Prepared for
MidCoast Council
ABN: 44 961 208 161

AECOM

Manning Water Supply Scheme

Coarse Screening of Water Security Options

08-Sep-2022
Coarse Screening of Water Security Options for the Manning Water Supply Scheme

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Client: MidCoast Council

ABN: 44 961 208 161

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List of Acronyms

Acronym	Term
DPE	Department of Planning and Environment
ET	Equivalent Tenant
IWCM	Integrated Water Cycle Management
LOS	Level of Service
RTP	Recycled Water Treatment Plant
STP	Sewage Treatment Plant
WTP	Water Treatment Plant

Executive Summary

MidCoast Council (Council) is currently reviewing its Integrated Water Cycle Management Strategy (IWCM). An issues identification process undertaken as part of this review re-confirmed there is insufficient secure yield for water supply in the Manning Water Supply Scheme.

The Manning Water Supply Scheme is Council's largest water supply, serving over 90 percent of the customers within the service area. Water security is a vital component of the strategy on which the livelihood of the community is dependent on.

Following completion of the issues identification phase, an assessment of demand management and source augmentation options is required. The coarse screening of water security options is the first step in this phase. AECOM was engaged to work in collaboration with Council to complete this task with an "all options on the table" approach.

A total of fifteen options were investigated to identify the key risks, issues and opportunities, prior to completing a coarse screening assessment based on a fatal flaw approach. A coarse screening workshop was undertaken with several Council stakeholders and each option was assessed against criteria based on Council's values and risks management framework. A total of sixteen options were ultimately addressed in this workshop. The outcome of each option is shown in Table 1.

Table 1 Outcomes of coarse screening process

Option No.	Description	Outcome
1	Augmentation of Bootawa Dam	Fail
2	Increase storage yield via new Peg Leg Creek Dam	**Pass**
3	Desalination of estuarine water at Nabiac Water Treatment Plant (mobile unit)	**Pass**
4	Desalination of sea water at Hallidays Point (permanent, when required)	**Pass**
5	Desalination of sea water at Forster (permanently in operation)	Fail
6	Recycled water for municipal irrigation, agricultural and construction use	**Pass**
7	Recycled water for non-potable use via dual reticulation	Fail
8	Recycled water for environmental flow replacement	Fail
9, 10	Purified recycled water for potable reuse (indirect and direct)	**Pass**
11	Stormwater harvesting and use from new Tuncurry development	Fail
12	Stormwater harvesting and use from other areas	Fail
13	Groundwater via Nabiac aquifer	**Pass**
14	Groundwater via alternative aquifer (Coastal Strip)	Fail
15	Interconnection with regional schemes (bulk transfer via road/rail)	Fail
16	Interconnection with regional schemes (new pipeline to Hastings / Port Macquarie)	**Pass**

Options which have passed the coarse screening process will proceed to the next phase of detailed feasibility assessment for further ranking and consideration in the development of water supply scenarios. Prior to this phase, it is recommended that Council addresses all aspects identified as 'unknown' in the shortlisted options to support efficient use of time and resources.

1.0 Introduction

1.1 Integrated Water Cycle Management

Integrated Water Cycle Management (IWCM) is a key criterion of the Best Practice Management Guidelines which guide effective and sustainable water supply and sewerage businesses. The IWCM Strategy:

- sets the objectives, performance standards and associated performance indicators for Council's water and sewer business
- identifies the needs and issues based on evidence and sound analysis
- ensures infrastructure matches needs
- determines the investment priority in consultation with the community and stakeholders
- identifies the 'best value 30-year' IWCM scenario on a social, environmental, economical and governance (quadruple bottom line) basis.

MidCoast Council is required to prepare a long-term IWCM strategy that integrates management of the water supply, sewerage and stormwater services within a whole of catchment strategy. The IWCM strategy is reviewed every four years with a major review every eight years.

In 2015, MidCoast Water undertook a comprehensive Integrated Water Cycle Management 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 provides Council with greater potential to implement true integrated water cycled management solutions, as they are now responsible for all sources of water, including stormwater, drinking water and beneficial reuse of treated water.

With a major review of the IWCM due in 2023, Council is currently reviewing their Integrated Water Cycle Management strategy. During the preceding issues identification phase (the '*Issues Paper*'), the Manning Water Supply Scheme was identified as having insufficient secure yield for water supply. Notably it does not meet the 5-10-10 rule which requires that water restrictions are in place for no more than 5% of the time, occur on average once every 10 years, and demand is not required to be reduced by more than 10%. In addition, the 2019/20 drought saw significant water restrictions (up to Level 4) imposed across the Council's service area for a period of over five months. This recent event highlighted the importance of robust, long term water security planning to support appropriate, affordable and sustainable water services.

This report summarises Part 1 of the optioneering phase and includes the approach and outcomes of a coarse screening assessment of the available supply augmentation and demand management options to improve long-term water security for the Manning Scheme.

1.2 Study Objectives

The objective of this study is to identify a short list of water security options for the Manning Water Supply Scheme using a coarse screening approach. The intention is for these options to progress to Part 2 of the optioneering phase for further investigation.

2.0 Background Information

This section outlines the current status of water source options either in use or investigated for use within the Manning Water Supply Scheme, including desalination, surface water storage, groundwater and recycled water. A literature review of supporting information and studies was completed. The intent of the review was to inform options for evaluation and highlight the knowledge gaps in the process at a high level. These gaps are included in the findings of the coarse screening workshop in Section 7.

2.1 2019/20 Drought

The 2019/20 drought triggered the longest continuous period of water restrictions in Council's service area, setting a new record with five months and 20 days between early September 2019 and February 2020. Level 4 restrictions were also introduced for the first time. Extraction from the Manning River ceased in October 2019 and levels in Bootawa Dam dropped to around 30%. (MidCoast Council, 2021) The situation was exacerbated further by the bushfires in November 2019 which contributed to the exceedance of water use targets set under restrictions. Multiple actions were implemented under Council's Drought Response Strategy, encompassing both demand and supply side management approaches. Water restrictions were introduced along with community education programs. Usage of recycled water was increased significantly for tasks ranging from stock watering to open space irrigation. Before the drought broke, Nabiac borefield expansion and emergency desalination projects were fast tracked to maximise Council's opportunities for securing the Manning Water Supply Scheme. The former is now officially being investigated for implementation with appropriate level of planning.

2.1.1 Temporary Desalination Plant

A temporary desalination plant was investigated by Hunter H2O for installation adjacent to the Nabiac Water Treatment Plant (WTP). Due to the severity of the drought conditions, this option was fast-tracked, and plans were progressed from ideation to construction over a short time frame under emergency provisions. A pipeline intended to service the desalination facility was partially completed before the drought broke and the project was shelved (Hunter H2O, 2020). Initial planning included transferring brine from the reverse osmosis units into the Wallamba River, however internal and external stakeholders raised concerns regarding the potential impacts on the environment from increased salinity levels in the river, particularly for the fishing industry (Hunter H2O, 2019). Note that mobile desalination units were in limited supply, with tough competition from neighbouring councils and limited supply in Australia.

2.2 Bootawa Dam Investigations

Bootawa Dam was constructed in 1968 and is located on an unnamed tributary of the Manning River, approximately 7.5 km southwest of Taree. The dam has a current surface area of around 1.1 square kilometres and has a current storage capacity of 2,250 ML. Several studies have investigated the raising of the dam by NSW Public Works, Dams & Civil since 2005, including a concept design developed by NSW Public Works in 2011 (NSW Department of Services, Technology & Administration, 2011). The report reviewed options for raising the embankment by 7 m at three different slopes: 2.5H to 1V, 3H to 1V and 4H to 1V, along with the provisional option of a parapet wall to raise overall storage volume by further 2 m. The proposed increase in storage level will augment the total storage capacity to 4,500 ML with the 7 m dam wall rise and 5,200 ML with the parapet wall. The 2011 cost estimates for each option were established with 20% contingency, ranging from $33M to $40M for different slope configurations.

An Aboriginal Cultural Heritage Assessment was prepared in 2013 to assess the potential impact of works on known and potential Aboriginal objects, places and cultural heritage values in consultation with four Aboriginal stakeholders (Virtus Heritage, 2013). No further relevant sites were identified beyond the two previously registered objects. The report noted that there was continued dispute between the Aboriginal stakeholder groups regarding the connection to the project, which could not be resolved. An environmental impact statement was also prepared in 2014 and concluded potential impacts could be managed with appropriate measures (NSW Public Works, 2014).

2.3 Peg Leg Creek Dam Investigations

Peg Leg Creek is situated off Clarkes Road in the small town of Tinonee. The area is primarily zoned 'Primary Production'. Potential sites for a new dam within the area were identified by NSW Public Works and a preliminary options investigation was undertaken by SMEC in 2016. The three options were each assessed for a number of crest levels for varying storage volumes. High-level costing was undertaken for single stage and multi-stage construction across all options.

Prior to the options investigation report, a preliminary Aboriginal archaeological assessment was undertaken in 2001 (Collins, 2001). The assessment was based on the two identified dam sites by NSW Public Works, albeit for different maximum crest levels. Advice and recommendations were made in consultation with the Local Aboriginal Land Council. No sites of Aboriginal cultural value were found within the area. In 2015, an Aboriginal Heritage Information Management System database search was undertaken for a 5 km radius from the project area, which found a total of 18 registered sites. It was noted that all sites need ground truthing and additional sites are likely to be found near the watercourse based on the pattern of the locality.

2.4 Groundwater Studies

A series of studies were conducted in 1999 for the Manning District Water Supply area which investigated several potential groundwater sites for augmentation or new supply of potable water. Seven sites were initially identified based on a desktop assessment which were assessed on water yield, impact on coastal environment and wetlands, expected water quality, point source pollution sources and extent of contamination (PPK Environment & Infrastructure, 1999). The Nabiac-Tuncurry Inland Dune and Wallamba River Alluvium sites were ultimately shortlisted by Department of Public Works for further investigation. The feasibility study determined the Wallamba River site had low potential for sustaining a borefield due to various factors and identified the Nabiac-Tuncurry site as a viable option pending further investigations (Douglas Partners, 1999), which was progressed to the current Nabiac borefield in operation.

The NSW Water Sharing Plan for the North Coast Coastal Sands Groundwater Sources (2016) formalises sharing arrangements and provides a consistent approach for water management. The plan lists an overview of the various coastal groundwater sources along the North Coast region including indicative volume of unassigned water for each site available for access through new licence approval from the Minister. Great Lakes Coastal Sands, which Manning Water Supply Scheme falls under, has an unassigned water volume of 13,755 ML per year as per the 2016 plan.

2.5 Recycled Water Schemes

Eight of Council's 14 sewage treatment plants are located within the Manning Water Supply Scheme area. Each of these STP's incorporates a recycled water service for onsite or offsite reuse. The three major recycled water schemes located within the Manning scheme are summarised below.

2.5.1 Dawson Sewage Treatment Plant

Treated effluent from the Dawson Sewage Treatment Plant (STP) is currently classified as low strength recycled water suitable for pastures and fodder crop production and approximately 441 ML/year is supplied to 13 farms in the region for this purpose. An average daily reuse volume of 0.9 ML/day was recorded in 2018/19.

2.5.2 Forster Sewage Treatment Plant

All treated effluent from Forster STP is discharged to the ocean. Only minor reuse of treated effluent occurs on site.

2.5.3 Hallidays Point Sewage Treatment Plant

Treated effluent from Hallidays Point STP is currently directed to the Tuncurry Recycled Water Treatment Plant (RTP) with excess flow discharged via exfiltration beds which have a total receiving capacity of 18 ML/day accounting for future expansion. The Tuncurry RTP uses membrane filtration and chlorination as advanced water treatment techniques to treat the effluent to a standard suitable for open space irrigation with unrestricted public access. The plant currently produces 3.5 ML/day of recycled

water, with provision for additional membrane filters to increase production to 7 ML/day. Existing users of Tuncurry RTP recycled water include Tuncurry Golf Course, cemetery, TAFE and high school, Sporties Club, and cricket ovals. An average daily reuse volume of 1.1 ML/day was recorded in 2018/19.

3.0 Basis of Planning

3.1 Basis of Assessment

3.1.1 Demand Forecast

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[1]. The 30-year residential forecast for the Manning scheme is presented in Figure 1. This data was obtained from MidCoast Council's water demand and population forecast projections. The 30-year demand forecast for the region supplied by the Manning scheme is presented in Table 2 (GHD, 2022). Current forecasts indicate that the total number of residential dwellings will increase by approximately 56 % over the 30-year period.

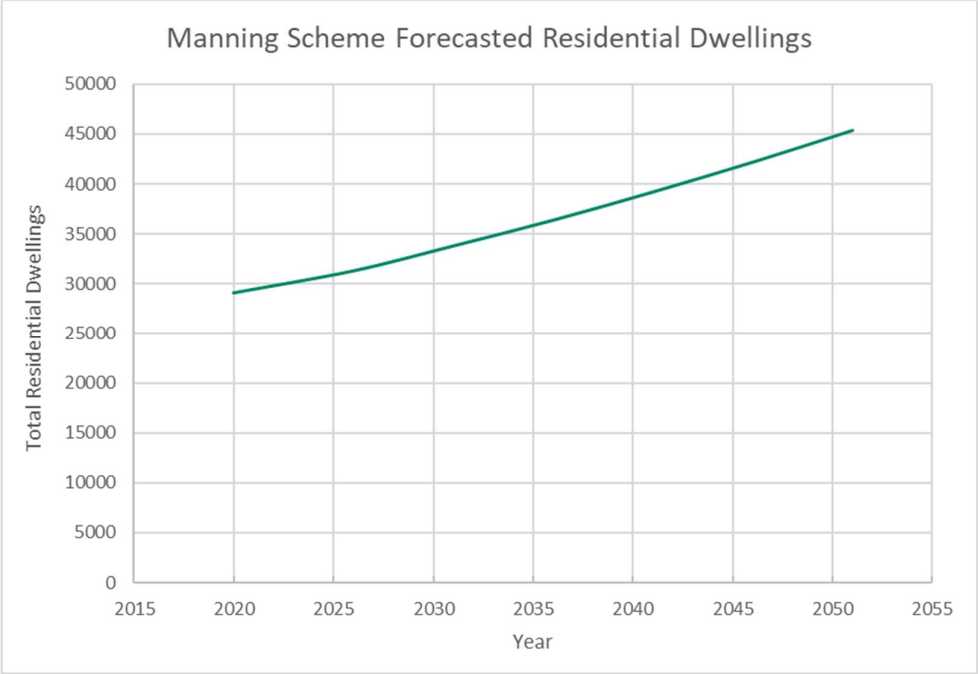

Figure 1 Manning Scheme 30- Year Forecasted Residential Dwellings

The Manning scheme demand forecasts are based on Council's 2019-2020 billing data (as the baseline year) to obtain ETs. Forecasts were estimated for future demands at 5-year increments that aligned with Census years, from 2026 to 2051, using Profile iD growth forecasts.

The 2019 - 2020 annual consumption was used to calculate average day demands. These demands included non-revenue water of 10%. The peak day demand was calculated by assigning a design peak day factor for each water supply zone (these factors were assigned based on the zone size, annual population variability and observed operational data). To complete the growth projections, new dwellings were applied 2,000 L/day for residential and 1,600 L/day non-residential peak day demands.

[1] At the time of reporting MidCoast Council derive population forecasts from id.com.au

Table 2 Manning Supply Scheme Demand Forecast

	2020	2051
Average Year Production, ML/year	6,799.7	12,813.4
Average Day Production, ML/day	18.6	35.1
Peak Day Production (scheme production requirements), ML/day	38.5	72.7
Peak Day Production (all network supply zones concurrently), ML/day	45.0	98.6

Sewerage scheme loading forecasts were obtained from Council's sewerage scheme demand spreadsheets. Demand forecasts are based on Council's 2019-2020 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. Peak dry weather flow factor 'd' was obtained from operational flow peaks. Wet weather flows were calculated using WSA 02. Table 2 shows projected loading for flows based on operational loading and growth projections.

A summary of sewage loadings for the three major sewage treatment plants is provided in Table 3 for use in recycled water investigations.

Table 3 Projected loadings for major STPs

STP	2021 ADWF ML/day	2021 PDWF ML/day	2021 ARI 2 ML/day	2021 ARI 5 ML/day	2051 ADWF Loading ML/day	2051 PDWF ML/day	2051 ARI 2 ML/day	2051 ARI 5 ML/day
Dawson	4.2	11.2	60.5	73.1	5.5	13.7	77.4	93.3
Hallidays Point	3.4	6.4	24.9	30.3	5.2	9.8	36.5	44.2
Forster	4.3	6.2	30.4	37.3	5.9	9.7	39.8	48.5

3.1.2 Level of Service

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 water security planning on the basis of:

- Total time spent in drought restrictions should be no more than 5 % of the time
- Restrictions should not need to be applied in more than 10 % of years and
- An average reduction of 10 % 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 design 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."

An assessment by NSW Urban Water Services in 2021 identified that there is insufficient yield for water supply security within the Manning Water Supply Scheme to meet this LOS rule.

At this level of options screening, the ability to determine the extent to which individual options comply with the above LOS rule is not possible however a qualitative consideration of reliability can be made. At a future stage of the project, and through scenario testing, the ability of options, or a suite of individual options, will require holistic water balance reliability (yield) modelling to determine compliance with this rule.

4.0 Assessment Approach and Criteria

4.1 Approach

The coarse screening process was based on a fatal flaw approach with each water security option assessed against the agreed 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 not scored due to lack of information, therefore progresses for further investigation

4.1.1 Financial Assessment

A high-level financial assessment was completed for each option to allow comparison. Existing cost estimates specific to the option were adopted where available. 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* (Department of Primary Industies, 2014) and from AECOM's experience with similar projects. Factors of 20% and 30% for survey, investigation, design and project management, and for contingency respectively were applied for all derived cost estimates. Indexation rates were applied to all options as necessary.

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

4.2 Criteria

The assessment criteria are provided in Table 4. The criteria were developed by the project team based on:

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

Table 4 Coarse Screening Assessment Criteria

Council Values	Council Risk Category	Indicator	Description and Objectives of Indicator
Wellbeing	Worker & public health and wellbeing	Health and wellbeing	Fit for purpose water quality - meeting legislative requirements Construction and operating/maintenance risks Delivering the option in a safe manner to customers - both during construction and in service delivery (operation)
	Service delivery and infrastructure	Availability	Available when it is needed, in drought or when demand is high (climate independent / dependent)
		Yield / beneficial to pursue / supply	Option will give either 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
		Practically viable	Option can be delivered by Council or with 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. Certainty over the planning and delivery pathways including timelines
	Financial Project budget	Cost - capital	Capital costs
		Cost - O&M	Operating and maintenance costs
Sustainability	Environment	Environmental impact	Impact to environment (during construction/delivery), including footprint of asset, clearing, flora/fauna, disturbance to and impacts of source water and water quality, 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)

5.0 Water Balance

5.1 Current System

A schematic of the Manning Water Supply Scheme is represented in the Figure 2below.

