



Mullumbimby Water Supply Strategy

Executive Summary



Final Draft Report for Public Exhibition

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Cover photo: Lavertys Gap weir, September 2018

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20-020 MULLUMBIMBY WATER SUPPLY STRATEGY					
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EXECUTIVE SUMMARY

Introduction

Mullumbimby's drinking water supply is sourced from the upper reaches of Wilsons Creek. Water is extracted from Lavertys Gap Weir on Wilsons Creek where it flows by gravity through an open channel, via a tunnel to the Mullumbimby water treatment plant (WTP) as shown on Figure 1. The channel and tunnel were the original raw water transfer system to the Mullumbimby Hydroelectric Power Station (now decommissioned). There is an emergency supply pipeline from the Rous County Council (RCC) bulk supply system with agreement to supply up to 0.5 ML/d to the lower areas of the Mullumbimby distribution system. The Mullumbimby water supply currently services approximately 1,620 residential properties (3,600 people) and 270 non-residential properties. Approximately 13 customers along Wilsons Creek Road are connected to the trunk main from the WTP.

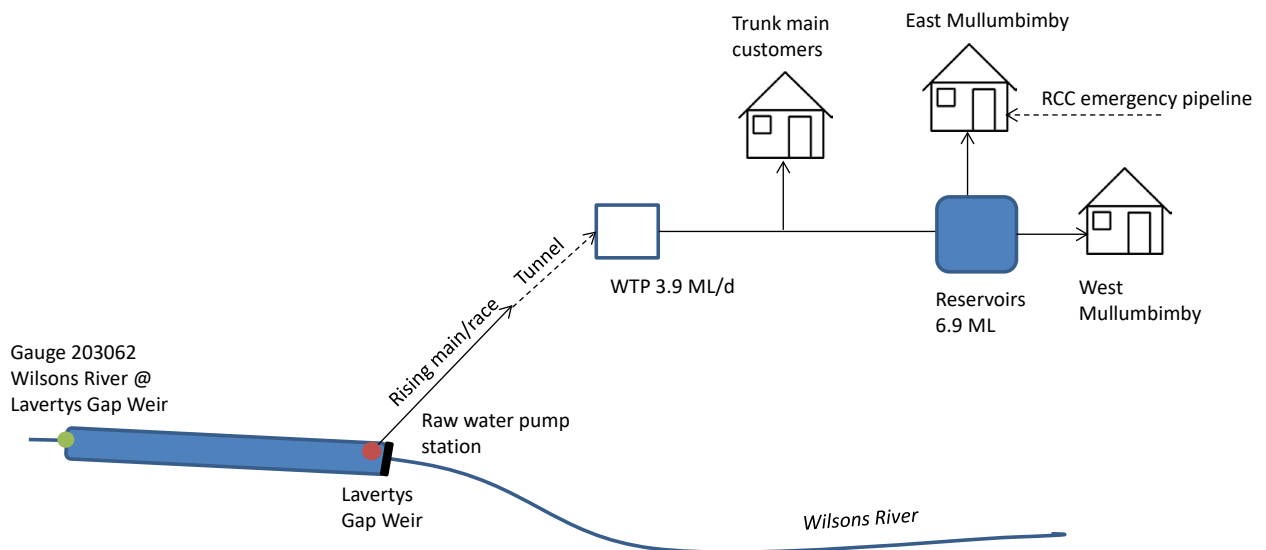


Figure 1: Mullumbimby water supply schematic diagram

Byron Shire Council (BSC) has engaged Hydrosphere Consulting to prepare a long-term strategy for Mullumbimby water supply. The key issue to be addressed is water supply security (servicing existing customers and future development over the long-term). The current demand for water is similar to the secure yield at Lavertys Gap Weir and if the worst drought on record were to repeat, the current supply would not meet demand. BSC has prepared growth management strategies for urban land, rural areas and business/industrial land which include future development that will increase the demand for potable water. The strategy also considers the following issues:

- Asset condition and performance - the raw water channel (constructed in the 1920s) has exceeded its useful life. The likelihood of failure is considered very high and on the basis that structural failure of the channel would cause extended interruption to the water supply, upgrading the raw water transfer system is a high priority while the weir supply continues to be used. In addition, due to the age of the Mullumbimby WTP (originally constructed in 1940), the WTP requires replacement in the next five to ten years. In addition, WTP upgrades are required to ensure removal of pathogens in the short-term.

