australian Guidelines for Water Recycling | • Advanced water treatment process including membrane filtration<br>• Transfer pumping infrastructure including pipelines to developments<br>• Additional storage for recycled water storage | Approximately up to 12 kL/d by 2050 (up to 90% of current effluent used for pasture irrigation in 2017-18, and 100% used in 2019-20 drought) | • Insufficient recycled water demand due to low growth<br>• Cross-contamination<br>• Public health risk due to potential for misuse of recycled water by customer<br>• Approvals and permits – specifically for land clearing adjacent to STP required for expansion<br>• Community acceptance | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse<br>• Only suitable for new residential developments (not practical to retrofit existing properties), can be discriminatory<br>• Partially rainfall dependent demand (outdoor use driven by day-to-day weather conditions)<br>• Developer driven, beyond Council's influence for implementation<br>• Increase in greenhouse gas emissions with increased level of treatment<br>• High operation and maintenance costs with dual network | • Rainfall independent yield<br>• Promotes community education and acceptance<br>• Effluent management<br>• Maintains aesthetic values during drought | 16,000 per dwelling including cost for treatment and distribution | Not assessed | Medium – not considered viable due to insufficient availability of effluent for recycled water use |
| **Recycled Water for Restricted Use** | • Existing effluent management consists of supplying recycled water for dairy cattle grazing to single user<br>• Option considers expansion of recycle water supply to new users for agricultural purposes<br>• No major infrastructure upgrades are required | • Expansion of recycled water distribution network to new users | Approximately up to 12 kL/d by 2050 (up to 90% of current effluent used for pasture irrigation in 2017-18, and 100% used in 2019-20 drought) | • Insufficient recycled water demand due to low growth<br>• Users not guaranteed over longer term | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse<br>• May require long pipelines for single users<br>• Rainfall dependent demand | • Rainfall independent yield<br>• Effluent management<br>• No upgrades required to treatment<br>• Increases reliability with increased number of users | | Not assessed | Medium – not considered viable due to insufficient availability of effluent for recycled water use due to existing user intake |
| **Recycled Water for Unrestricted Use** | • Upgrade of Stroud STP to Australian Guidelines for Water Recycling for unrestricted use for open space irrigation<br>• Open spaces for irrigation may include Stroud Showground and Stroud Public School | • New RTP with membrane filtration, chlorination and treated water storage tanks<br>• Transfer pumping infrastructure including pipelines<br>• Storage and recycled water irrigation infrastructure at end user sites (if Council owned and operated) | Approximately up to 12 kL/d by 2050 (up to 90% of current effluent used for pasture irrigation in 2017-18, and 100% used in 2019-20 drought) | • Existing uptake of potable water for sites negligible – insufficient for material impact on potable water demand<br>• Approvals and permits – specifically for land clearing adjacent to STP required for expansion<br>• Community acceptance | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse<br>• Significant infrastructure required to maximise use<br>• Rainfall dependent demand<br>• Increase in operation and maintenance costs<br>• Increase in greenhouse gas emissions with increased level of treatment | • Rainfall independent yield<br>• Promotes community education and acceptance<br>• Effluent management<br>• Maintains aesthetic values during drought<br>• Increases reliability with increased number of users | | Not assessed | Medium – not considered viable due to insufficient availability of effluent for recycled water use due to existing user intake |
| **Recycled Water for Environmental Flows** | • Substitution of flows downstream of Karuah River offtake point for Stroud WTP to enable greater extraction upstream<br>• Replacement flows supplied from Stroud STP<br>• Replacement of flows to potentially enable increased extraction rates under normal conditions for storage in future off-stream storage dam<br>• Further studies will be required to determine the limitations on | • Upgrade of Stroud STP to achieve water quality required to a level appropriate for the ecosystem of the Karuah River<br>• Transfer pumping infrastructure including pipeline to river discharge<br>• Construction of additional off-stream storage as per 'Off-Stream Storage' option | Approximately up to 12 kL/d by 2050 (up to 90% of current effluent used for pasture irrigation in 2017-18, and 100% used in 2019-20 drought) | • Approvals and permits – specifically for land clearing adjacent to STP required for expansion, pipeline Mill Creek crossing for STP to river discharge<br>• Community acceptance<br>• Impact on river health and ecology from substitution flow<br>• Impact on river health and ecology from increased offtake | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse<br>• May not improve yield / supply if river extraction limits are reached<br>• Potential high increase in operation and maintenance costs with increased level of treatment<br>• Requires additional off-stream storage to enable increased extraction | • Effluent management<br>• May improve river flow<br>• Adaptable to growth | | Not assessed | Low – no feasibility investigations completed |

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| Option | Description | Key Infrastructure | Additional Yield | Risks | Issues | Opportunities | CAPEX | OPEX | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| | increased extraction and to determine the required substitution water quality for maintaining a healthy river system | | | | • Rainfall dependent water source for extraction<br>• Supporting legislation not fully developed | | | | |
| **Purified Recycled Water** | • Expansion of Stroud STP to advanced level treatment for indirect purified recycled water use<br>• Recycled water from STP redirected to future off-stream storage to mix with raw water extracted from Karuah River | • Upgrade of Stroud STP to achieve advanced water quality including membrane filtration, reverse osmosis, UV advanced oxidation, and treated water storage tanks<br>• Transfer pumping infrastructure including pipeline to off-stream storage<br>• Construction of additional off-stream storage as per 'Off-Stream Storage' option | Approximately up to 12 kL/d by 2050 (up to 90% of current effluent used for pasture irrigation in 2017-18, and 100% used in 2019-20 drought) | • Community acceptance<br>• Failure at critical control points can result in severe public health consequences<br>• Approvals and permits – for purified recycled water plant, land clearing adjacent to STP required for expansion, pipeline Mill Creek crossing for STP to WTP | • Insufficient availability of recycled water whilst maintaining current level of effluent reuse<br>• Supporting legislation not fully developed<br>• Large carbon footprint with high energy intensive operation of recycled water plant<br>• Significant increase in operation and maintenance costs | • Effluent management<br>• Rainfall independent yield<br>• Increase in reliability of supply | | Not assessed | Medium – advanced treatment technically viable, but insufficient availability of effluent for recycled water use due to existing user intake |

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# Appendix D

# Coarse Screening Workshops

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# Appendix E

# Options Capital and Operating Cost Estimates

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# Appendix F

# Quadruple Bottom Line Analysis

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# Appendix G

# Water Yield Assessment Report

# Appendix H

# Financial Modelling Report

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# Appendix I

# Community Engagement Report

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# Appendix J

## 30-year Capital and Operational Plan

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# Appendix M

# Drought Contingency and Emergency Response Plan

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