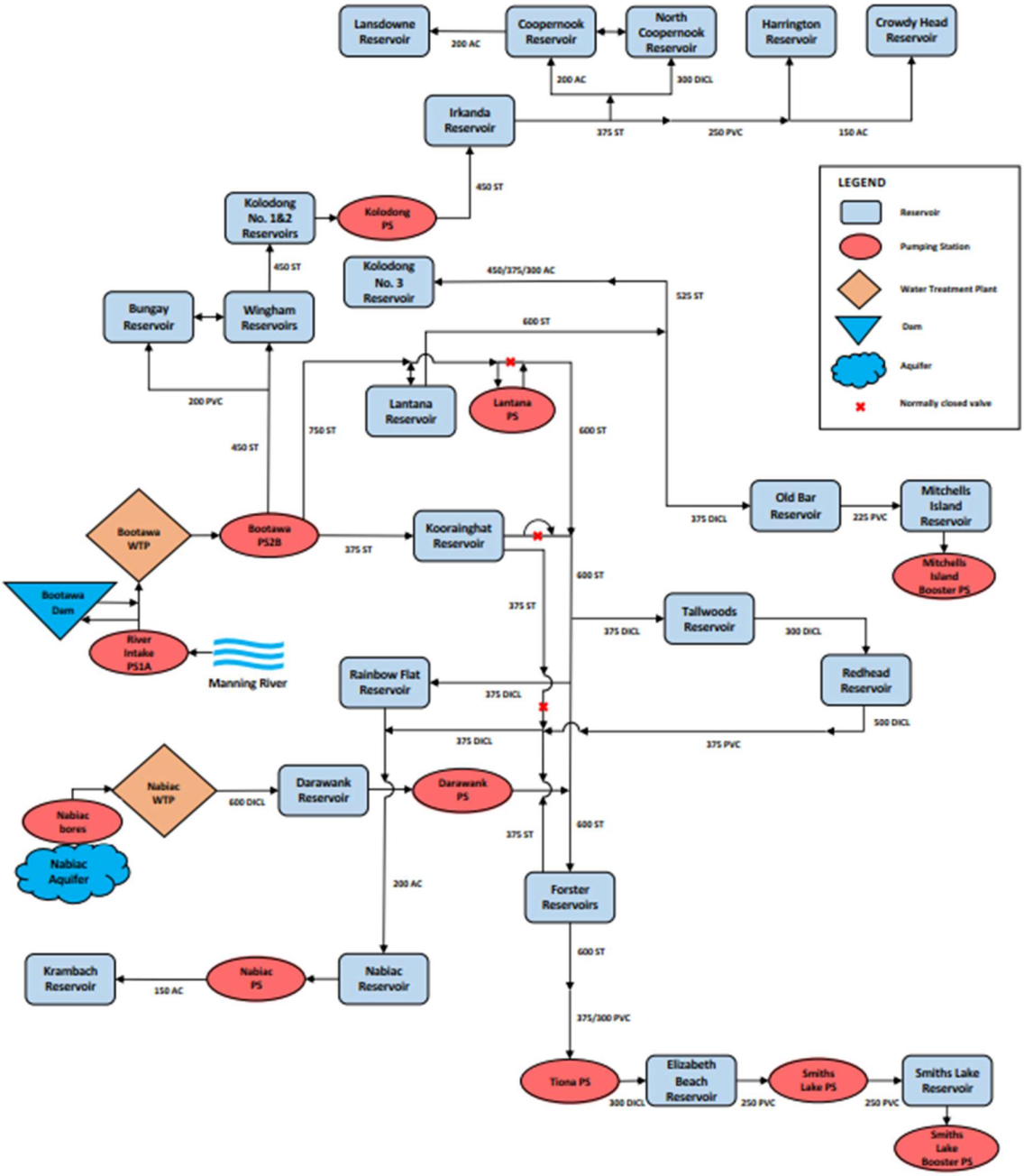

Figure 2 Overview of Manning Water Supply Scheme

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 3.

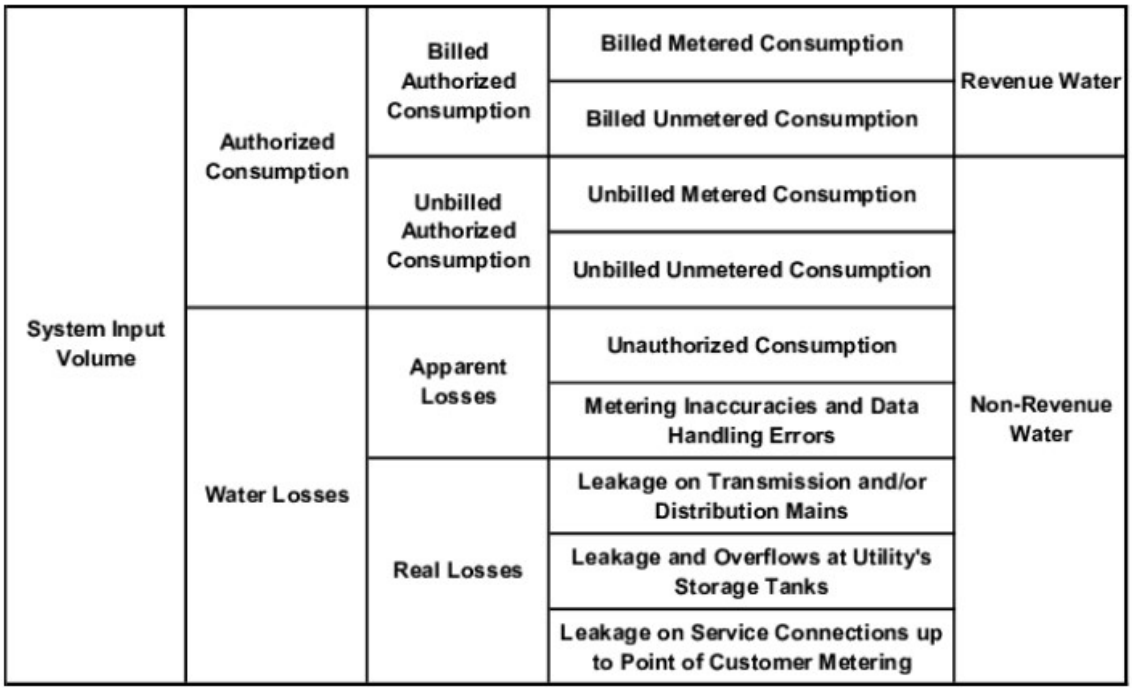

Figure 3 – Standard IWA Water Balance

Derivation of the water balance involved analysis of customer billing data for a 5-year period (FY 15-16 to FY 19-20). Customer billing data for revenue water is broken down as follows:

- Residential
- Commercial
- Industrial
- Institutional
- Public

Analysis of historical climate data and 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. The analysis demonstrated that average demand (in ML/day) remained relatively consistent with fluctuations in average yearly rainfall and with population increases over the 5-year period. This is displayed in Figure 4 and Table 5 below.

Table 5 Historical annual water demand and rainfall

Period	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020
Average Demand (ML/day)	21.5	22.1	22.1	21.6	19.9
Yearly Rainfall (mm)	1049	1154	834	679	933

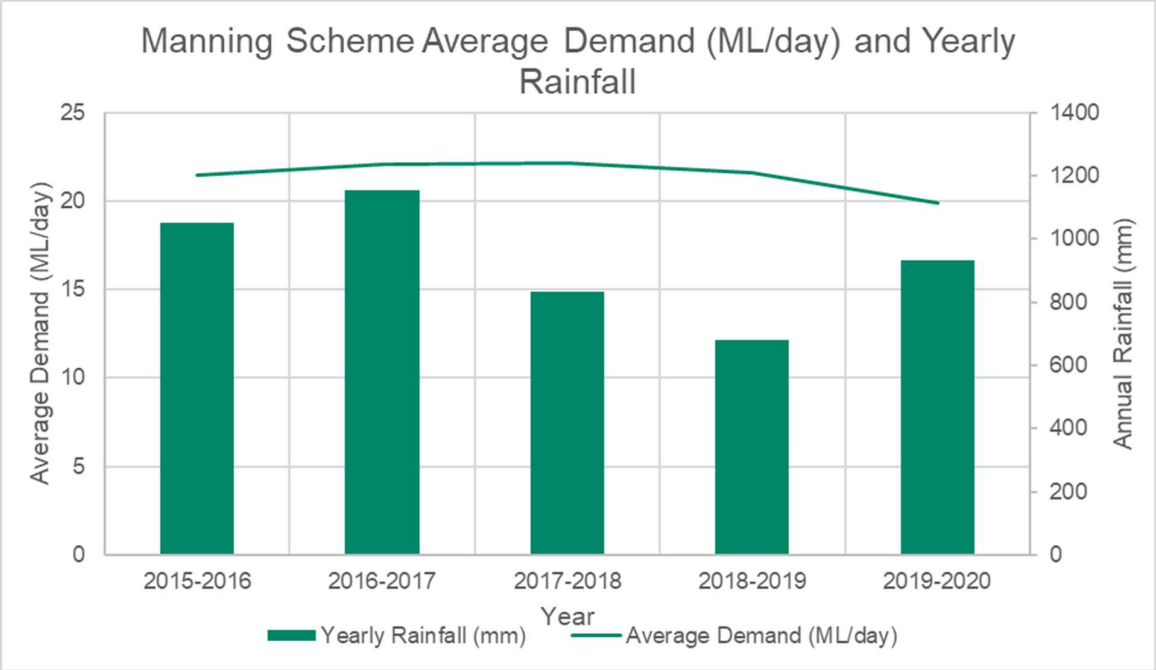

Figure 4 Historical annual water demand and rainfall

It is seen that, while population growth has continued (Figure 1 in section 3), demand for the scheme has remained relatively consistent over the past 5 years, with growth in new development fronts likely to have been offset by the installation of more efficient devices, and customer behaviour changes linked to Council's water saving education programs and water restrictions during the drought of 2019-2020.

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 analysis is included in Appendix A and summarised below. Figure 4 shows the annual rainfall for 2017 – 2018 and 2019 – 2020 as relatively consistent. However, 2019 – 2020 was a period of high variance of drought and rain. Based on this, the water balance was completed for 2017-2018, as this period was identified as a representative year of average climate from the analysed data. 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 - 2018 (141.6 kL/property) is lower than the 2017 - 2018 NSW state average (171.41 kL/property). Refer to Figure 5.
- Council's average annual water supplied per property (kL/property) was benchmarked against different LWU's in NSW of similar climate climate (annual rainfall). This benchmarking in terms of climate demonstrated that Council's demand (141. 6 kL/property) for 2017 - 2018 was below the average demand (161.6 kL/property) for LWU's of similar annual rainfall (averaging around 1000mm) for the 2017 - 2018 period (Coffs Harbour, Lismore Tweed Shire and MidCoast LWUs). Refer to Figure 6.
- Council's average water demand since 2013-2014 has been relatively stable, fluctuating between 139 kL/property and 15.5 kL/property. Refer to Figure 7.
- Council's non-revenue water per connected property for 2017 – 2018 is 75 litres/day/property, which is slightly lower than the 2017 – 2018 state average of 78 litres/day/property. Refer to Figure 8.

Generally, the transmission losses were identified as reasonable, as they are below the state average. These losses will continue to be targeted with Council's ongoing demand management programs. The focus therefore should be on customer side demand management for achieving gains in the system.

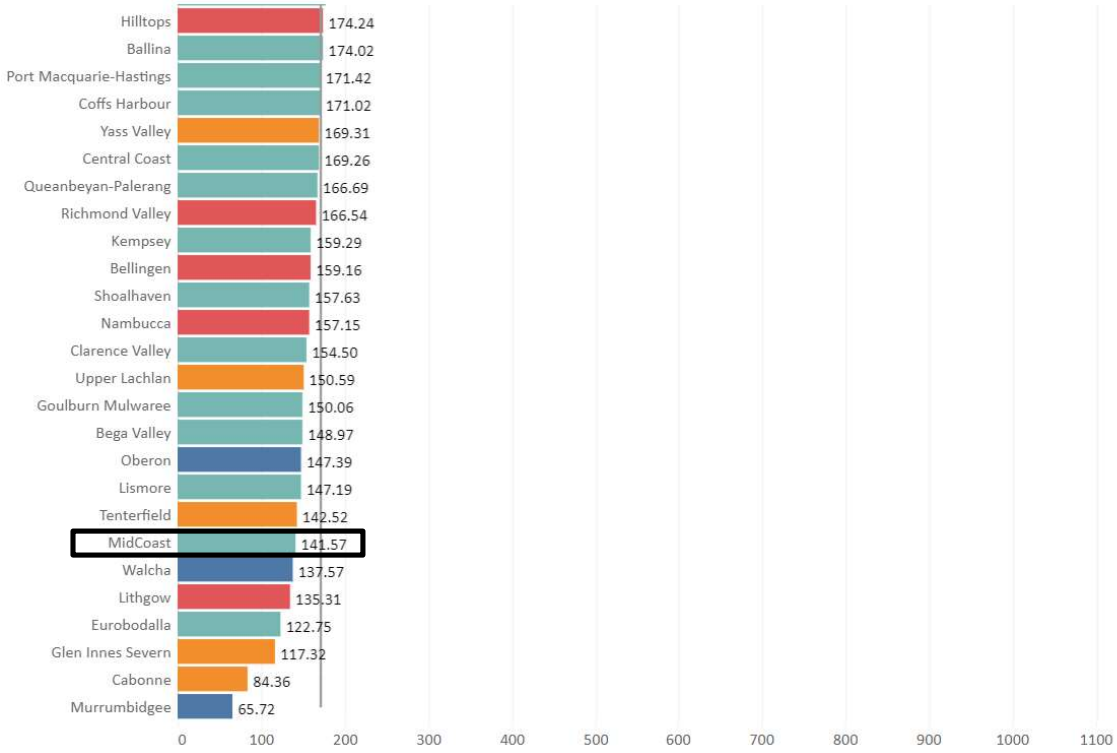

Figure 5: Average annual residential water supplied 2017 - 2018 (potable) (kL/property)

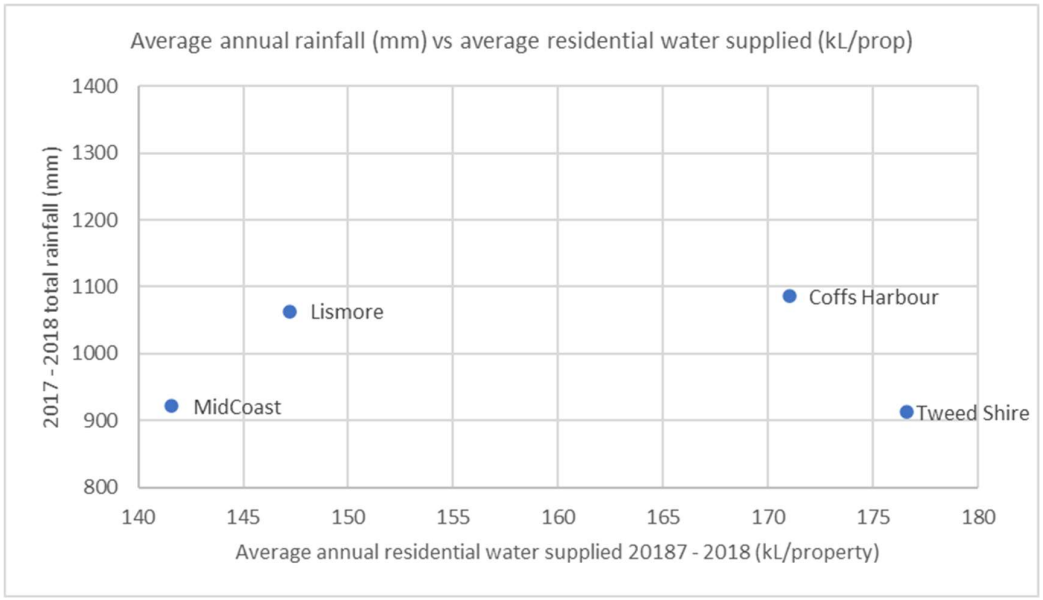

Figure 6 Comparison of average annual rainfall (mm) and 2017 - 2018average residential usage (kL/property)

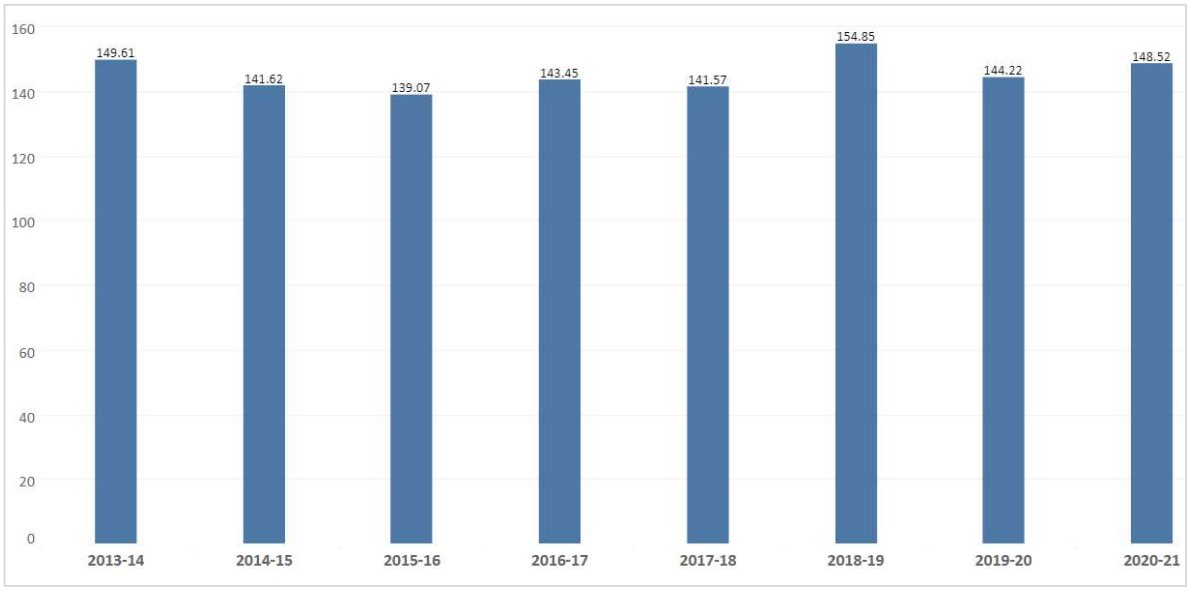

Figure 7 Average annual residential water supplied (potable) (kL/property)

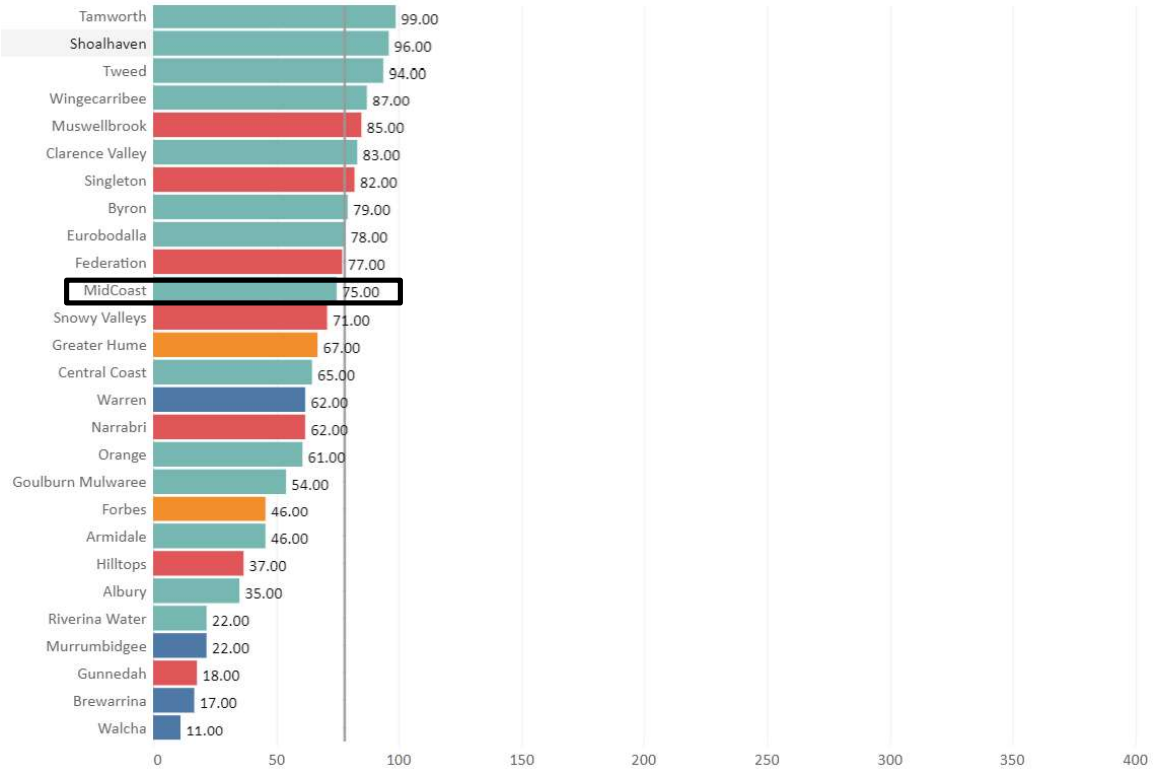

Figure 8 Non-revenue water (potable) 2017 - 2018 (L/day/connected property)

5.2 Opportunities for Demand Management

Based on the water balance analysis, it is determined that the best opportunity for demand management will come from customer side reductions. While demand management will have a minor impact on water security, overall demand reductions will give Council an opportunity to reduce water consumption and potentially delay infrastructure in the capital program.