- Drought management and emergency response - restrictions are currently introduced based on the water level and inflows in Lavertys Gap weir. Restrictions were imposed in Mullumbimby during the droughts of 2002/03, 2006/07 and 2019/20. An emergency supply from the Rous County Council (RCC) regional supply can supply water to lower elevation areas (East Mullumbimby) and was used for 30 days during summer 2019/20.
- Heritage considerations and management obligations - Lavertys Gap Weir and the channel (as part of the Mullumbimby hydro-electric power complex) are listed on the NSW State Heritage Register. In addition, the WTP has heritage significance at a local level.

This report assesses the security of the existing water supply system based on its secure yield and current demand. Options to increase the supply and reduce potable water demand have been identified and analysed and scenarios have been developed using combinations of the options to achieve the required secure yield in 2050. An integrated water cycle management (IWCM) approach has been used to compare options and scenarios and identify the preferred supply augmentation scenario to meet the predicted 2050 demand.

Security of Current Water Supply

'Secure yield' is defined as the highest annual water demand that can be supplied from a water supply headworks system whilst water restrictions are not too severe, not too frequent, nor of excessive duration. A model has been developed using GoldSim 12.1 (Monte Carlo simulation software) to simulate the Mullumbimby water supply and assess the secure yield for various Global Climate Models using the methodology prescribed by the draft *Guidelines on Assuring Future Urban Water Security* (NSW Office of Water, 2013). Water security is achieved if the secure yield of a water supply is at least equal to the unrestricted dry year annual demand.

The historical demand for potable water in a 'dry year' (a year with low rainfall) and an 'average year' (a year with average rainfall) were calculated using the data on existing customers and demand. The predicted residential, business and industrial development was used to estimate the additional number of future connected properties in Mullumbimby and the total demand over the next 30 years. Reduced water losses are predicted as a result of pressure reduction measures to be implemented as part of Council's water loss management program.

Mullumbimby's demand for water is increasing with development and population growth. The current (2020) and 2050 dry year unrestricted demand are compared to the secure yield in Table 1. The RCC emergency supply pipeline improves the water supply security although it is not intended to operate any more than an emergency supply. Assuming that water loss reduction measures are implemented and the emergency supply is available, the supply will be secure until 2027 (Figure 2). After this time, the existing system cannot meet forecast demand without the potential for more frequent, longer and severe water restrictions. The supply deficit at 2050 (excluding the emergency supply) will be 377 ML/a.

Table 1: Comparison of demand and secure yield

Component (ML/a)	2020	2050
Dry year unrestricted demand (including water loss reduction)	483	754
Secure yield - weir supply	440	377
RCC emergency supply	183	183
Total system yield	623	560
Supply deficit (excluding emergency supply)	+43	377

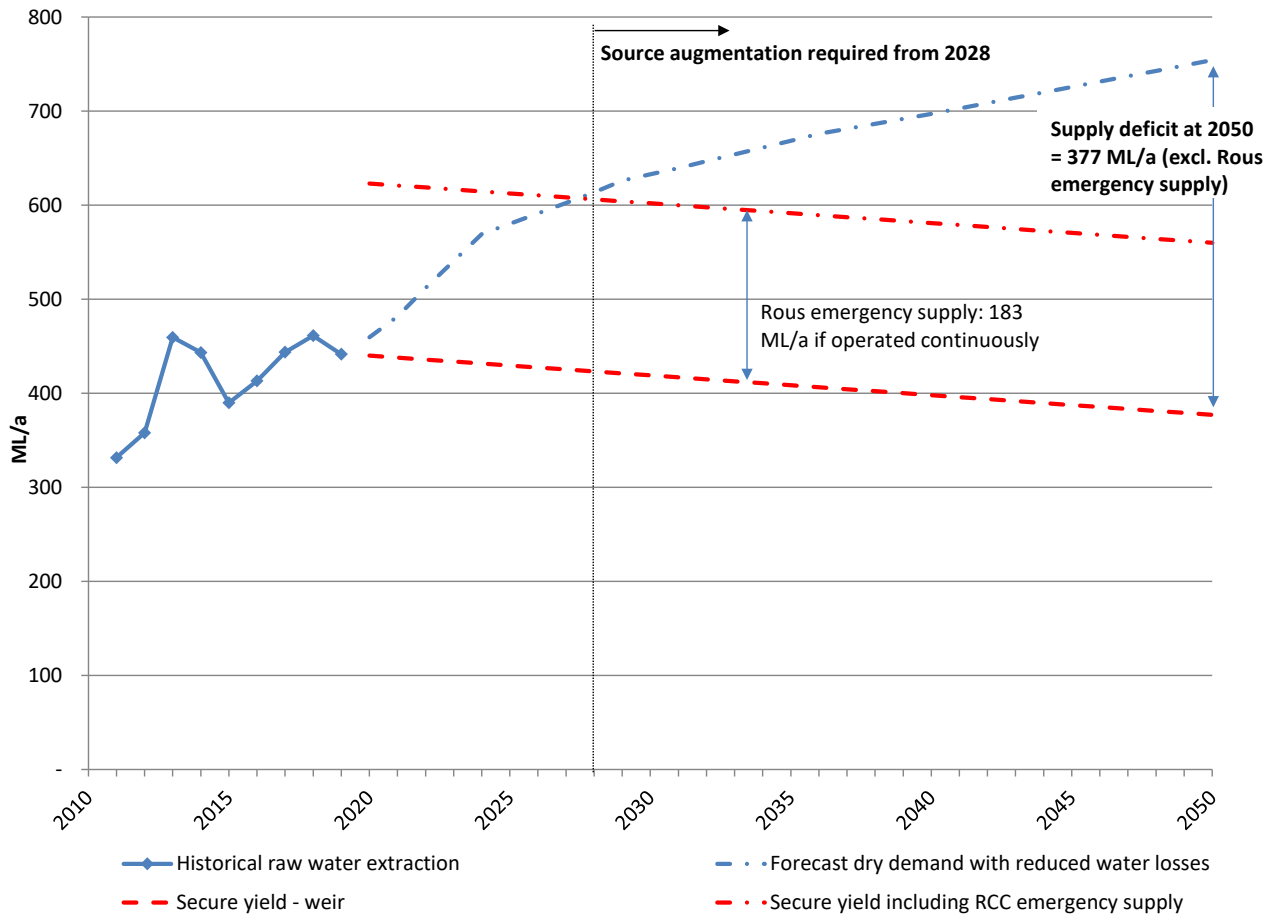


Figure 2: Comparison of forecast raw water demand and secure yield

Demand-Side Options

Implementation of demand-side options (demand management, urban effluent reuse and private supplies) will form part of the long-term strategy through the implementation of parallel initiatives including the NSW government BASIX program, BSC’s recycled water strategy (currently being reviewed and updated), the Regional Demand Management Plan (RDMP, including rainwater tank rebates, the Sustainable Water Partner Program, smart metering and community engagement and education) and Council’s water loss reduction measures. Increased drought restrictions are not proposed as part of the long-term strategy but may be required until water security is resolved.

Water Supply Options and Supply Scenarios

A coarse screening assessment considered a range of new as well as previously identified supply options. The following options passed the coarse assessment and are further assessed and discussed in detail in this report:

- Option 1. Do nothing (for comparison with augmentation options).
- Option 2. Raising Lavertys Gap weir.
- Option 3. Off-stream storage.
- Option 4. A: Permanent connection to the RCC bulk water supply.
B: Emergency connection to regional supply
- Option 5. Groundwater.