Council has identified several demand management opportunities, including:

- Implementation of a smart meter program (currently in progress)
- Increased uptake of water efficient devices including rainwater tanks
- Ongoing community water education program
- Installation of bulk flow meters at strategic locations
- Leak detection programs

Council is targeting a 5% reduction in demand over the next three to five years, with an aim to see a 10% 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 9 and Figure 10, which shows projected annual demand (ML/year) with and without demand management targets.

There appears to be inconsistency in data to confidently estimate amount of non-revenue water in the water balance. It is recommended that meter calibration and interrogation of the data be completed as part of ongoing management. Nonetheless, Council will continue to target a reduction in leakage as part of Council's business as usual.

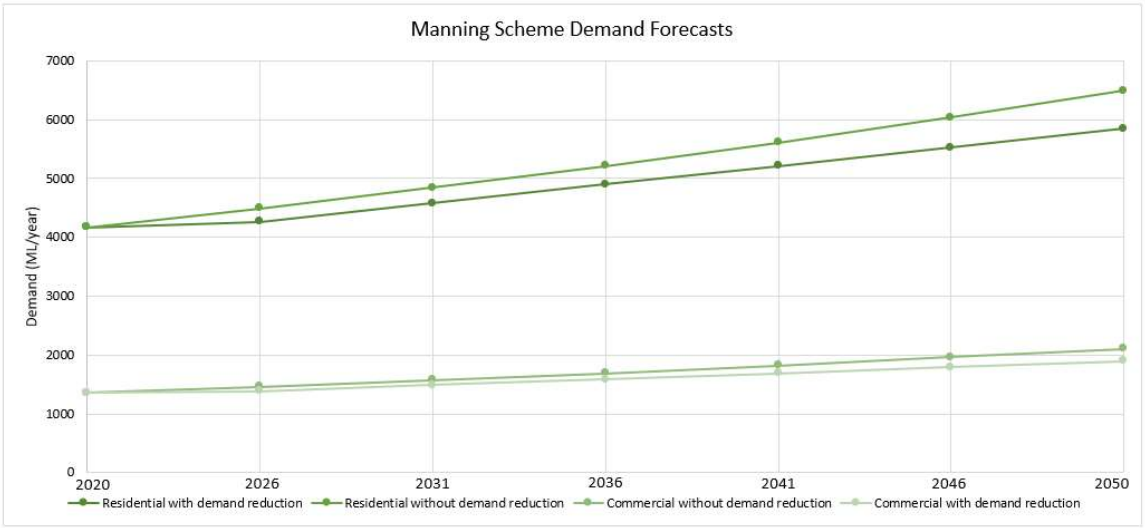

Figure 9: Manning scheme residential and commercial demand forecasts- with and without demand management targets

Figure 10: Manning scheme industrial, institutional and public demand forecasts- with and without demand management targets

Other opportunities to enhance customer demand management are also available and can be combined with Council's existing programs targeted at water literacy and awareness.

Another option to enhance customer demand management is the reintroduction of Council's Water Smart rebate program. 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. The opportunities and costs associated with re-introducing the scheme to promote the retrofit of rainwater tanks in existing properties warrants further investigation in the next phase of Council's water security planning.

6.0 Review of Options

An ‘all options on the table’ approach was adopted and a total of 15 options were identified through discussions with Council for assessment through the coarse screening process. The investigated options include:

1. Augmentation of Bootawa Dam
2. Increase storage yield via new Peg Leg Creek Dam
3. Desalination of estuarine water at Nabiac WTP (mobile unit)
4. Desalination of sea water at Hallidays Point (permanent, when required)
5. Desalination of sea water at Forster (permanently in operation)
6. Recycled water for municipal irrigation, agricultural and construction use
7. Recycled water for non-potable use via dual reticulation
8. Recycled water for environmental flow replacement
9. Purified recycled water for indirect potable reuse
10. Purified recycled water for direct potable reuse
11. Stormwater harvesting and use from new Tuncurry development
12. Stormwater harvesting and use from other areas
13. Groundwater via Nabiac aquifer
14. Groundwater via alternative aquifer (Coastal Strip)
15. Interconnection with regional schemes

The options are described in detail below, including an assessment of the risks, issues and opportunities and high-level cost estimates. Refer for Appendix B for high-level cost estimates developed for each of the options.

An additional option, being the inter-regional transfer of water from Port Macquarie Hastings via a new transfer pipeline was identified during the coarse screening workshop. An assessment of the risks, issues and opportunities associated with this option was not undertaken as part of this coarse screening process. Refer to Section 7.0 for further discussion on this option,

6.1 Option 1: Manning River – Augmentation of Bootawa Dam

This option involves augmenting storage at Bootawa Dam with a 7m raising of the dam embankment in a single stage construction based on the concept design completed in 2011. The capacity of the dam will essentially be doubled, providing up to 4,500 ML in storage with a provision for further expansion to 5,200 ML with a 2 m parapet wall. Varying slope configurations were considered in the design however no recommendations were made for a preferred configuration. The fill material for the earth fill type embankment will be sourced from borrow sites at the dam.

Principal items for the augmentation include:

- Raising of the main embankment
- Saddle dam across the existing spillway channel
- New spillway channel, intake tower and access bridge, penstock through the right abutment leading downstream of the tower base, valve house
- Excavated channel between the existing dam storage and the new intake tower
- Modification of existing inlet pipes and relocation of inlet structure, and access roads
- Decommissioning of the existing intake tower/outlet system

The concept design requires the lowering of dam storage levels to RL 49.0 m for the duration of construction (estimated 15 months) and to RL 45.0m for the upgrade of intake infrastructure (estimated at around three weeks). This equates to approximate total storage capacities of 51% and 25% respectively based on the original dam design capacity curve. This reduction in capacity would trigger Level 4 water restrictions (severe[2]) for the duration of the construction phase.

Given the reforms in dam safety with the introduction of Dam Safety Act 2015 and Dam Safety Regulation 2019, the design will need review to ensure the basis of design and the proposed modifications comply with current regulatory requirements.

[2] Level 4, severe water restrictions are triggered when dam level drop below 60%.

Risks

- Extraction limited to periods of favourable water quality and flow
- Water security during construction phase
- Compliance of proposed augmentation to current dam safety standards
- Environmental – potential loss of koala habitat
- Community / regulatory opposition, current socio-political sentiment towards proposed dam projects

Issues

- Long lead time
- Remains rainfall dependent
- Cultural heritage artefacts
- Site geology – weathered rock
- Impact to known Aboriginal cultural heritage sites
- Low resilience – no additional source flexibility

Opportunities

- Utilises existing infrastructure
- Provision for future expansion (2m parapet wall)
- Improvement in river flow – extraction over longer periods with greater available storage volume

Additional Yield	2,250 ML (7m raising)
Capital Cost	$40.3 M to $48 M
Operational Cost	$381 per ML of treated water
Level of Confidence	High – concept design report completed, and preliminary environmental impact assessment undertaken

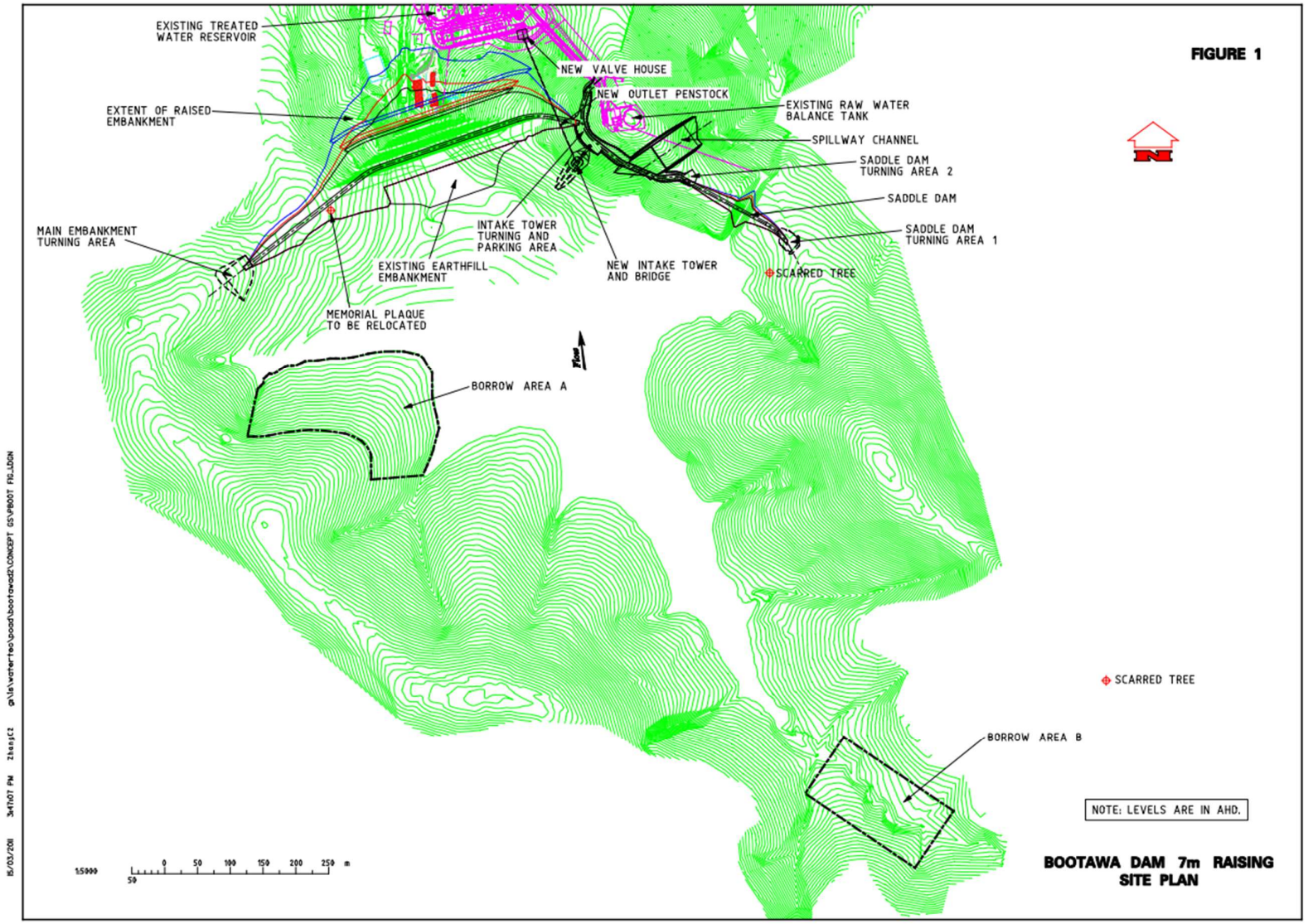

Figure 11 Option 1 Bootawa Dam raising (NSW Department of Services, Technology & Administration, 2011)

6.2 Option 2: Manning River – New Peg Leg Creek Dam

This option involves the construction of a new off-river storage dam on the perennial Peg Leg Creek in Tinonee. The analysis of this option is based on detail provided in the preliminary options investigation report (SMEC, 2016). At this time three options were investigated, each at varying crest levels with potential storage volumes ranging from 7,000 ML to 27,000 ML. Options for staged construction of the dam were also explored. In this option the earth fill dam would receive raw water supplied from the Manning River via the existing extraction infrastructure. Raw water would then be transferred to the Bootawa WTP for treatment via a new pipeline of approximately 10 km in length.

The proposed sites are situated on land partially owned by Council and over a relatively complex geological area with a shallow soil profile overlying a deep weathered rock profile. While no recommendations for a preferred option were made, a central staged raising methodology was identified as being the most suitable for the site.

Principal items for this option include:

- Earth and rockfill embankment
- Spillway channels
- Inlet and outlet structure including intake tower, and inlet and outlet pipework
- Saddle dams
- Pumping system and pipeline for transfer from Manning River
- Pumping system and pipeline for transfer to Bootawa WTP

Risks

- Environmental approvals and permits associated with greenfield site (state forest)
- Encroaches state forest
- Extraction limited to periods of favourable water quality and flow
- High probability for cultural heritage sites
- Community / regulatory opposition, current socio-political sentiment towards proposed dam projects

Issues

- Long lead time
- Rainfall dependent
- Large carbon footprint
- Increase in construction costs with complex geology
- Availability of fill material
- Easements through private property for pipelines

Opportunities

- Flexibility in staging and future expansion
- Enhanced stored raw water quality management
- Increased resilience for Bootawa Dam
- Offset costs – potential for energy resource (hydropower)

Additional Yield	7,000 ML to 27,000 ML
Capital Cost **Operational Cost**	$89.6 M to $268.2 M $381 per ML of treated water (plus additional costs of pumping between sites)
Level of Confidence	Medium – preliminary options investigation completed but further works required on geotechnical conditions, hydrological aspects, approvals, material availability, and environmental impacts

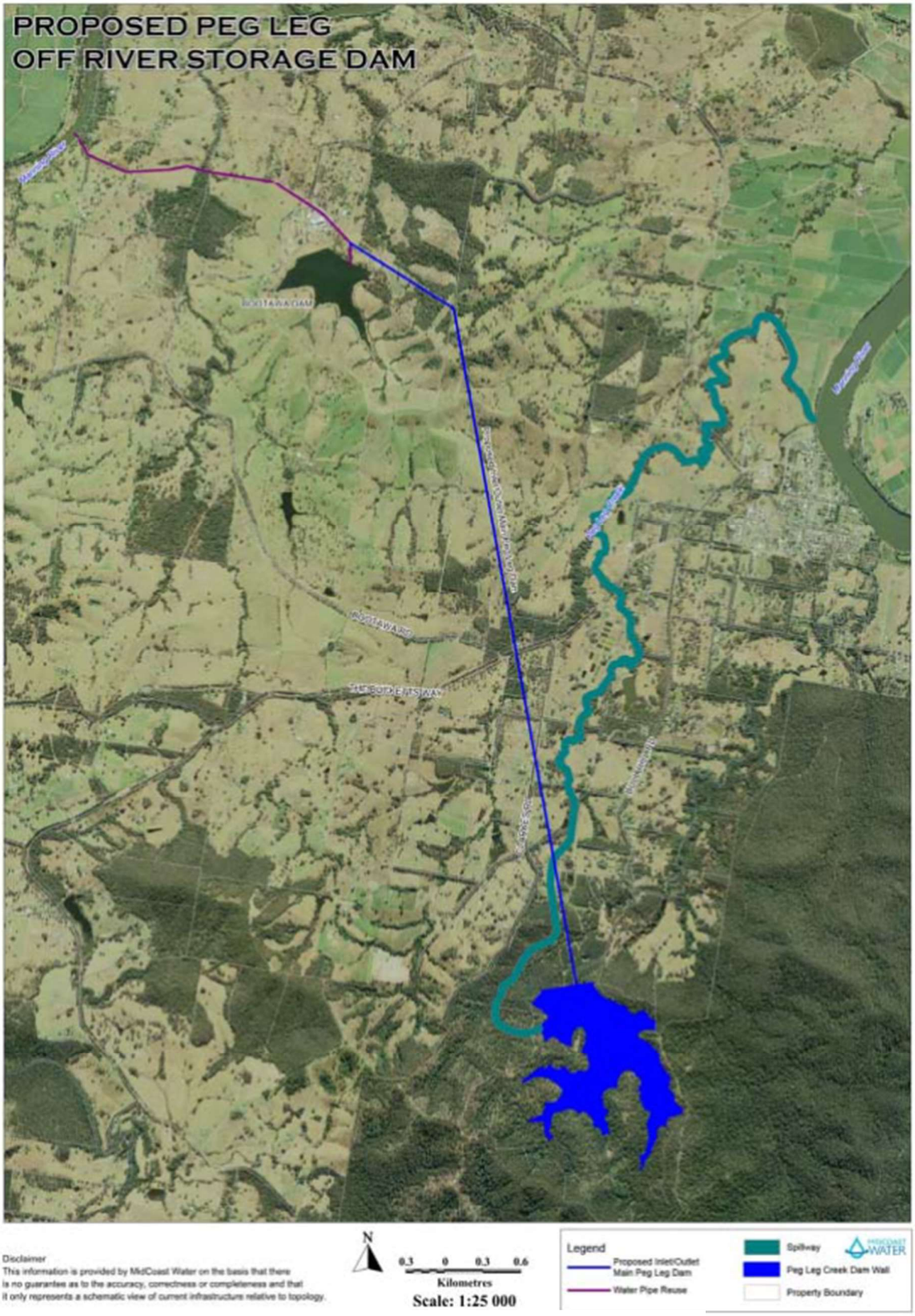

Figure 12 Option 2 New Dam Peg Leg Creek (Smec, 2016)

6.3 Option 3: Desalination of Estuarine Water

This option involves extraction of estuarine water from the Wallamba River and treatment via a packaged desalination plant adjacent to the Nabiac WTP during periods of drought only. Based on the work completed by Council in the 2019/20 droughts, this option will require intake from the river and treatment through mobile desalination units. Permeate from the desalination unit would be fed into the Nabiac WTP and discharged into the water network for distribution. Based on stakeholder feedback during preliminary investigations, brine would be discharged via extension of the pipeline constructed during the 2019/20 drought to a new ocean outfall located off Nine Mile Beach.