Following a detailed assessment of these options, Option 2 (raising Lavertys Gap weir) was not recommended for further consideration due to the minimal yield benefit, high costs and significant impacts on terrestrial biodiversity as well as downstream users and the environment.

Four scenarios have been developed from combinations of the remaining options that would achieve the required secure yield over the long term (754 ML/a, an increase of 377 ML/a at 2050). All scenarios include the following common components:

- Continued use of the weir supply and Mullumbimby WTP until the preferred source augmentation strategy is implemented.
- Short- term WTP upgrades to ensure consistent supply of microbially safe water until the preferred source augmentation strategy is implemented.
- Extension of the RCC emergency bulk water supply connection to service all Mullumbimby water supply customers to be used as a secure emergency response measure when required to supplement the weir supply (Option 4B).
- An increase in the Lavertys gap weir licence extraction limit (likely to be required from 2023 unless an alternative source is implemented).
- Review and update of the drought management plan based on the performance of the supply and drought management regime during the recent drought.
- Implementation of the demand management measures in the RDMP.
- Water loss reduction measures.
- Continued investigation of the long-term impacts of climate change on the secure yield of the weir supply.
- Resolution of the heritage management requirements for the weir, channel and WTP.
- Development of alternative supply options for the trunk main customers.
- Continued identification and implementation of urban effluent reuse opportunities (future demand will be reduced with potable water savings and yield deficit will be reduced accordingly).

No local options have been identified for Mullumbimby that do not require major infrastructure solutions. The potentially feasible water supply augmentation scenarios are (Table 2):

- Scenario S1: Base case: Improvements to the existing raw water transfer system, a new WTP and full emergency connection to the regional supply. This scenario would provide secure yield until 2027. Beyond 2027, restrictions may become more frequent and/or more severe.
- Scenario S2: Off-stream storage: Improvements to the existing raw water transfer system, full emergency connection to the regional supply, construction of a 200 ML off-stream storage and new WTP. High stream flows would be transferred to fill the off-stream storage. Water from the storage will be treated at the new WTP and transferred to the township.
- Scenario S3: Permanent connection to RCC regional supply: In this scenario, Mullumbimby would form part of the RCC regional supply network with bulk treated water transferred to the Azalea Street reservoirs.
- Scenario S4: Supplementary groundwater: Improvements to the existing raw water transfer system, a new WTP, full emergency connection to the regional supply, construction of new bores to the south-west of Mullumbimby with raw water transferred either to the weir or the new WTP for treatment and distribution to the township.

Table 2: Water supply scenarios

Scenario	S1	S2	S3	S4
Upgrade raw water transfer system from weir ¹	✓	✓		✓
WTP replacement	✓	✓		✓
Option 1 - Do Nothing	✓			
Option 3 - Off-stream Storage		✓		
Option 4A - RCC (permanent)			✓	
Option 4B - RCC (emergency extension)	✓	✓	✓	✓
Option 5 - Groundwater				✓

1. The preferred option to upgrade the raw water transfer system from the weir (for S1, S2 and S4) is a new pumped pressure pipeline following an alternative alignment that is independent of the channel.

Environmental Impacts

All surface water options considered for Mullumbimby (Wilson's Creek extraction for S1 and S2 and Rocky Creek extraction for S3) rely on existing infrastructure and extraction from the Richmond River system. Although there are significant initial impacts associated with dam and weir construction, the ecology within the storage area and downstream eventually adapts to the changed flow regime with subsequent loss of habitat for many native species. The terrestrial environments impacted by the existing surface water supplies have been modified through increased water level in the storages and land clearing to varying extents. All proposed supply augmentations for each scenario will require infrastructure development that is not expected to significantly impact on the terrestrial environment. Scenarios relying on groundwater supplies (S4 – potentially a local fractured rock groundwater supply and S3 – proposed future coastal sand aquifer

supply at Tyagarah) have the potential to impact on groundwater dependent ecosystems. However, these impacts are expected to be adequately managed through site selection and extraction regimes. Similarly, any impacts on the terrestrial environment due to establishment of groundwater sources are expected to be adequately managed through site selection.

The dominant environmental impacts are largely related to the existing water supply arrangements and are not expected to be altered with ongoing use of these supplies. The impacts of proposed system augmentation to achieve secure yield requirements (off-stream storage in S2 and groundwater in S3 and S4) are expected to be adequately managed.

Preferred Scenario

As the environmental impacts of the four scenarios are expected to be adequately managed, assessment of the scenarios to date has focused on security of supply and economic considerations. The water supply scenarios are compared in Table 3 on the basis of security of supply and costs.

Table 3: Comparison of supply scenarios

Scenario	Security of supply	Capital cost (2021\$) ¹	30-year operation and maintenance cost (2021\$) ¹
S1: Base case: Improvements to the existing raw water transfer system, a new WTP and full emergency connection to the regional supply and new WTP.	Secure until 2027. Beyond 2027, restrictions may become more frequent and/or more severe.	\$14,430,000 (weir supply, WTP, emergency supply)	\$4,862,000 (operation of weir supply)
S2: Off-stream storage: Improvements to the existing raw water transfer system, full emergency connection to the regional supply, construction of a 200 ML off-stream storage and new WTP.	A 200 ML storage is expected to provide a secure supply until approximately 2060.	\$35,830,000 (weir supply, WTP, emergency supply, 200 ML storage)	\$5,363,000 (operation of weir supply)
S3: Permanent connection to RCC regional supply: Mullumbimby would form part of the RCC regional supply network with bulk treated water transferred to the Azalea Street reservoirs.	The secure yield would be determined by the RCC bulk supply system, as with the remainder of Byron Shire.	\$4,264,000 (emergency supply, pipeline duplication)	\$20,910,000 (purchase of water)
S4: Supplementary groundwater: Improvements to the existing raw water transfer system, new WTP, full emergency connection to the regional supply, construction of new bores to the south-west of Mullumbimby with raw water transferred either to the weir or the new WTP for treatment and distribution to the township.	A supplementary groundwater supply with a yield of 1.1 ML/d is expected to provide a secure supply until 2050. Higher groundwater yields would reduce reliance on the weir supply and increase the security of the groundwater option.	\$18,149,000 (weir supply, groundwater bores, WTP, emergency supply)	\$5,497,000 (operation of weir and groundwater supply)

1. The costs do not include current operating costs, staff costs or costs of infrastructure modifications for heritage preservation as these are common to all scenarios.

A triple-bottom-line (TBL) assessment has been used to compare the scenarios (Table 3).

Table 4: TBL assessment criteria

Criteria	Description	Information used
Environmental (ranked considering the biodiversity management hierarchy - avoid, minimise, rehabilitate, offset)		
Aquatic	Impact on groundwater and surface water quality and aquatic ecology and measures to offset those impacts.	Aquatic biodiversity impacts (e.g. high value aquatic ecosystems, threatened species, water quality, groundwater dependent ecosystems) and offsets proposed (e.g. environmental flows).
Terrestrial	Impact on terrestrial ecology and measures to offset those impacts.	Terrestrial biodiversity impacts (e.g. high value terrestrial ecosystems, threatened species) and offsets proposed (e.g. stewardship/compensation).
Energy consumption	Energy requirements	Operational energy consumption (comparative).
Social		
Community acceptance	Predicted community acceptance	Community consultation has not yet been undertaken.
Security of supply	Year of augmentation required (following implementation of the scenario)	Secure yield assessment of each option.
Economic		
Net present value (NPV)	NPV of capital and operating costs (80 years) at 5% discount rate.	Estimated capital and operating costs.
Life-cycle cost	Total cost over 30 years	Estimated capital and operating costs.

A weighted score (higher is better) has been calculated for each scenario. Ranking has been calculated as follows:

$$(\text{Environmental Score} + \text{Social Score})/\text{NPV}$$

Weightings are assigned to each criterion based on relative importance so that the sensitivity of the weightings can be tested.