The plant will be activated for emergency response only during times of drought. Desalination units would need to be procured accordingly, however the infrastructure to support the units will be designed and delivered upfront for preparedness.

Principal infrastructure items include:

- River intake and raw water pumping infrastructure on the Wallamba River
- Network of tanks for attenuation of flow situated on hardstand or in-ground with connecting pipework
- Mobile desalination unit such as microfiltration and seawater reverse osmosis units
- Generator for emergency power supply
- Permeate lines to Nabiac Water Treatment Plant
- Reverse osmosis brine pumping system
- Discharge line to ocean outfall extending from the original constructed discharge pipeline

Risks

- Availability of units
- Impacts on marine ecology and environment from increased salinity levels
- Approvals for ocean outfall
- Availability of required skillset for RO plant operation

Issues

- Easements through private property for pipelines
- Construction through environmental corridors
- Not fully rainfall independent
- Availability of resources for plant operation
- Large carbon footprintHigh operational scost
- Energy requirements – limited supply to site,

Opportunities

- Renewable energy – solar farm to offset supply to site
- Easy integration into supply system

Additional Yield	8 ML/D (based on HunterH20 design report)
Capital Cost **Operational Cost**	$12.1 M scaled based on Council's investigation and similar emergency desalination plants in Australia $1.1 M ongoing per month, scaled based on Council's investigations
Level of Confidence	Medium – some planning completed, but requires further assessment of environmental constrains and impacts, market research for suitable vendors, power supply constraints and revision of design

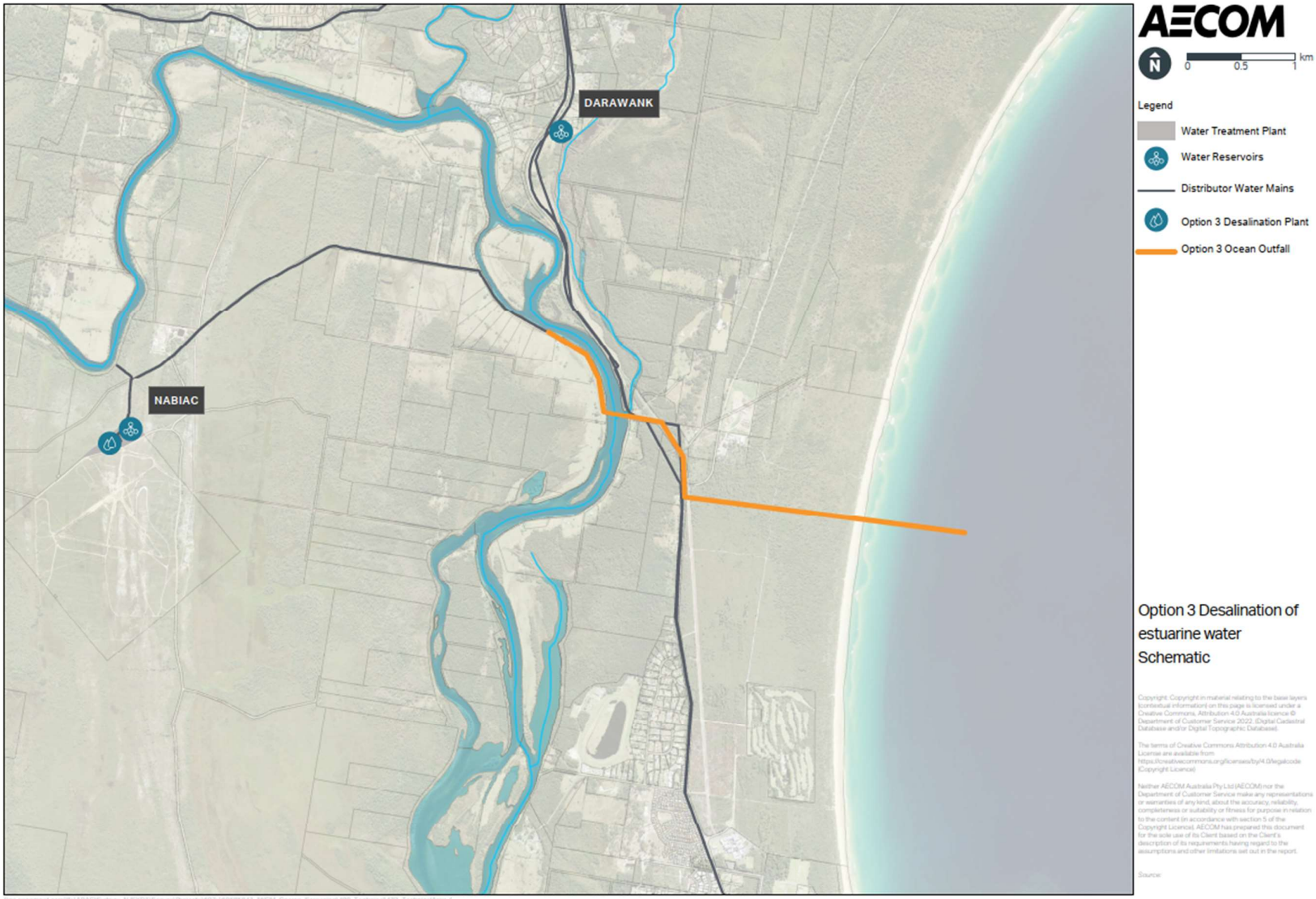

Figure 13 Option 3 Desalination of estuarine water

6.4 Option 4: Desalination of Sea Water – Hallidays Point

This option involves a permanent desalination plant potentially located at Hallidays Point STP. Sea water intake and brine discharge points would be located offshore from Back Beach, with sea water treated to potable water standards before being pumped to Darawank reservoir for distribution.

Operation of the plant would supplement existing dam supply when required, with the capability to supply the entire region during extreme drought. Consideration will therefore be required to maintain the process units, either through a routine maintenance program, or ongoing low yield plant operation, allowing for units to be boosted to full capacity or required levels as necessary.

Indicative principal infrastructure items include:

- Sea water intake and pumping infrastructure
- Raw water and treated water storage tanks
- Screening filters and microfiltration units
- Reverse osmosis units
- Generator for emergency power supply
- Permeate pipeline to Darawank Reservoir
- Reverse osmosis brine pumping system and discharge line to ocean outfall

Note that this option has not been considered in any previous investigations or studies and would require further detailed investigation should it pass the coarse screening process.

Risks

- Approvals and permits
- Aquatic ecology – impingement and entrainment at intake point
- Aquatic ecology – impacts of brine discharge at immediate location
- Construction through environmental corridors

Issues

- Large carbon footprint
- High operation and maintenance costs
- Long lead time
- Community support
- Requires specialised skillset for plant operation

Opportunities

- Rainfall independent
- Reliable source supply
- Proven technology
- Operation flexible to demand
- Remote location with sufficient buffer from nearest sensitive receptors

Additional Yield	Up to 40 ML/D
Capital Cost **Operational Cost**	$101.9 M scaled down based on desalination plants in Australia Up to $4.3 M/yr depending on operating yield; scaled down based on desalination plants in Australia
Level of Confidence	Low - no planning or feasibility investigations undertaken as option is only at the ideation stage

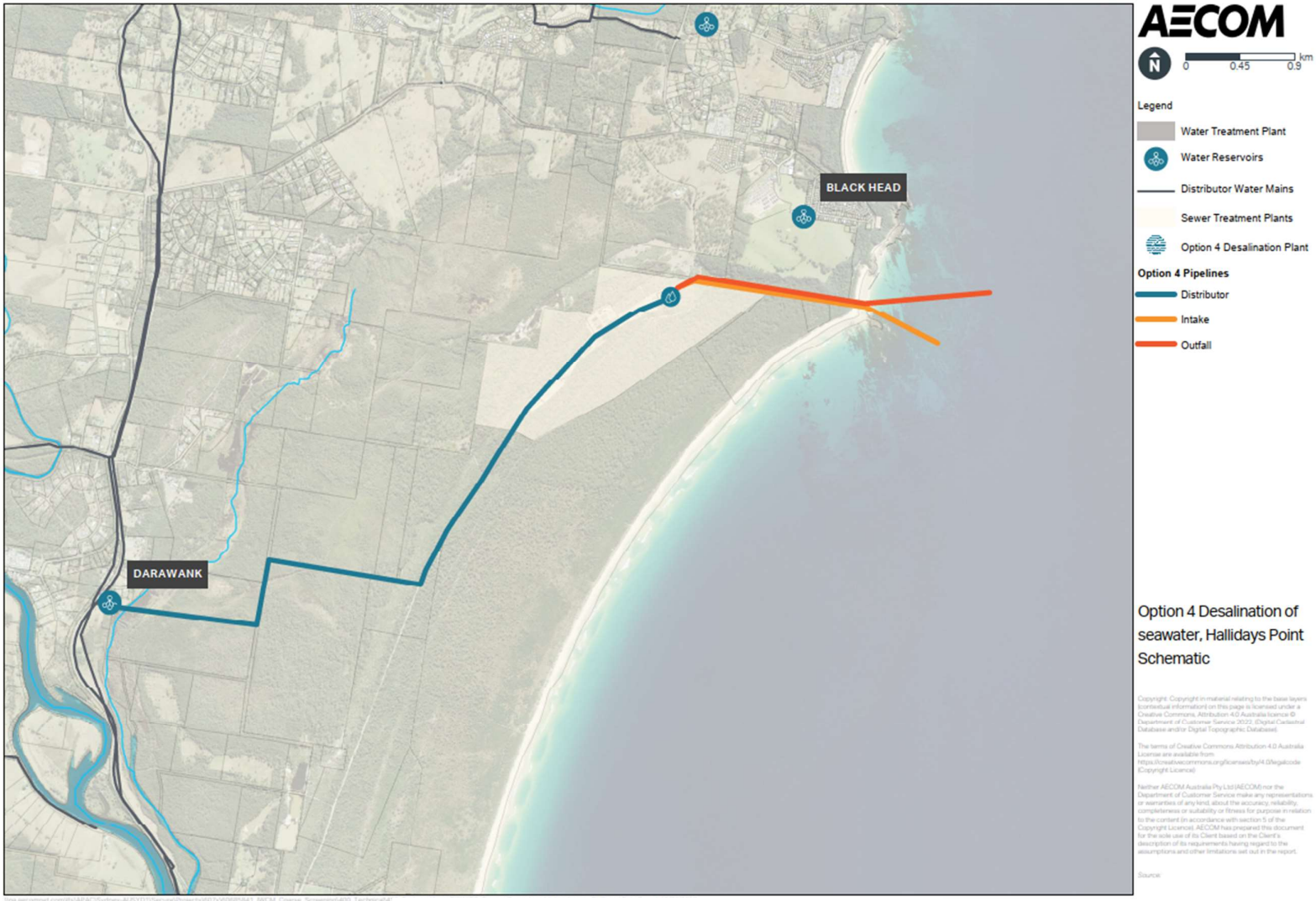

Figure 14 Option 4 Desalination of sea water at Hallidays Point

6.5 Option 5: Desalination of Sea Water – Forster

This option involves a permanent desalination plant located at or near Forster STP. The plant would operate permanently and would bifurcate the Manning Supply Scheme, essentially establishing a separate Southern Manning Supply Scheme. Desalinated water would be pumped from the plant to Forster reservoir, where it would supply the Southern Forster region. Parts of Tuncurry and Hallidays Point will also be serviced from this system as the Forster reservoir balances with Redhead and Rainbow Flat reservoirs with the same top water level. The existing Forster STP ocean outfall is the primary driver of this option as it could potentially eliminate the need for a new discharge outfall for brine from the desalination process.

Indicative principal infrastructure items include:

- Sea water intake and pumping infrastructure
- Raw water and treated water storage tanks
- Screening filters and microfiltration units
- Reverse osmosis units
- Generator for emergency power supply
- Permeate pipeline to Forster Reservoir
- Reverse osmosis brine pumping system Forster STP ocean outfall

Note that this option has not been considered in any previous investigations or studies and would require further detailed investigation should it pass the coarse screening process.

Risks

- Approvals and permits – outfall in Port Stephens Great Lakes Marine Park
- Aquatic ecology – impingement and entrainment at intake point
- Aquatic ecology – brine discharge via beach outfall
- Capacity of existing Forster STP outfall pipe
- Complicated distribution network

Issues

- Large carbon footprint
- High operation and maintenance costs
- Long lead time
- Not supportive region-wide
- Community support
- Requires specialised skillset for plant operation
- Existing ocean outfall discharges at foreshore; likely to require extension to open water with increased discharge

Opportunities

- Rainfall independent
- Reliable source supply
- Proven technology
- Existing outfall for brine discharge
- Operation flexible to demand

Additional Yield	10 ML/D
Capital Cost	$26.3 M scaled down based on desalination plants in Australia
Operational Cost	$1.1 M/yr scaled down based on desalination plants in Australia
Level of Confidence	Low - no planning or feasibility investigations undertaken as option is only at the ideation stage

Figure 15 Option 5 Desalination of sea water at Forster

6.6 Option 6: Recycled Water for irrigation, agricultural and construction use

This option considers increased use of recycled water for non-drinking purposes in the community. Opportunities are available to expand on the existing schemes and offset potable water demand with recycled water. At this stage only Dawson STP, Forster STP and Hallidays Point STP were included in this assessment due to the potential recycled water yield, however the other smaller plants will be considered in future sustainable effluent management investigations.

A comprehensive list for potential uses of recycled water was derived from discussions with Council and discussed below.

- **Irrigation and Farming:** The existing schemes primarily direct treated effluent and recycled water to beneficial re-use through irrigation. The Dawson STP effluent scheme currently supports mostly farming-related activities, while the Tuncurry RTP currently supplies mostly sporting customers and public open spaces. There are multiple sites across these regions that could potentially be suitable for further irrigation. In Taree, some of these include Taree Recreation Centre, Taree Sports Club, St Clare's High School, Taree Showgrounds, Taree Croquet Club, and local parks. Sites in the Forster region include Forster Golf Course, The Y (Aquatic and Leisure Centre), Forster Public School. Pacific Palms Sports Fields, Palms Oasis Caravan Park, Great Lakes College, and local parks. Delivery of recycled water to these sites however requires crossing of Wallis Lake, either via new submarine mains or mains attached to the Forster-Tuncurry bridge.
- **Industrial and commercial:** A very small portion of the land in Taree, Tuncurry and Forster are classified under commercial and industrial zoning. Opportunities for reuse are seemingly rare but opportunities for reuse can be pursued as they emerge with business and industry development. It is however noted that retrofitting of existing premises will not be pursued by Council due to high costs involved for a low yield. As such, reuse opportunities under this category will be opportunistic and an ongoing consideration only.
- **Construction and Maintenance Activities**: Dedicated recycled water offtake points can be utilised for activities such as dust suppression, roads maintenance, and routine sewer mains flushing programs.

Further investigation into recycled water demand is needed to accurately address the required infrastructure for treatment and distribution of recycled water. Options may include fixed offtake points or expansion of recycled water distribution network. For maximum use of effluent from the three STPs, the following will need to be considered at a minimum:

- Upgrade of Taree Effluent Management Scheme to Dawson RTP with advanced water treatment, suitable for unrestricted public access. Principal items may include:
    - Pre-treatment screening
    - Membrane Filtration
    - Chlorination
    - Raw water and treated water storage tanks
- Expansion of Tuncurry RTP with diversion of treated effluent from Forster STP to increase supply of raw water to the RTP. Principal items may include:
    - Additional screening and membrane filters
    - Transfer pumping system and pipeline from Forster STP to Tuncurry RTP

Risks

- Insufficient recycled water demand for material impact on potable water use
- Significant distribution infrastructure to maximise use
- Approvals and permits
- Water consumption behavioural change in community with greater availability of recycled water
- Community Acceptance

Issues

- Rainfall dependent demand
- Greenhouse gas emissions from increase in energy intensive treatment processes
- High operation and maintenance costs
- Can be developer driven and beyond Council's influence

Opportunities

- Community participation
- Effluent management
- Promotes community education and acceptance

Additional Yield	Up to 14.6 ML/D (across the 3 STPs by 2051, excludes current use)
Capital Cost	$21.1 M for 14.6 ML/D; susceptible to desirable water quality
Operational Cost	$820 per ML of treated water; susceptible to desirable water quality
Level of Confidence	Low – further investigations required to determine demand for recycled water, required water quality for end-usage, and feasibility of transfer main from Forster STP to Tuncurry RTP

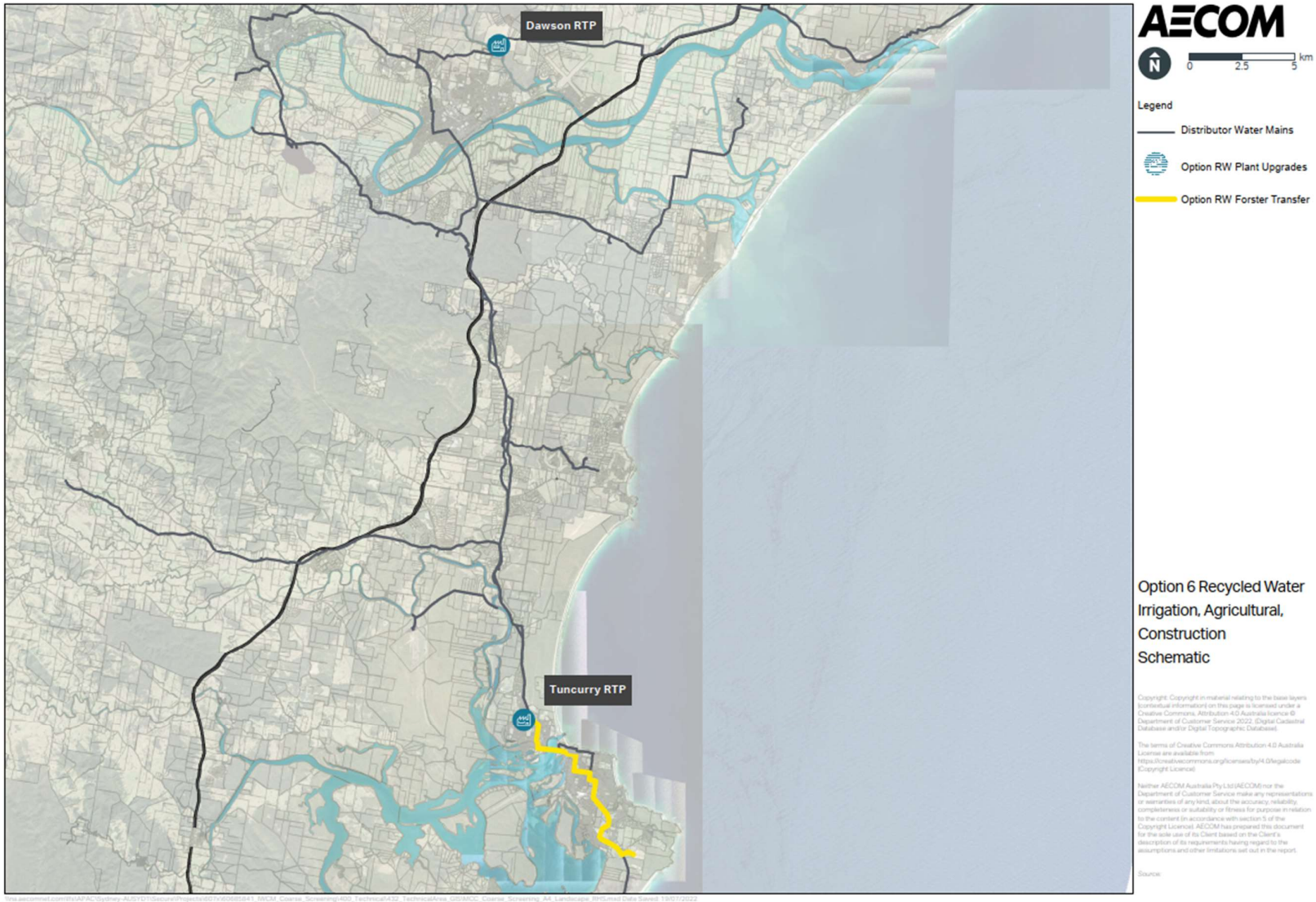

Figure 16 Option 6 Recycled Water for irrigation, agricultural and construction use

6.7 Option 7: Recycled Water for non-potable use via dual reticulation

This option involves a dual reticulation network to supply both potable and recycled water for new development areas only. Recycled water could be utilised for outdoor uses, toilet flushing and laundry purposes and for hot water, offsetting potable water demand for domestic uses. Recycled water could be sourced from Tuncurry RTP and/or Dawson RTP.

As per Option 6, the following infrastructure would need to be considered at a minimum:

- Upgrade of Taree Effluent Management Scheme to Dawson RTP with advanced water treatment, suitable for unrestricted public access. Principal items may include:
    - Pre-treatment screening
    - Membrane Filtration
    - Chlorination
    - Raw water and treated water storage tanks
- Expansion of Tuncurry RTP with diversion of treated effluent from Forster STP to the RTP. Principal items may include:
    - Additional screening and membrane filters
    - Transfer pumping system and pipeline from Forster STP to Tuncurry RTP

In addition to the above, the individual developers would need to provide the following:

- Reticulation network to supply recycled water to each property
- Dual plumbing within properties to facilitate supply of recycled water for appropriate use

For both the reticulation network and within properties, all recycled water infrastructure must be clearly identified to prevent accidental cross-contamination with potable water supply.

Risks

- Water quality to meet guidelines
- Public health – potential for misuse of recycled water
- Community acceptance
- Approvals and permits
- Recycled water demand
- Cross-connections
- Water consumption behavioural change in community with greater availability of recycled water

Issues

- Rainfall dependent demand for outdoor use
- Greenhouse gas emissions from increase in energy intensive treatment processes
- High operation and maintenance costs with dual reticulation network
- Suitable for new residential, can be discriminatory
- Developer driven, beyond Council's influence

Opportunities

- Rainfall independent demand for internal use
- Community participation
- Effluent management
- Aesthetic values maintained in drought conditions

Additional Yield	Up to 40 ML/D, and additional volumes from subsequent potable water offset
Capital Cost	Indicative $16,000 per dwelling for 161 L/D average day demand, based on similar project inclusive of full treatment and transfer infrastructure
Operational Cost	$820 per ML of treated water minimum, additional for higher level of treatment
Level of Confidence	Medium – no planning investigations completed but assessment based on experience and similar projects in industry

6.8 Option 8 Recycled Water – Environmental Flows

This option involves the substitution of flow in the Manning River downstream of the Bootawa Dam offtake point, to offset a potential increase in extraction rate. The replacement flows would be supplied from Dawson RTP where the effluent will be treated to a level appropriate for the ecosystem of the Manning River. Replacement of environmental flows in the river would potentially enable increased extraction rates under normal conditions for either storage in the dam or directly for treatment at the WTP. Further studies will be required to determine the limitations on increased extraction and to determine the appropriate water quality required for maintaining a healthy river system.

Similar to Option 6, for maximum use of effluent from the Taree STP, the following will need to be considered at a minimum for upgrade of Taree Effluent Management Scheme to Dawson RTP with advanced water treatment. Principal items may include:

- Pre-treatment screening
- Membrane Filtration
- Chlorination
- Raw water and treated water storage tanks
- Transfer pumping system and pipeline from RTP to downstream of offtake point

Risks	Issues	Opportunities
• Impacts on river health and ecology from substitution flow • Impacts on river health and ecology from increased salinity levels with increased offtake • Approvals and permits • Community acceptance	• High capital costs • Greenhouse gas emissions from increase in energy intensive treatment processes • High operation and maintenance costs • May not improve yield/supply during drought as extraction limits would still apply	• May improve river flow • Effluent management • Adaptable to growth

Additional Yield	Unknown – up to 4.6 ML/D can be substituted in flow from Dawson RTP
Capital Cost **Operational Cost**	$14.3 M for maximum flow substitution; susceptible to desirable water quality $820 per ML of treated water; susceptible to desirable water quality
Level of Confidence	Low – no feasibility of planning investigations undertaken

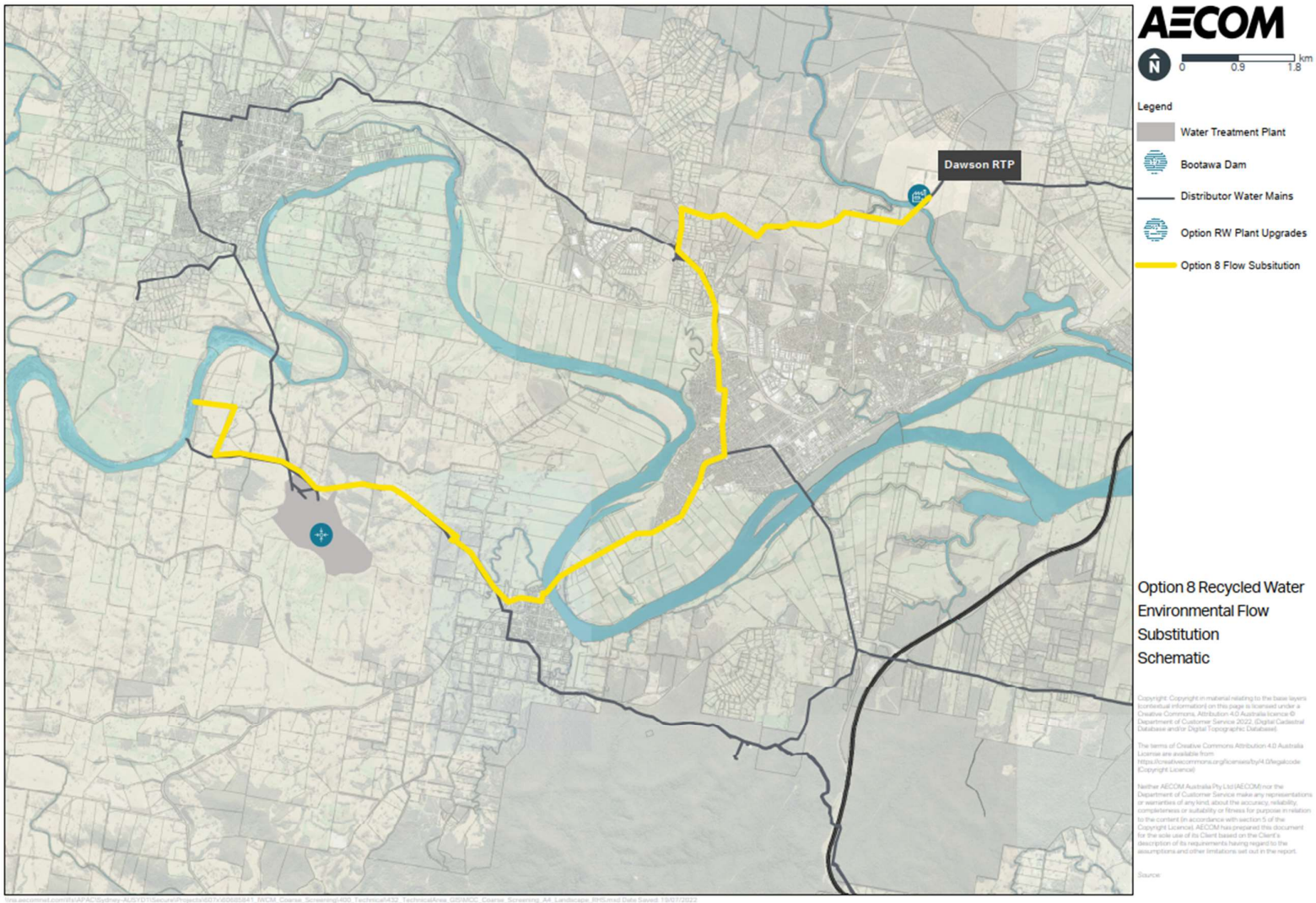

Figure 17 Option 8 Environmental Flow Substitution

6.9 Option 9 Purified Recycled Water for Indirect Potable Reuse

The Nabiac water supply system was commenced in 2019 to supplement the Manning system by drawing water from the adjacent inland dune aquifer borefield with provision for expansion at the Nabiac WTP to 24ML/day. This option looks at replenishing groundwater in the aquifers to enable greater extraction in the future through managed Aquifer Recharge. Recharging can be achieved either through direct injection into the wells, or through basins at the borefield. The presence of indurated sand layers between the ground and bottom of the aquifers however pose a challenge for replenishment through basins, and direct injection is therefore a more favourable methodology. Volumes for additional extraction and replenishment will need to be determined following further studies and investigations.

Indicative principal infrastructure items include:

- Expansion of Tuncurry RTP for additional capacity
- Upgrade of Tuncurry RTP with advanced water treatment to the required water quality
- Transfer pipeline from Tuncurry RTP to the borefield
- Aquifer injection system

Risks

- Recharge flow impacts on groundwater system
- Contamination of increased salinity levels from greater extraction
- Contamination from emerging contaminants
- Water clogging from bacterial growth of precipitation of iron
- Approvals and permits

Issues

- Water quality of source water vs groundwater
- Injection points suitable for ground profile
- Licencing for increased extraction
- Increased operational costs

Opportunities

- Rainfall independent
- Increased reliability with replenishment for a young aquifer
- Effluent management
- Potentially flexible – adaptable to growth
- Skillset available with existing resources managing borefield

Additional	Unknown – up to 5.9 ML/D can be recharged in flow from Tuncurry
Capital Cost **Operational Cost**	$14.2M for maximum flow recharge; susceptible to desired water quality $820 per ML of treated water; susceptible to desirable water quality
Level of Confidence	Low – no feasibility or planning investigations undertaken.

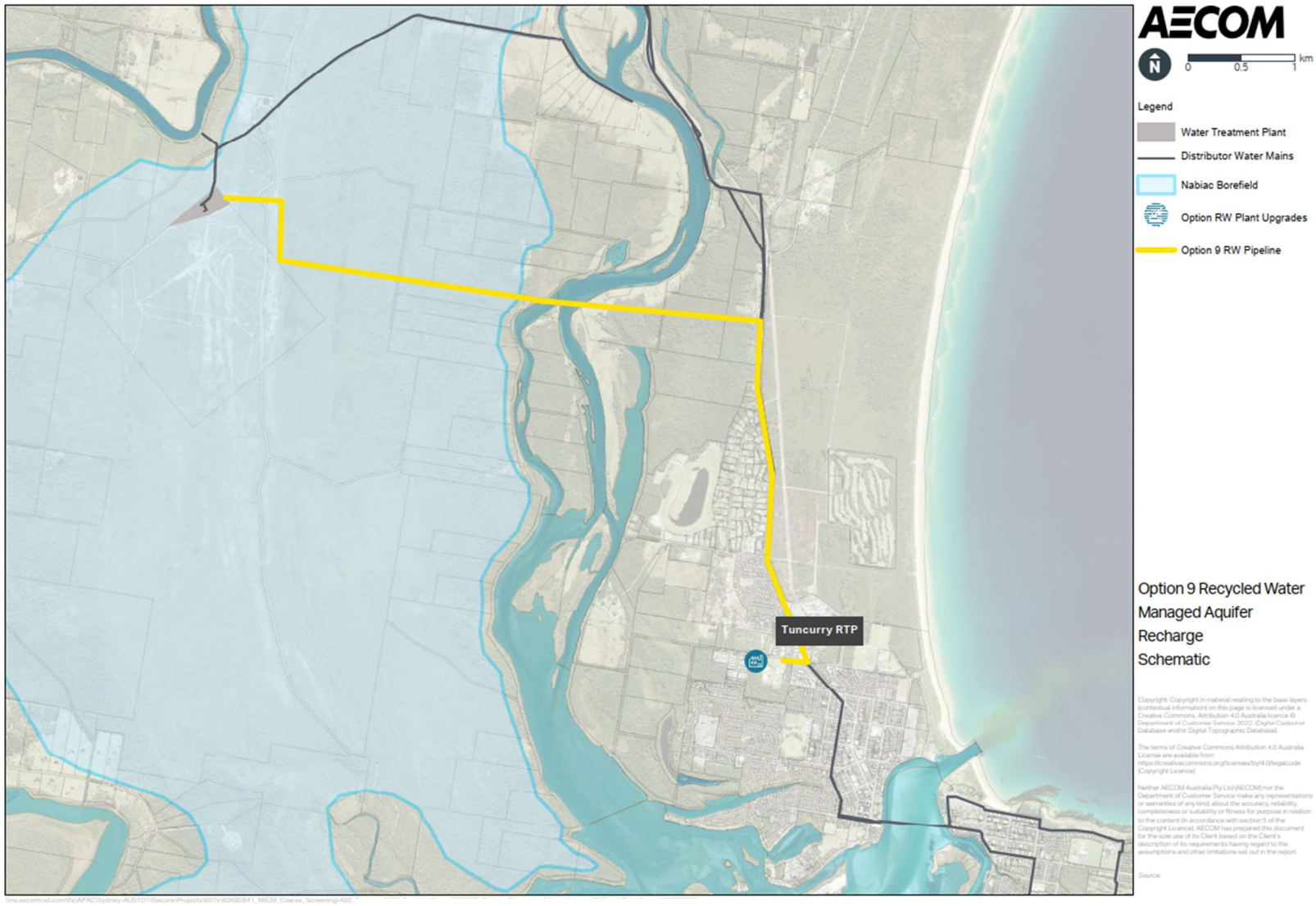

Figure 18 Option 9 Purified Recycled Water Managed Aquifer Recharge

6.10 Option 10 Purified Recycled Water for Direct Potable Reuse

This option involves direct potable reuse of recycled water from Tuncurry RTP and Dawson RTP. As per Option 6, effluent from Forster, Hallidays Point and Taree STPs would be directed to the RTP's for further advanced water treatment to Australian Drinking Water Guideline (ADWG) standards for potable water. Purified recycled water would then be returned the network via Taree and Darawank reservoirs. A new reservoir to supply to the southern region is also proposed to reduce complexity and simplify the network. There is sufficient land available at Tuncurry RTP to locate the proposed new reservoir.

Principal items for the upgrade of recycled water treatment plants to meet ADWG may include the following processes (based on Southeast Queensland Western Corridor Scheme):

- Upgrade of Taree Effluent Management Scheme to Dawson RTP, including:
  - Pre-treatment screening
  - Membrane Filtration
  - Reverse Osmosis
  - UV Advanced Oxidation
  - Raw water and treated water storage tanks
- Expansion of Tuncurry RTP with diversion of treated effluent from Forster STP, including:
  - Additional screening and membrane filters
  - Reverse Osmosis
  - UV Advanced Oxidation
  - Transfer pumping system and pipeline from Forster STP to Tuncurry RTP

Risks

- Community acceptance
- Severe public health consequences

Issues

- Supporting legislation
- Greenhouse gas emissions from increase in energy intensive treatment processes
- High operation and maintenance costs

Opportunities

- Rainfall independent
- Adaptable to growth
- Effluent management
- Utilises existing distribution infrastructure

Additional Yield	Up to 14.6 ML/D (across 3 STPs by 2051, excludes current use), but availability of raw water can increase with growth
Capital Cost **Operational Cost**	$35.5 M for maximum possible flow, susceptible to required water treatment > $820 per ML of treated water; further investigations required
Level of Confidence	Medium – advanced treatment technically viable, but further investigations for each site and for transfer of flows between STP and RTP

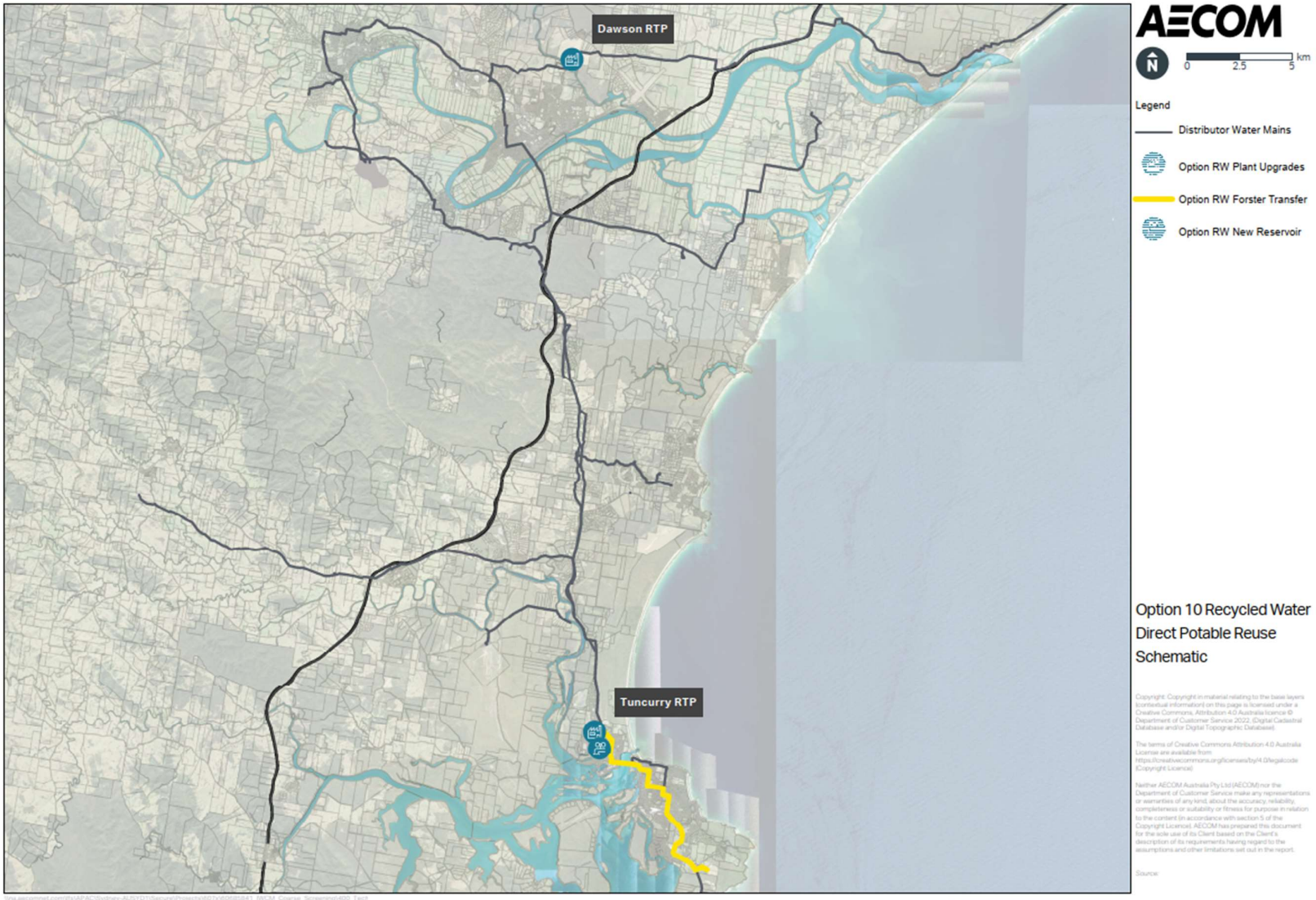

Figure 19 Option 10 Purified Recycled Water for Direct Potable Use

6.11 Option 11 Stormwater Harvesting - North Tuncurry

North Tuncurry Urban Release Area is a new residential development located north of Tuncurry Golf Course with a proposed yield of approximately 2000 Equivalent Tenant (ET). The current stormwater concept design for the development includes a series of stormwater detention ponds and an outlet to Wallis Lake.