A summary of the TBL assessment (with equal weighting for each criterion) is provided in the following table. Changing the weightings does not change the outcomes of the multi-criteria analysis (MCA) ranking.

Table 5: Summary of MCA outcomes

Scenario	Weighted environmental score (/5)	Weighted social score (/5)	NPV (\$ million, 30 years @ 5%)	Total score (per \$ NPV)	Rank (based on MCA)
S1: Base Case	4.50	1.00	13.41	205	3
S2: Off-stream Storage	3.67	3.50	29.54	121	4
S3: Permanent connection to RCC regional supply	4.67	4.00	13.75	315	1
S4: Groundwater	3.67	3.25	15.78	219	2

Based on the TBL assessment, the most favourable scenario is S3: Permanent connection to the RCC regional supply (Figure 3). This scenario would have minimal environmental impact and the security of supply is only limited by the security of the RCC regional supply. Social acceptance of this scenario has not yet been determined but when other factors such as energy consumption, infrastructure modifications and required investment are considered, the regional supply has significant benefit over the local scenarios. The NPV of the regional scenario is the lowest of all scenarios. There are significant capital cost savings in avoiding the need to replace the Mullumbimby WTP and upgrade the weir supply in addition to constructing new infrastructure, however, the ongoing costs of a regional supply are higher than local scenarios.

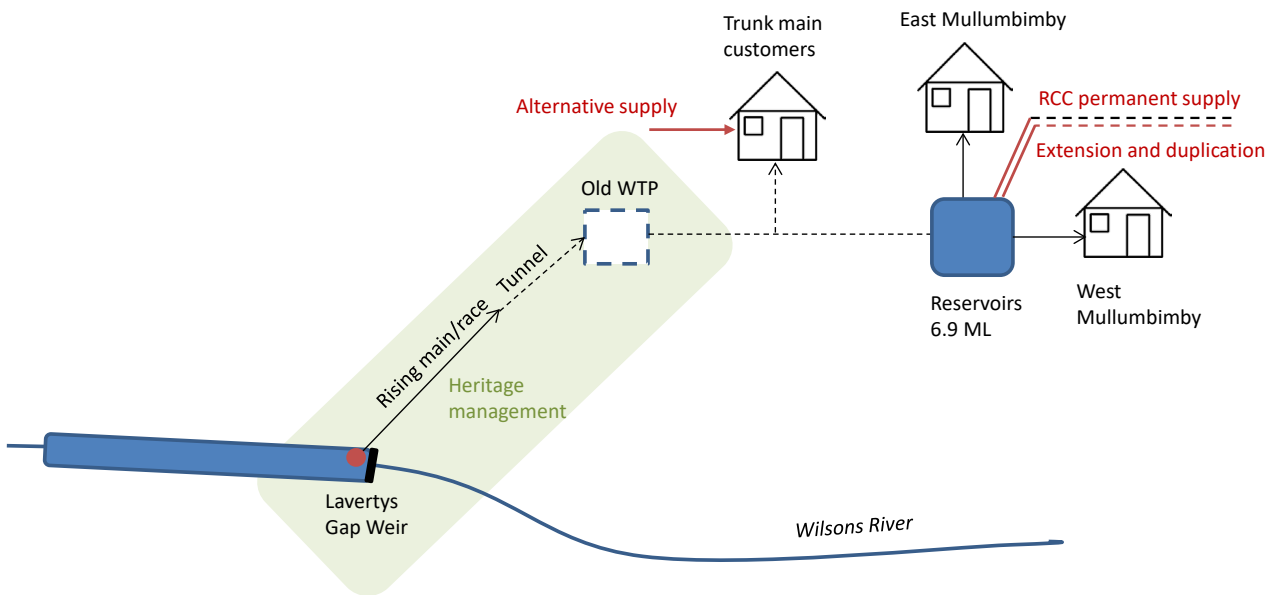


Figure 3: Preferred scenario S3: Permanent connection to RCC regional supply

The benefits of centralisation of water supplies and regional interconnection have been recognised in a previous study undertaken by the Northern Rivers Regional Organisation of Councils (now Joint Organisation) including improved financial outcomes through economies of scale, access to a wider range of options to improve efficiency, system resilience and operational flexibility. Financial benefits would result from regional opportunities for staging of water source development, increased flexibility in scheme development, reduced duplication of infrastructure and sharing of costs over a larger customer base. There is also the potential to reduce the risk of supply shortage in the region through supply diversity, supply