This option involves capturing this stormwater and transferring it to Tuncurry RTP to supplement the flow of raw water from Hallidays Point STP. Indicative principal infrastructure required includes a transfer trunk pipeline from the development to the RTP, and additional storage at the RTP to store harvested stormwater until the peak wet weather flows from Hallidays Point STP have passed if not stored at the development site.

The stormwater management plan has been prepared by the developer, and Council's influence is further limited as the development falls under state-led rezoning. Council understands that stormwater harvesting is not being considered by the Developer primarily due to wet weather storage requirements.

In addition, Tuncurry RTP would have limited capacity to receive captured stormwater during wet weather due to increased flows from Hallidays Point STP.

Risks

- Wet weather storage
- Recycled water demand in Tuncurry
- Pervious ground profile for capturing stormwater
- Insufficient yield for material impact on offsetting potable use

Issues

- Developer led stormwater management plan
- Rainfall dependent demand
- Limited spare treatment capacity at RTP due to wet weather flow from Hallidays Point STP
- Reduced demand for recycled water during wet weather conditions

Opportunities

- Setting example
- Developer contributed assets

Additional Yield	1,820 ML/year based on Mean Annual Runoff Volume
Capital Cost **Operational Cost**	$2.1 M, additional cost for storage if required $820 per ML of treated water
Level of Confidence	Low – no feasibility investigations undertaken and stormwater harvesting is not being considered by developer

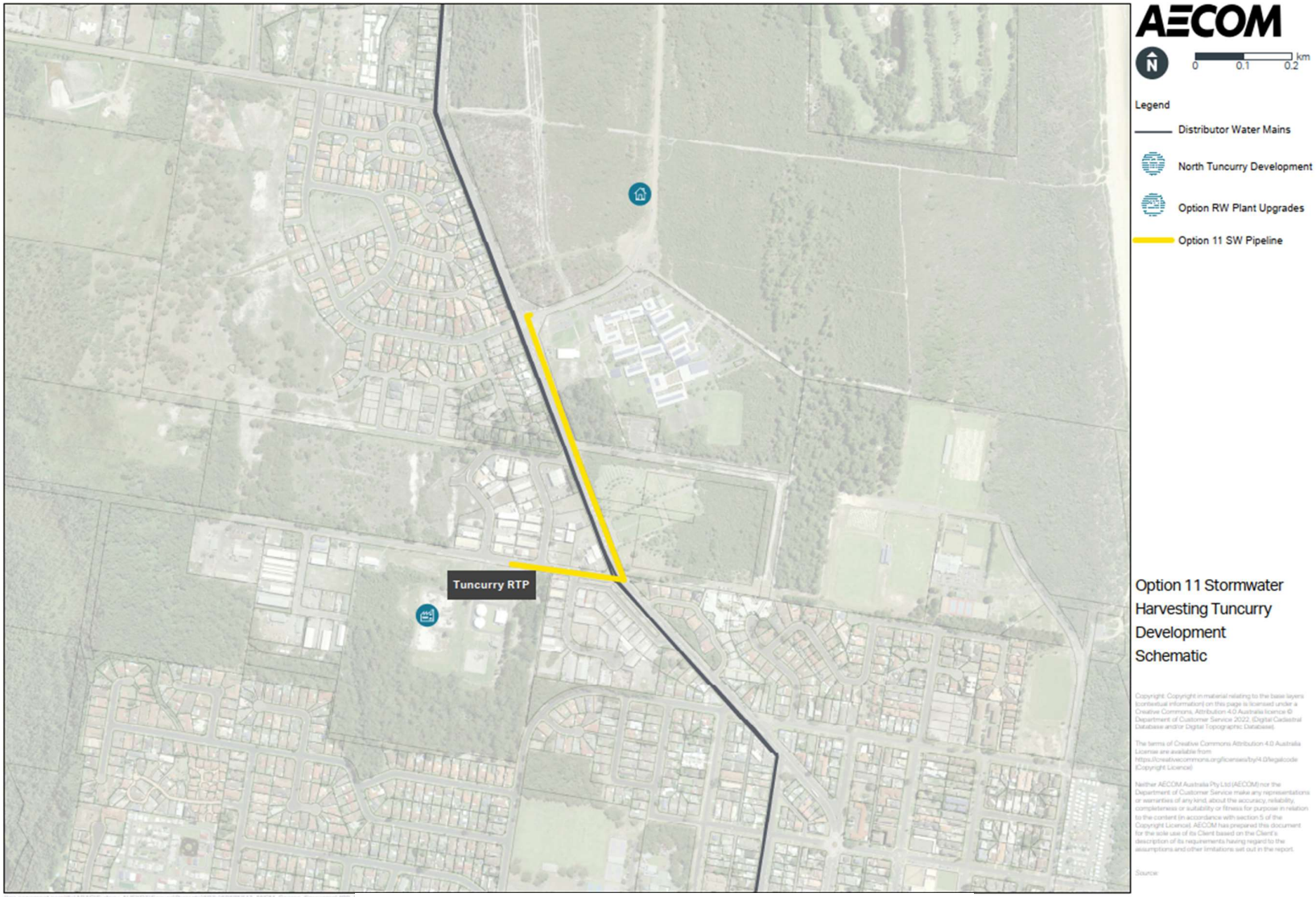

Figure 20 Option 11 Stormwater Harvesting North Tuncurry Development

6.12 Option 12 Stormwater Harvesting – Other Areas

This option considers stormwater harvesting for localised opportunities through stormwater collection, storage, treatment and distribution. Existing stormwater infrastructure can be utilised for collection, however additional infrastructure may be required to convey flow to a central location within the local catchment for treatment and distribution. The level of treatment required will vary depending on the usage. Based on the geographical conditions and existing infrastructure, a large-scale centralised stormwater scheme would require significant infrastructure and expense. Hence ideally, this option is best suited for new development areas that can integrate harvesting schemes as part of stormwater management plan through smart planning and design.

Stormwater in the region is largely sparse with many small catchments that direct flow to receiving waterways through different pathways. The coastal nature of the scheme has resulted in stormwater infrastructure constructed ad hoc as development of towns expanded, with opportunities to drain to natural waterways and the ocean largely adopted. Apart from the Tuncurry harvesting opportunity (Option 9), no other large catchments with a singular collection point have been identified. Further investigation will be required to determine catchments with substantial runoff for harvesting. Significant retrofitting of infrastructure would be required to direct and convey the flow to a central point, and therefore this option is best suited to new development areas only.

Risks

- Water quality and associated level of treatment
- Demand for harvested water
- Mosquito breeding at collection points and storage basins
- Sparse catchments
- Insufficient yield for material impact on offsetting potable water use

Issues

- Rainfall dependent demand
- Coastal ground profile
- Storage for each catchment
- Significant infrastructure for retrofitting
- Suitable for new developments only

Opportunities

- Reduced pollutants in natural waterways and systems
- Flow attenuation for low flow events

Additional Yield	Unknown – dependent on individual catchments
Capital Cost	Unknown – high possibility for developer contributions
Operational Cost	Unknown – dependent on individual catchments and end-use
Level of Confidence	Low – no feasibility or planning investigations undertaken, and limited opportunity for centralised stormwater harvesting scheme

6.13 Option 13 Groundwater – Nabiac Aquifer

The Nabiac Water Supply System commenced operation in February 2019, supplementing the Manning system by drawing water from an inland dune aquifer located near Nabiac. Initial construction was concluded with 12 bores in operation, but four additional bores were commissioned during the drought, bringing the total to 16 bores currently available for groundwater extraction. Five additional bores were also approved during the recent 2019/20 drought, and are now under way for commissioning under the Stage 2 borefield expansion. The total production capacity of current bores is equivalent to 12 ML/day during a drought event. Under the average conditions (based on rainfall), extraction from the aquifers is limited to 9 ML/day. Stage 2 expansion will increase this total yield from the borefield to 18 ML/day for extraction under drought conditions. Due to environmental constraints and current licence arrangements, extraction from the Nabiac borefield is limited to the ongoing expansion works and further yield is inaccessible.

Risks

- Saline intrusion
- Extraction rate exceeds recharge capacity
- Impacts on groundwater system from increased extraction
-

Issues

- Drought extraction only

Opportunities

- Rainfall independent
- Utilises existing infrastructure
- Short lead time
- Reliable source

Additional Yield	Up to 18 ML/D in drought conditions
Capital Cost **Operational Cost**	Project underway by Council $836 per ML of treated water
Level of Confidence	High – works are currently under way by Council for this option

6.14 Option 14 Groundwater – Coastal Strip

This option considers additional groundwater sources in the Manning region. Prospective sites identified in the 1999 studies were assessed to have a low yield compared to the Nabiac borefield with none of the sites predicted to exceed 10 ML/day. While there is an option to re-investigate, numerous sites may be required to reach the desired water security yield. Previously investigated sites include:

- Wallamba River Alluvium
- Myall Lakes - Smith Lakes High Dunes
- Myall River Alluvium
- Tuncurry to Hallidays Point Coastal Dunes
- Old Bar to Crowdy Head Coastal Dunes
- Manning River Alluvium.

Only the Wingham River Alluvium site was considered in the feasibility study but was ultimately ruled out due to low possibility of obtaining groundwater supply and sustaining a borefield. Other mentioned sites were not taken to the feasibility stage, but the NSW Water Sharing Plan indicates multiple active groundwater licences in the Great Lakes Coastal Sands region that hold unassigned groundwater volumes. These sites can be investigated further for suitability for Manning Supply Scheme and approval license applied for accordingly.

Risks

- Insufficient groundwater availability
- Environmental impacts from increased extraction
- Approvals and permits
- Water quality and associated level of treatment

Issues

- Significant infrastructure for extraction, transport, and treatment
- Distance to nearest reservoir or WTP for treatment
- Long lead time for new borefield

Opportunities

- Potential for staging

Additional Yield	Unknown
Capital Cost	Unknown – indicative $57.9 M for system identical to Nabiac Inland Dune Aquifer Water Supply System
Operational Cost	Unknown
Level of Confidence	Low – no feasibility or planning investigations undertaken, but earlier studies do not identify other sites with a reasonable impact on yield

6.15 Option 15 Interconnection with Regional Schemes

This option considers acquiring potable water from neighbouring water supply schemes and service providers when required through water carting. Water can be transported via trucks or rail freight. Carting for the entirety of the region is impractical and a major challenge on account of both freight and availability of supply on an ongoing daily basis for prolonged periods. The activity of unloading water from rail carriages was also acknowledged as a challenge by Council when this option was investigated in the recent 2019/20 droughts

Risks

- Dependent on supply availability
- Availability of freight for prolonged periods
- Availability of freight for required water volumes
- Infrastructure for unloading water from freight
- Public health consequences from water contamination

Issues

- High daily costs
- Not a permanent solution
- Impractical to transport total daily demand
- Distance of transportation
- Greenhouse gas emissions from daily use of freight

Opportunities

- Scalable to requirements

Additional Yield	Unknown – dependent on available supply
Capital Cost	Indicative $0.033 per L from Hunter Water; economies of scale achievable
Operational Cost	Unknown – may require re-treatment if risk of contamination identified
Level of Confidence	High – based on investigations undertaken by Council in the recent droughts

7.0 Coarse Screening of Options

7.1 Coarse Screening Workshop

The coarse screening workshop was held with participation from various Council stakeholders. The aim of the workshop was to arrive at an endorsed short-list of water security options for further investigation prior to development of the IWCM Strategy.

The objective of the workshop was to:

- Present the long-list of water security options for discussion
- Undertake a coarse screening of the long-list of options
- Agree the short-list of options for further investigation

A brief evaluation of each option was undertaken amongst break out groups and the findings were challenged and discussed with the wider group before arriving at the concluding assessment. The findings of the coarse screening are presented in the following tables.

During the workshop discussion one additional option was identified, Option 16 Inter-regional transfer of water from Port Macquarie Hastings via new transfer pipeline. An assessment of this option has not been undertaken and as such the option cannot be failed. This option will thus progress to Stage 2 for further investigation.

It was agreed to combined Option 9 and Option 10 into a single purified recycled water option.

Refer to Appendix C for Workshop Briefing Paper, Minutes and Presentation Slides.

				1	2	3	4	5
Council Values	**Council Risk Category**	**Measure Indicator for Coarse Screening**	**Description & objectives of indicator**	**Augmentation of Bootawa Dam**	**Increase storage yield via new Peg Leg Creek Dam**	**Desalination of estuarine water at Nabiac WTP (mobile unit)**	**Desalination of sea water at Hallidays Point (permanent, when required)**	**Desalination of sea water at Forster STP (permanently in operation)**
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	Unknown – design needs to be updated for risk assessment to the Dam Safety NSW regulations and requirements, Potential community impacts of prolonged Level 4 restrictions during construction phase	Pass - new dam can be designed and delivered to current standards and regulations	Pass – proven technology for treatment of water; manageable construction and operating risks	Pass - new plant can be designed and managed to current standards and regulations	Pass - new plant can be designed and managed to current standards and regulations
	Service delivery and infrastructure	Availability	Available when it is needed, in drought or when demand is high (climate independent / dependent)	Pass - limited supply available in drought conditions, rainfall dependent; dependent on river water quality; low on resilience with no additional source flexibility	Pass - boosts resilience for Bootawa dam; limited supply available in drought conditions, rainfall dependent; dependent on river water quality	Unknown - fit-for-purpose only as an emergency response; trigger points and timeframes for operation need defining; consideration for lock-in contracts for procurement of mobile units	Pass - rainfall independent; plant to operate at desired levels as and when required	Pass – rainfall independent; permanently in operation for supplying to Southern Manning region
		Yield / beneficial to pursue / supply	Option will give either 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	Unknown – modelling required to defined impact on water balance	Pass - can be designed to optimal solution	Pass – note limited extraction from estuarine due to impacts on river system, and limited availability of power supply to site	Pass - fully operational only in drought conditions	Unknown - does not supply to entire region, only benefits Southern Manning; impact on water balance needs to be defined
		Practically viable	Option can be delivered by Council / external support	Fail – lowering of levels below 51% over the entirety of construction period (15 months), reducing water security for region for a prolonged period	Pass – new dam can be delivered with the latest technology and market capabilities	Unknown – competition for units across the state and/or nation in drought conditions	Pass– new plant can be delivered with the latest technology and market capabilities	Fail - existing beach outfall from STP has limited hydraulic capacity, likely to require extension to open water within Marine Park
		Integration with existing network	Project can be integrated into the existing and/or (planned) future supply network, based on built environment and operations	Pass – no infrastructure upgrades required at WTP or distribution network beyond Dam upgrades	Pass – no infrastructure upgrades required at WTP or distribution network	Pass – permeate directed to adjacent WTP	Pass - in close proximity to Darawank reservoir based on assessed location at Hallidays Point STP	Fail - operational complexity with connectivity of reservoirs; does not support northern Manning region
Integrity	Compliance	Regulatory and governance	Option is achievable or supported by existing legislation and framework	Unknown - design needs to be updated to Dam Safety NSW regulations and requirements, environmental approvals for site clearing needs defining, specifically for koala habitation	Pass - risks associated with building a new dam, but manageable	Unknown - approvals and permits for ocean outfall need investigating	Unknown - approvals and permits for new desalination plant, specifically for seawater intake, ocean outfall and site-specific requirements	Unknown - approvals and permits for new desalination plant, specifically for seawater intake and site-specific requirements; impact on Marine Park needs assessing
	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?	Pass - potential sequencing issues for construction with regards to lowering of dam levels in dry period	Unknown - long lead time; potential for political interference given the long lead time; flexibility in delivery with opportunity for staging	Unknown - lead time for ocean outfall approvals and permits need defining; availability of mobile desalination units cannot be guaranteed until required	Unknown - planning pathway needs to be defined	Unknown - planning pathway needs to be defined
	Financial Project budget	Cost - Capital	Capital Costs	Pass – cost based on Concept Design report	Pass – cost based on Preliminary Investigation report	Pass – major infrastructure constructed upfront for easy integration with mobile units	Pass – costs scaled based on desalination plants in Australia	Pass – costs scaled based on desalination plants in Australia
		Cost - O&M	Operating and maintenance costs	Pass – cost based on per ML of treated water at WTP	Pass - potential for offsetting costs with hydropower; cost based on per ML of treated water at WTP	Unknown - potential for offsetting costs with solar farm on site; specialised and additional resources required to operate plant when required	Pass - opportunity to operate plant at a minimum optimal level to avoid maintenance issues on standby mode; periodic membrane replacement costly; costs scaled based on desalination plants in Australia	Pass – costs scaled based on desalination plants in Australia

				1	2	3	4	5
Council Values	**Council Risk Category**	**Measure Indicator for Coarse Screening**	**Description & objectives of indicator**	**Augmentation of Bootawa Dam**	**Increase storage yield via new Peg Leg Creek Dam**	**Desalination of estuarine water at Nabiac WTP (mobile unit)**	**Desalination of sea water at Hallidays Point (permanent, when required)**	**Desalination of sea water at Forster STP (permanently in operation)**
Sustainability	Environment	Environmental impact	Impact to environment (during construction/delivery), including footprint of asset, clearing, flora/fauna, disturbance to and impacts of source water and water quality, and heritage impacts	Unknown - impact on koala habitat from clearing of vegetation	Unknown - environmental impacts need to be fully defined and an assessment undertaken	Unknown - construction corridor for brine discharge pipeline and ocean outfall impacts need defining	Unknown - environmental impact statement needs to be defined	Unknown - environmental impact statement needs to be defined; existing STP outfall discharges into Port Stephens-Great Lakes Marine Park
		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	Unknown - potential loss of koala habitat needs to be investigated; impact on carbon footprint for construction but marginal change in ongoing carbon emissions	Unknown - decrease in resource consumption following construction; intergenerational equity dependent on chosen option	Unknown – high energy intensive process can be offset with solar farm, but further investigation required into specific requirements	Unknown - environmental impact statement needs to be defined; potential for offsetting some energy consumption with renewable energy	Unknown - environmental impact statement needs to be defined; potential for offsetting energy consumption with renewable energy; potential discharge to Great Lakes Marine Park
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)	Pass - existing Aboriginal disputes, reputational risk to Council, but manageable with appropriate measures; potential community impacts of prolonged Level 4 restrictions during construction phase	Unknown - aboriginal and cultural heritage assessment needs to be updated in detail for preferred dam site option; sites encroaches state forest which Council is in the process of acquiring	Unknown - community acceptance of ocean outfall needs investigating	Unknown - community acceptance of desalination plant and ocean outfall needs investigating	Unknown - community acceptance of desalination plant, extension of outfall within marine park
Outcome				**Fail – risk to water security based on construction requirements**	**Pass – further investigation required to determine feasibility of option**	**Pass – suitable for emergency response only as a failsafe option**	**Pass - further investigation required to determine feasibility of option**	**Fail – operational complexity, extension of ocean outfall within marine park**

				6	7	8	9	10
Council Values	**Council Risk Category**	**Measure Indicator for Coarse Screening**	**Description & objectives of indicator**	**Recycled water for municipal irrigation, agricultural and construction use**	**Recycled water for non-potable use via dual reticulation**	**Recycled water for environmental flow replacement**	**Recycled water for indirect potable reuse**	**Recycled water for direct potable reuse**
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	Pass - offset for non-potable use and treated to appropriate water quality	Pass – offset for non-potable use and treated to high strength recycled water quality	Unknown – water quality dependent on end-user, needs further investigating	Pass – investigation required into treatment for emerging contaminants to avoid contamination of groundwater	Pass –severe public health risk, high level treatment required
	Service delivery and infrastructure	Availability	Available when it is needed, in drought or when demand is high (climate independent / dependent)	Unknown - limitations on availability and demand as demand dependent on weather, potentially negligible demand in wet weather; supply independent of rainfall	Pass – both in-house demand and supply independent of rainfall	Fail – river conditions in drought upstream of substitution point at offtake point remain unchanged, rainfall dependent	Pass – independent of rainfall	Pass – independent of rainfall
		Yield / beneficial to pursue / supply	Option will give either 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	Fail – dependent on customer demand; insecure yield; localised opportunities only	Fail – suitable for new developments which has very limited benefit on yield to support entire region	Fail – no net impact on additional yield as substitution downstream of offtake point	Unknown – ideally increased extraction with replenishment of flows to aquifer, consultation required with DPE	Pass – can be maximised with flow from the 3 STPs
		Practically viable	Option can be delivered by Council / external support	Pass – similar projects delivered by Council for Tuncurry RTP	Pass – deliverable both with Council's and market capabilities	Pass – note long distance between RTP and discharge point with 2 water crossings	Pass – deliverable with market capabilities	Pass – deliverable with market capabilities
		Integration with existing network	Project can be integrated into the existing and/or (planned) future supply network, based on built environment and operations	Pass – existing networks can be expanded or additional offtake points introduced	Pass – systems and processed required for management of dual network but achievable	Pass – no infrastructure upgrades required at WTP or distribution network	Pass – major infrastructure includes injection wells and upgrade of RTP to required water quality, no infrastructure upgrades required at WTP or distribution network	Pass – major upgrade required at RTPs
Integrity	Compliance	Regulatory and governance	Option is achievable or supported by existing legislation and framework	Pass – water will need to meet the Australian Guidelines for Water Recycling	Pass – water will need to meet the Australian Guidelines for Water Recycling	Unknown - consultation required with DPE to determine requirements for water quality and licence to discharge	Unknown– water will need to meet the Australian Guidelines for Water Recycling Managed Aquifer Recharge	Unknown –supporting legislation for purified recycled water currently a gap in existing legislation
	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?	Pass – pathways similar to Tuncurry RTP	Pass – plants will need to be upgraded for developers to deliver on infrastructure	Unknown – planning pathways need to be defined with DPE consultation	Unknown – planning pathways need to be defined with DPE consultation	Fail – extensive community education required for acceptance of option; pathway unclear with unsupportive legislation
	Financial Project budget	Cost - Capital	Capital Costs	Unknown – indicative only; distribution network not costed as demand not quantified	Fail – high cost per dwelling for low impact with limitation for new developments only	Unknown – indicative only; further information required to determine level of advanced water treatment for substitution flow	Unknown – indicative only; investigation required to determine level of advanced water treatment for recharge, number of injection wells and injection sites	Pass – extensive advanced water treatment required
		Cost - O&M	Operating and maintenance costs	Pass – cost per L of treatment, susceptible to desired water quality; additional costs for expanded network will need to be assessed based on demand	Fail – high maintenance costs for low impact with limitation for new developments only	Unknown – indicative only; further information required to determine level of advanced water treatment for substitution flow	Unknown – indicative only; further information required to determine level of advanced water treatment for recharge, number of injection wells and injection sites	Pass – extensive advanced water treatment required
Sustainability	Environment	Environmental impact	Impact to environment (during construction/delivery), including footprint of asset, clearing, flora/fauna, disturbance to and	Pass – reduced nutrient loading in waterways from effluent management	Pass – reduced nutrient loading in waterways from effluent management	Unknown – assessment of environmental impact statement required	Unknown – assessment of environmental impact statement required	Pass – reduced nutrient loading in waterways from effluent management

				6	7	8	9	10
Council Values	**Council Risk Category**	**Measure Indicator for Coarse Screening**	**Description & objectives of indicator**	**Recycled water for municipal irrigation, agricultural and construction use**	**Recycled water for non-potable use via dual reticulation**	**Recycled water for environmental flow replacement**	**Recycled water for indirect potable reuse**	**Recycled water for direct potable reuse**
			impacts of source water and water quality, 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	Unknown – circular economy with re-use of effluent from STPs but needs investigation on impact of reduced flow on river systems	Unknown – risk of change in water consumption behaviour with increased availability of recycled water; circular economy with re-use of effluent from STPs but needs investigation on impact of reduced flow on river systems	Unknown – investigation required into impacts on river ecology from substitution flow, required water quality suitable for substitution, and volume limitations both for substitution and extraction	Unknown – investigation needed to quantify sustainable recharging volumes; strategic injection points for minimised impact on groundwater ecosystems; suitable water quality to prevent contamination and suitable treatment for emerging contaminants; and additional extraction volumes	Unknown – circular economy with re-use of effluent from STPs but needs investigation on impact of reduced flow on river systems
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)	Pass – can be developer driven, but agreements currently exist for utilisation of water from RTP	Unknown – likely to be developer driven, community acceptance not known as recycled water is directly fed to the households	Pass – effluent management schemes currently discharge to waterways as well	Unknown – community consultation required	Unknown – consultation required to determine community's appetite for direct reuse via the distribution network
Outcome				**Pass – suited as a supplementary option for expansion of existing schemes**	**Fail – negligible material impact on water security**	**Fail – negligible material impact on water security**	**Pass – further investigation required to determine feasibility of option**	**Pass – further consultation required with community, highly likely a long-term option**

				11	12	13	14	15
Council Values	**Council Risk Category**	**Measure Indicator for Coarse Screening**	**Description & objectives of indicator**	**Stormwater harvesting and use from new Tuncurry North development**	**Stormwater harvesting and use from other areas**	**Groundwater via Nabiac aquifer**	**Groundwater – Coastal strip**	**Interconnection with regional schemes – Bulk transfer via road/rail**
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	Pass - additional treatment may be required depending on runoff water quality	Unknown - water quality dependent on site characteristics, highly likely to be manageable through appropriate treatment	Pass – extracted water treated at Nabiac WTP	Unknown - water quality of groundwater varies site to site and may require a system similar to Nabiac Inland Dune Aquifer Water Supply System	Unknown – dependent on supply, risk of contamination during transportation which may require re-treatment
	Service delivery and infrastructure	Availability	Available when it is needed, in drought or when demand is high (climate independent / dependent)	Fail – runoff climate dependent	Fail – runoff climate dependent	Pass – rainfall dependent, extraction limits defined in licencing agreement for drought conditions	Unknown – rainfall dependent, further investigations required based on site specific characteristics	Unknown – dependent on supply availability
		Yield / beneficial to pursue / supply	Option will give either 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	Fail – insufficient and limited benefit on yield to support entire region	Fail – localised opportunities only, insufficient yield to support entire region	Pass – cannot be expanded beyond current licence arrangements	Unknown – dependent on site specific characteristics	Fail – does not provide permanent secure yield
		Practically viable	Option can be delivered by Council / external support	Fail – no intent from developer to harvest stormwater from site	Fail - significant infrastructure required for collection, treatment, storage and distribution for each catchment	Pass – expansion of borefield investigation under way	Fail – significant infrastructure required to source and distribute to either closest reservoir or treatment plant, or new system similar to Nabiac	Fail – impractical for total daily demand, not viable to provide required yield for prolonged periods
		Integration with existing network	Project can be integrated into the existing and/or (planned) future supply network, based on built environment and operations	Pass – minor infrastructure required	Fail - significant infrastructure required for collection, treatment, storage and distribution for each catchment	Pass – expansion of existing scheme	Fail – significant infrastructure required to source and distribute to either closest reservoir or treatment plant	Fail – additional infrastructure potentially required to convey flow from freight to reservoir or WTP
Integrity	Compliance	Regulatory and governance	Option is achievable or supported by existing legislation and framework	Pass –water will need to meet the Australian Guidelines for Water Recycling	Pass –water will need to meet the Australian Guidelines for Water Recycling Stormwater Harvesting and Reuse	Pass – expansion of existing scheme	Pass – framework identical to current work being undertaken for Nabiac, may require some additional permits or approvals based on site specific characteristics	Pass – water quality will need to be tested before being discharged for distribution
	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?	Pass – delivery of infrastructure developer dependent	Unknown – dependent on urban growth and developments	Pass – expansion of borefield investigation under way	Unknown – Nabiac supply system required 20+ years in planning and delivery	Pass – availability of freight is potentially an obstacle depending on market supply availability
	Financial Project budget	Cost - Capital	Capital Costs	Pass – high cost for small yield	Unknown – dependent on urban growth and developments	Pass – expansion of borefield investigation under way	Unknown – indicative only for new system similar to Nabiac, dependent on site/s	Fail – indicative cost only, but high costs for daily transportation and required yield
		Cost - O&M	Operating and maintenance costs	Pass – cost per L of treatment at RTP	Unknown – dependent on urban growth and developments	Pass – expansion of existing scheme	Unknown – indicative only for new system similar to Nabiac, dependent on site/s	Unknown – increased efforts in treatment if risk of contamination

				11	12	13	14	15
Council Values	**Council Risk Category**	**Measure Indicator for Coarse Screening**	**Description & objectives of indicator**	**Stormwater harvesting and use from new Tuncurry North development**	**Stormwater harvesting and use from other areas**	**Groundwater via Nabiac aquifer**	**Groundwater – Coastal strip**	**Interconnection with regional schemes – Bulk transfer via road/rail**
Sustainability	Environment	Environmental impact	Impact to environment (during construction/delivery), including footprint of asset, clearing, flora/fauna, disturbance to and impacts of source water and water quality, and heritage impacts	Pass – transfer pipeline to RTP along road alignment	Unknown – significant infrastructure require for each harvesting scheme	Pass – expansion of borefield investigation under way	Unknown – dependent on site specific characteristics	Unknown – daily carting emissions will need to be quantified
		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	Pass – reduced pollutants in the waterways and potentially minimal impact on resource consumption	Unknown – reduced pollutants in the waterways, but significant infrastructure require for each harvesting scheme	Pass – expansion of existing scheme; expansion of borefield investigation under way	Unknown – dependent on site specific characteristics	Fail – not a sustainable solution and does not provide security beyond the immediate horizon
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)	Pass – agreements currently exist for utilisation of water from RTP	Pass – stormwater harvesting schemes are currently in use in numerous areas around Australia with no major concerns from community	Pass – expansion of existing scheme	Pass – no concerns with community acceptance of Nabiac system, however may be susceptible to site specific characteristics	Pass – no concerns with community acceptance for treated water transportation and consumption in times of need
Outcome				**Fail – negligible material impact on water security**	**Fail – negligible material impact on water security**	**Pass – option under way by Council**	**Fail – significant infrastructure required across multiple sites to secure yield**	**Fail – impractical as a long term solution dependent on external factors**

7.2 Short-list of Options

The table below presents the final list of short-listed options.

Table 6 Coarse Screening Outcomes

Option to progress to Stage 2	
Option 2	Increase storage yield via new Peg Leg Creek Dam (pending information on dam safety standards and lowered level capacity)
Option 3	Desalination of estuarine water at Nabiac WTP (mobile unit)
Option 4	Desalination of sea water at Hallidays Point
Option 6	Recycled water for municipal irrigation, agricultural and construction use – applicable only as a supplementary option
Option 13	Groundwater – Nabiac Aquifer
Option 16	Interconnection with regional schemes (new pipeline to Port Macquarie – Hastings)
Option 17	Purified recycled water for potable reuse (combined from Options 9 and 10)
Options that failed to progress to Stage 2	
Option 1	Augmentation of Bootawa Dam
Option 5	Desalination of sea water at Forster
Option 7	Recycled water for non-potable use via dual reticulation
Option 8	Recycled water for environmental flow replacement
Option 11	Stormwater harvesting and use from new Tuncurry development
Option 12	Stormwater harvesting and use from other areas
Option 14	Groundwater via alternative aquifer
Option 15	Interconnection with regional schemes (bulk transfer via road/rail)

8.0 Conclusion and Recommendations

8.1 Outcomes

Key outcomes from the coarse screening are summarised below.

- Seven (7) options in total are to be progressed to the next stage for assessment.
- Option 3 Desalination of estuarine water is best suited as a short-term solution and is recognised as an emergency response option only.
- Option 6 Recycled water for irrigation, agricultural and construction use is considered an expansion to the existing schemes and is recognised as a supplementary option that can be explored further under the effluent management investigations.
- Options 9 and 10 are combined into a single Purified Recycled Water option for the next stage with direct potable reuse option regarded as a long-term option.
- A new option was established through interactive discussions in the workshop. The option of exploring interconnection with adjacent water supply schemes, specifically the connection to Port Macquarie-Hastings service area. This option includes consideration for a connecting main between the two regions that can essentially convey water to both regions under required circumstances. Other neighbouring regions were also discussed but promptly ruled out due to technical practicalities and potential feasibility of supply from the regions. Consultation with Port Macquarie-Hastings Council is required to assess the feasibility of this option.

  This new option will progress to the next stage for further assessment on technical feasibility and viability potentially in liaison 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.

8.2 Next Steps

The purpose of this assessment was to compete a coarse screening of ‘all options on the table’ and to progress to the next stage with a short-list of options based on a fatal flaw approach. A high-level review of each option was undertaken, but numerous options were scored with an ‘Unknown’ against multiple assessment criteria. Council has identified the next stage involves feasibility level, proof of concept assessment for the suitable options for further ranking and inclusion into the scenarios.

It is highly recommended that before progressing to the scenario stage all ‘Unknown’ criteria are addressed by Council to further rule out options that essentially ‘Fail’ and reduce efforts of exploring options that are deemed unfit for the IWCM strategy.

Note that not all “failed” options should be explicitly ruled out by Council but may be integrated and implemented into other strategies or plans that have objectives better suited for the outcomes of these options.

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Appendix A

Water Balance

THEME - HEADWORKS WATER SAVINGS

Manning Water Supply Scheme - 2017 - 2018 Financial Year

Level 0	ML/a	Level 1	ML/a		ML/a		ML/a	Level 2	ML/a
Volume of Water Extracted from Surface Water Sources - Manning River	7,615	Leakage from Dam							-
		Rainfall on Dam catchment							
		Evaporative Losses from Dam							-
		Supplied to WTP from/through LWU owned Dams	-	Volume Received at the WTP Inlet	6,792	Volume of water produced & Supplied to Retic Network from Bootawa Dam	7,450	Volume of water lost across the WTP	165
		Supplied directly to WTP from Rivers/Creeks	-						
Volume of Water Extracted from Bores - Nabiac Borefield	0		-	Volume Received at the WTP Inlet	-	Volume of water produced & Supplied to Retic Network from Nabiac Borefield		Volume of water lost across the WTP	-
Volume of Water Extracted from Seawater for Desalination	0		-	Volume Received at the WTP Inlet	-	Volume of water produced & Supplied to Retic Network from Desalination Plant	-	Volume of water lost across the WTP	-
Volume of water lost in the Headworks Network									165
Volume of water supplied to Manning Scheme									7,450

THEME - RETICULATION NETWORK WATER SAVINGS

Manning Water Supply Scheme - 2017 - 2018 Financial Year

Level 0	ML/year		Level 1	ML/year	Level 2	ML/year	Level 3	ML/year	Level 4	ML/year	Level 5	ML/year	Level 6	ML/year
Own Sources	7,450	Reticulation Network Input	Billed Water Exported to other systems/Bulk Customers	0	Authorised Consumption	6,908	Billed Authorised Consumption (WB62) [W11.1]	6,871	Billed Water Exported to other systems (bulk supply) (WB59) [W14.1]	0	Bulk supply	0	Revenue Water	6,871
			Water Supplied to Retail Customers in System	7,450					Billed metered consumption by registered (retail) customers	6,871	By water carters / standpipes	0		
											Residential	4,666		
											Commercial	1,491		
											Industrial	483		
											Instituitional	144		
											Public	87		
											Rural	0		
											Municipal - excluding parks	0		
											Municipal - public parks	0		
									Billed unmetered consumption by registered (retail) customers	0	By water carters / standpipes	0		
											Residential	0		
											Commercial	0		
											Industrial	0		
											Instituitional	0		
											Public	0		
											Rural	0		
											Municipal - excluding parks	0		
											Municipal - public parks	0		
Water Imported	0						Unbilled authorised consumption (WB61)	37	Unbilled metered consumption	0	By water carters / standpipes	0	Non-revenue Water (WB70) [W10.1] - *expect >= 10%*	579
											Residential	0		
											Commercial	0		
											Industrial	0		
											Rural	0		
											Municipal - excluding parks	0		
											Municipal - public parks	0		
									Unbilled unmetered consumption - estimate is 0.5%* of water supplied	37	System cleaning	?		
											Fire services	?		
											Use of hydrants for sewer flushing or street cleaning	?		
					Water Losses (WB69)	542	Apparent Losses (WB67)	145	Unauthorized consumption (theft and illegal use) (WB65) - estimate is 0.1%* of water supplied	7	Unauthorised use of fire hydrants or fire connection	?		
											Illegal by-passing of customer meters	?		
											Other theft	?		
									Customer meter under-registration (WB66)	137	Residential estimate 2% (can add 0.5% for meter non-registration) of metered residential consumption	93		
											Non-residential estimate 2% of metered non-res consumption	44		
							Real Losses (WB68) [A10] - *expect >= 6%*	397	Real Losses	397	Avoidable Real Losses	-542		
											Unavoidable Real Losses from main UARL (L/d) = 18 * Lm * P Lm = length of main (km), P = av pressure (m)	427		
											Unavoidable Real Losses from service connections UARL (L/d) = 0.8 * Ns * P Ns = no of service connections, P = av pressure (m)	512		
							Real Losses %	5%					NRW %	8%