redundancy, climate resilience and system flexibility. A regional scheme also allows access to a wider range of options to improve environmental and social outcomes than a local scheme.

Implementation Plan

A secure water supply is critical to ensure the Mullumbimby community's health and quality of life as well as a sustainable environment and continued economic prosperity. Council has a duty to ensure that there is enough water available to meet the long-term needs of Mullumbimby. Based on the current demand and secure yield forecasts, investment in new water sources cannot be continuously deferred and by 2027 new sources of water will be required to meet the town's long-term water needs.

The Mullumbimby Water Supply Strategy includes a diversified portfolio of actions to meet the community's water needs based on connection to the RCC regional supply:

- Priority actions: improved drought resilience and treatment performance:
 - Emergency pipeline extension to service the whole town.
 - Duplication of RCC regional supply pipeline to provide supply redundancy.
 - WTP upgrades to ensure consistent supply of microbially safe water in the short-term.
 - Asset management planning for existing water supply assets that are not required as part of the regional scheme.
 - Drought management and emergency response planning.
 - Consultation with RCC, the community, trunk main customers, Essential Energy and government agencies regarding the preferred strategy and implementation requirements.
 - Heritage investigations to provide guidance on long-term maintenance and management of the weir, channel and WTP.
 - Financial planning to develop funding strategies and ensure affordability of the preferred scenario.
- Ongoing actions: reducing potable water demand including water loss management and the increased use of recycled water.

The expected delivery of the preferred scenario (capital and operating cost estimates and timing) is shown in Table 5. The cost estimates do not include staff time or existing strategic planning or operational expenditure which are not influenced by the preferred water supply strategy for Mullumbimby. The implementation plan assumes that the permanent connection to the regional supply will be available from 2025.

Strategic planning actions such as financial planning and demand management would be undertaken for all BSC water supplies as part of existing budgets and have not been included here. Effluent reuse opportunities are currently unknown and costs have not yet been estimated. These actions are part of Council's shire-wide water supply strategic planning and delivery and would be included in all future water supply scenarios.

On-going monitoring and review are required to ensure the strategy actions effectively resolve the identified issues. The Council-wide *Water Supply and Sewerage Strategic Plan* (draft, 2017) and financial plan should be reviewed to incorporate the adopted strategy for Mullumbimby water supply. Annual reviews of capital and operating expenditure and financial planning should also be undertaken.

Table 6: Mullumbimby water supply strategy implementation - cost estimates

Delivery Program year		Year 5	Year 1	Year 2	Year 3	Year 4	Year 1	Year 2	Year 3	Year 4	Year 1
Year		1	2	3	4	5	6	7	8	9	10
Action/cost estimate (2021 \$'000)	Ten-year cost	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Emergency pipeline extension - planning, design and approval	100	100									
Emergency pipeline extension - construction	1,182		1,182								
Pipeline duplication - planning, design and approval	100		150								
Pipeline duplication - construction	1,182			2,500							
Emergency water supply - purchase of water (allowance)	170	50	60	60							
WTP upgrades	330	106	112	112							
Regional water supply - purchase of water	4,800				650	660	670	690	700	710	720
Asset management planning	200		100	100							
Drought management plan review	50	50									
Consultation	170	50	50	50	20						
Heritage management	100		50	50							
Totals	9,751	356	1,704	2,872	670	660	670	690	700	710	720

Planning and approvals	Construction	Operation
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