(WB61) - The National Performance Framework default value for unmetered, unbilled authorised supply is 0.5% of total water supplied.
(WB65) - The National Performance Framework default value for unauthorised consumption is 0.1% of total water supplied
(WB66) - The assumption of 2% (plus additional 0.5%) of metered consumption is from DPIE Benchmarking Report Appendix B1.1. The source of this is the error limit of ± 2.0% for in-service compliance of water meters from AS3565.4

UARL = (18 * Lm + 0.80 * Ns) * P

Where:

UARL	=	Unavoidable annual real losses (Litres/day)
Lm	=	Length of mains (km)
Ns	=	No. of service connections (main to street:property boundary)
P	=	Average operating pressure at average zone point (metres)

Appendix B

Cost Estimates

CAPEX SUMMARY									
Option	Description	Yield		Total Direct Cost	SID	Contingency	Total CAPEX	Indexation Rate	Updated Cost
1.1	Augmentation of Bootawa Dam	2,250	ML	$ 23,937,100			$ 33,511,940	1.20	$ 40,289,253
1.2	Augmentation of Bootawa Dam	2,250	ML	$ 25,404,300			$ 35,566,020	1.20	$ 42,758,742
1.3	Augmentation of Bootawa Dam	2,250	ML	$ 28,510,600			$ 39,914,840	1.20	$ 47,987,048
2.1	Increase storage yield via new Peg Leg Creek Dam	7,000	ML	$ 49,620,200			$ 80,300,000	1.12	$ 89,617,830
2.2	Increase storage yield via new Peg Leg Creek Dam	20,500	ML	$ 148,538,600			$ 240,300,000	1.12	$ 268,183,868
3.0	Desalination of estuarine water at Nabiac WTP	8	ML/D	$ 8,054,345	20%	30%	$ 12,081,517		$ 12,081,517
4.0	Desalination of sea water at Hallidays Point, 100% operational	40	ML/D	$ 67,951,264	20%	30%	$ 101,926,896		$ 101,926,896
5.0	Desalination of sea water at Forster	10	ML/D	$ 17,486,443	20%	30%	$ 26,229,664		$ 26,229,664
6.0	Recycled water for irrigation / construction use	15	ML/D	$ 14,078,090	20%	30%	$ 21,117,134		$ 21,117,134
7.0	Recycled water for non-potable use via dual reticulation	40	ML/D						
8.0	Recycled water for environmental flow replacement	Unknown		$ 9,525,649	20%	30%	$ 14,288,473		$ 14,288,473
9.0	Purified Recycled Water for Indirect Potable Reuse (Managed Aquifer Recharge)	Unknown		$ 9,262,341	20%	30%	$ 13,893,512		$ 13,893,512
10.0	Purified Recycled Water for Direct Potable Reuse	40	ML/D	$ 23,692,080	20%	30%	$ 35,538,119		$ 35,538,119
11.0	Stormwater harvesting and use from new Tuncurry North development	1,820	ML/yr	$ 1,395,940	20%	30%	$ 2,093,910		$ 2,093,910
12.0	Stormwater harvesting and use from other areas	Unknown							
13.0	Groundwater via Nabiac aquifer	6	ML/D						
14.0	Groundwater – Coastal strip	Unknown		$ 38,611,191	20%	30%	$ 57,916,787		$ 57,916,787
15.0	Interconnection with regional schemes - Water Carting	Unknown							

Option	Item	Qty		Unit Rate	Indexation Factor	Direct Cost	Source	Notes
	Augmentation of Bootawa Dam, 2.5H 1V							
1.1	**Total Direct Cost**					**$ 23,937,100**		
	Raising Bootawa Dam					23,937,100	*NSW Department of Services, Technology & Administration, 2011*	*Demolition of old pump station not included in costs; cost in 2011 $*
	Augmentation of Bootawa Dam, 3H 1V							
1.2	**Total Direct Cost**					**$ 25,404,300**		
	Raising Bootawa Dam					25,404,300	*NSW Department of Services, Technology & Administration, 2011*	*Demolition of old pump station not included in costs; cost in 2011 $*
	Augmentation of Bootawa Dam, 4H 1V							
1.3	**Total Direct Cost**					**$ 28,510,600**		
	Raising Bootawa Dam					28,510,600	*NSW Department of Services, Technology & Administration, 2011*	*Demolition of old pump station not included in costs; cost in 2011 $*
	Increase storage yield via new Peg Leg Creek Dam, 7000 ML							
2.1	**Total Direct Cost**					**$ 49,620,200**		
	New Peg Leg Dam					49,620,200	*Smec, 2016*	*Dam site 2A - single stage; RL 92; 7,000 ML; cost in 2016 $*
	Increase storage yield via new Peg Leg Creek Dam, 20,500 ML							
2.2	**Total Direct Cost**					**$ 148,538,600**		
	New Peg Leg Dam					$ 148,538,600	*Smec, 2016*	*Dam site 3 - staged; RL 95; 20,500 ML; cost in 2016 $*
	Desalination of estuarine water at Nabiac WTP							
3	**Total Direct Cost**					**$ 8,054,345**		
	Desalination Plant	8	ML/D	617,277		$ 4,938,214		
	DN375 main to outfall - excavation	3600	m	355	1.14	$ 1,456,526	*NSW Reference Rates Manual, 2014*	*Assumed DN400 PE equivalent DN375 DICL*
	DN375 main to outfall - horizontal drilling	1300	m	1,200	1.06	$ 1,659,604	*Sydney Water Cost Estimating Tool, 2020*	*Across river and ocean outfall*
	Desalination of sea water at Hallidays Point							
4	**Total Direct Cost**					**$ 67,951,264**		
	Desalination Plant	40	ML/D	1,538,702		$ 61,548,089	*2020 Lower Hunter Water Gap Analysis*	
	DN750 Distributor Main to Darawank	6174	m	910	1.14	$ 6,403,176	*NSW Reference Rates Manual, 2014*	*Water Mains Rate, Trunk Mains DICL*
	Desalination of sea water at Forster							
5	**Total Direct Cost**					**$ 17,486,443**		
	Desalination Plant	10	ML/D	1,538,702		$ 15,387,022	*2020 Lower Hunter Water Gap Analysis*	
	DN375 Distributor Main to Darawank	5189	m	355	1.14	$ 2,099,420	*NSW Reference Rates Manual, 2014*	*Water Mains Rate, Trunk Mains DICL*
	Recycled water for municipal irrigation, agricultural and construction use							
6	**Total Direct Cost**					**$ 14,078,090**		
	Dawson RTP Upgrade	**4.6**	**ML**					
	Screening	1		236,180	1.06	$ 251,260	*Sydney Water Cost Estimating Tool, 2020*	*Sewage Treatment » Advanced Treatment » Micro Screening (1-1000 L/s), assumed intantaneous daily flow 53 L/s, new WWTP*
	Membrane Filtration	1		1,269,556	1.06	$ 1,350,616	*Sydney Water Cost Estimating Tool, 2020*	*Sewage Treatment » Advanced Treatment » Membrane Filtration (1-1000 L/s), assumed intantaneous daily flow 53 L/s, new WWTP*
	Storage, 5 ML	1		1,910,000	1.14	$ 2,176,811	*NSW Reference Rates Manual, 2014*	*Water Service Reservoirs, Concrete*
	Sub-total					***$ 3,778,687***		
	Tuncurry Expansion	**7.6**	**ML**					
	Additional Membrane Filters, 7.6 ML	1		1,869,086	1.06	$ 1,988,425	*Sydney Water Cost Estimating Tool, 2020*	*Sewage Treatment » Advanced Treatment » Membrane Filtration (1-1000 L/s), assumed intantaneous daily flow 88 L/s, growth*
	Additional Screening, 7.6 ML	1		320,667	1.06	$ 341,141	*Sydney Water Cost Estimating Tool, 2020*	*Sewage Treatment » Advanced Treatment » Micro Screening (1-1000 L/s), assumed intantaneous daily flow 88 L/s*
	Additional 8 ML storage at RWTP	1		2,700,000	1.14	$ 3,077,168	*NSW Reference Rates Manual, 2014*	*Water Service Reservoirs, Concrete*
	DN375 Forster Transfer Main - excavation	7686	m	355	1.14	$ 3,109,683	*NSW Reference Rates Manual, 2014*	*Water Mains Rate, Trunk Mains DICL*
	DN375 Forster Transfer Main - drilling	804	m	1,200	1.06	$ 1,026,401	*Sydney Water Cost Estimating Tool, 2020*	*Directional Drilling » Length to 150m » 375 dia*
	DN375 Forster Transfer Main - excavation	1870	m	355	1.14	$ 756,584	*NSW Reference Rates Manual, 2014*	*Water Mains Rate, Trunk Mains DICL*
	Sub-total					***$ 10,299,403***		
	Recycled water for non-potable use via dual reticulation							
7								
	Cost per dwelling					$ 15,685	*Turner Road and Oran Park Development 2015-16*	*Cost based on ADD = 0.9 ML/day for 1174 dwellings, inclusive of treatment and transfer infrastructure, excludes connection and internal plumbing*

Option	Item	Qty		Unit Rate	Indexation Factor	Direct Cost	Source	Notes
	Recycled water for environmental flow replacement							
8	**Total Direct Cost**					**$ 9,525,649**		
	Dawson RTP Upgrade	4.6	ML			$ 3,778,687	*Option 6*	
	DN300 Transfer Main - excavation	17322	m	264	1.14	$ 5,211,819	*NSW Reference Rates Manual, 2014*	*Water Mains Rate, Trunk Mains DICL*
	DN300 Transfer Main - drilling	475	m	1,059	1.06	$ 535,143	*Sydney Water Cost Estimating Tool, 2020*	*Directional Drilling » Length to 150m » 300 dia*
	Purified Recycled Water for Indirect Potable Reuse (Managed Aquifer Recharge)							
9	**Total Direct Cost**					**$ 9,262,341**		
	Reverse Osmosis, 5.9 ML	1		2,884,608	1.06	$ 3,068,787	*Sydney Water Cost Estimating Tool, 2020*	*Sewage Treatment » Advanced Treatment » Reverse Osmosis (5-555 L/s), assumed intantaneous daily flow 68 L/s*
	DN375 Transfer Main - excavation	8,792	m	355	1.14	$ 3,557,160	*NSW Reference Rates Manual, 2014*	*Water Mains Rate, Trunk Mains DICL*
	DN375 Transfer Main - drilling	360	m	1,200	1.06	$ 459,583	*Sydney Water Cost Estimating Tool, 2020*	*Directional Drilling » Length to 150m » 300 dia*
	Water Reservoir, 5 ML	1		1,910,000	1.14	$ 2,176,811	*NSW Reference Rates Manual, 2014*	*Water Service Reservoirs, Concrete; receiving reservoir at Nabiac*
	Purified Recycled Water for Direct Potable Reuse							
10	**Total Direct Cost**					**$ 23,692,080**		
	Dawson RTP Upgrade							
	Dawson Recycled WTP					$ 3,778,687	*Sydney Water Cost Estimating Tool, 2020*	*Sewage Treatment » Advanced Treatment » Micro Screening (1-1000 L/s), assumed intantaneous daily flow 53 L/s, new WWTP*
	Reverse Osmosis, 4.6 ML	1		2,414,450	1.06	$ 2,568,610	*Sydney Water Cost Estimating Tool, 2020*	*Sewage Treatment » Advanced Treatment » Membrane Filtration (1-1000 L/s), assumed intantaneous daily flow 53 L/s, new WWTP*
	Sub-total					***$ 6,347,297***		
	Tuncurry Advanced Water RTP							
	Additional Membrane Filters, 7.6 ML	1		1,869,086	1.01	$ 1,889,184	*Sydney Water Cost Estimating Tool, 2020*	*Sewage Treatment » Advanced Treatment » Membrane Filtration (1-1000 L/s), assumed intantaneous daily flow 88 L/s, growth*
	Additional Screening, 7.6 ML	1		320,667	1.01	$ 324,115	*Sydney Water Cost Estimating Tool, 2020*	*Sewage Treatment » Advanced Treatment » Micro Screening (1-1000 L/s), assumed intantaneous daily flow 88 L/s*
	Additional 5 ML storage at RWTP	1		1,910,000	1.14	$ 2,176,811	*NSW Reference Rates Manual, 2014*	*Water Service Reservoirs, Concrete*
	Reverse Osmosis, 11 ML	1		4,685,662	1.06	$ 4,984,836	*NSW Reference Rates Manual, 2014*	*Water Mains Rate, Trunk Mains DICL*
	DN375 Transfer Main - excavation	7686	m	355	1.14	$ 3,109,683	*NSW Reference Rates Manual, 2014*	*Water Mains Rate, Trunk Mains DICL*
	DN375 Transfer Main - drilling	804	m	1,200	1.06	$ 1,026,401		
	DN375 Transfer Main - excavation	1870	m	355	1.14	$ 756,584		
	Water Reservoir, 8 ML	1		2,700,000	1.14	$ 3,077,168		
	Sub-total					***$ 17,344,783***		
	Stormwater harvesting and use from new Tuncurry North development							
11	**Total Direct Cost**					**$ 1,395,940**		
	DN1200 Transfer Main	1038	m	1180	1.14	$ 1,395,940	*NSW Reference Rates Manual, 2014*	*Stormwater mains, RCP, 1200; based on developer submitted plans*
	Groundwater – Coastal strip							
14	**Total Direct Cost**					**$ 38,611,191**		
	Nabiac Borefield Construction.			$5,680,148	1.12	$6,339,260	*Nabiac Inland Dune Aquifer Water Supply System Project Management Plan, Apr 2016*	
	Nabiac Water Treatment Plant Including SCADA and Telecommunications for the Scheme Integration			$16,433,122	1.12	$18,339,984	*Nabiac Inland Dune Aquifer Water Supply System Project Management Plan, Apr 2016*	
	Nabiac to Darawank Transfer Main			$3,935,289	1.12	$4,391,931	*Nabiac Inland Dune Aquifer Water Supply System Project Management Plan, Apr 2016*	
	Lead In Services inc. High Voltage installation			$2,410,309	1.12	$2,689,996	*Nabiac Inland Dune Aquifer Water Supply System Project Management Plan, Apr 2016*	
	Darawank Balance Tank			$2,291,295	1.12	$2,557,172	*Nabiac Inland Dune Aquifer Water Supply System Project Management Plan, Apr 2016*	
	Darawank Pump station			$3,665,885	1.12	$4,091,266	*Nabiac Inland Dune Aquifer Water Supply System Project Management Plan, Apr 2016*	
	MCW planning and management of Scheme			$180,624	1.12	$201,583	*Nabiac Inland Dune Aquifer Water Supply System Project Management Plan, Apr 2016*	

OPEX SUMMARY					
Option	**Description**	**Operating Cost**		**Source**	**Notes**
1.1	Augmentation of Bootawa Dam	381	per ML of treated water	*MCC existing operational costs*	
1.2	Augmentation of Bootawa Dam	381	per ML of treated water	*MCC existing operational costs*	
1.3	Augmentation of Bootawa Dam	381	per ML of treated water	*MCC existing operational costs*	
2.1	Increase storage yield via new Peg Leg Creek Dam	381	per ML of treated water	*MCC existing operational costs*	*Additional costs for pumping infrastructure not included*
2.2	Increase storage yield via new Peg Leg Creek Dam	381	per ML of treated water	*MCC existing operational costs*	*Additional costs for pumping infrastructure not included*
3.0	Desalination of estuarine water at Nabiac WTP	1,132,240	per month	*MCC investigations 2019-20 drought*	*Scaled from 3 ML/d and 5.5 ML/d plants*
4.0	Desalination of sea water at Hallidays Point, 100% operational	4,308,907	per year	*Lower Hunter Water Gap Analysis 2020*	*Scaled down from currently operating plants in Australia*
4.1	Desalination of sea water at Hallidays Point, 50% operational	2,154,454	per year	*Lower Hunter Water Gap Analysis 2020*	*Scaled down from currently operating plants in Australia*
4.2	Desalination of sea water at Hallidays Point, 20% operational	861,781	per year	*Lower Hunter Water Gap Analysis 2020*	*Scaled down from currently operating plants in Australia*
4.3	Desalination of sea water at Hallidays Point, 10% operational	430,891	per year	*Lower Hunter Water Gap Analysis 2020*	*Scaled down from currently operating plants in Australia*
5.0	Desalination of sea water at Forster	1,077,227	per year	*Lower Hunter Water Gap Analysis 2020*	*Scaled down from currently operating plants in Australia*
6.0	Recycled water for irrigation / construction use	820	per ML of treated water	*MCC existing operational costs*	*Additional treatment costs not included, further investigation required*
7.0	Recycled water for non-potable use via dual reticulation	820	per ML of treated water	*MCC existing operational costs*	*Additional dual reticulation and treatment costs not included, further investigation required*
8.0	Recycled water for environmental flow replacement	820	per ML of treated water	*MCC existing operational costs*	*Additional treatment costs not included, further investigation required*
9.0	Purified Recycled Water for Indirect Potable Reuse (Managed Aquifer Recharge)	820	per ML of treated water	*MCC existing operational costs*	*Additional treatment costs and well operating not included, further investigation required*
10.0	Purified Recycled Water for Direct Potable Reuse	820	per ML of treated water	*MCC existing operational costs*	*Additional treatment costs not included, further investigation required*
11.0	Stormwater harvesting and use from new Tuncurry North development	820	per ML of treated water	*MCC existing operational costs*	
12.0	Stormwater harvesting and use from other areas	Unknown			*Costs are site specific and dependent on end-use*
13.0	Groundwater via Nabiac aquifer	836	per ML of treated water	*MCC existing operational costs*	
14.0	Groundwater – Coastal strip	Unknown			*Costs dependent on various factors such as site locality, raw water quality etc.*
15.0	Interconnection with regional schemes - Water Carting	Unknown			*Costs dependent on various factors such as recevied water quality, unloading sites, unloading infrastructure etc.*

Appendix C

Coarse Screening Workshop

AECOM

IWCM Strategy
Coarse Screening of Water Security Options for the Manning Water Supply Scheme

Coarse Screening Workshop

To	MidCoast Council	Page	6
CC	Coarse Screening Workshop Attendees		
Subject	IWCM Strategy Coarse Screening of Water Security Options for the Manning Water Supply Scheme		
From	AECOM		
File/Ref No.	60685841	Date	18-Jul-2022

Introduction

The Coarse Screening of Water Security Options for the Manning Water Supply Scheme project is the first step in the "all options on the table" approach for the Manning Scheme. This is being completed as part of MidCoast Council's Integrated Water Cycled Management (IWCM) Strategy. A comprehensive list of water security options, including both water demand and source augmentation options, have been evaluated. Each option has been investigated to identify the key risks, issues and opportunities, prior to completing a coarse screening assessment based on a fatal flaw approach. The outcome of the project will be a short-list of options that pass the coarse screening and move into a quadruple bottom line investigation, for consideration in the scenarios phase of the IWCM strategy.

The coarse screening workshop will present the list of water security options for discussion and endorsement of a short-list of options for further investigation. This briefing paper provides background information for the workshop attendees.

Background

IWCM takes a holistic approach to effective and sustainable urban water supply and sewerage business. The IWCM Strategy sets the objectives, performance standards and associated performance indicators, while ensuring infrastructure meets the needs and priorities of the community and stakeholders. The outcome is a 30-year IWCM scenario that best meets the needs of the region on a social, environmental, economic and governance (quadruple bottom line) basis.

MidCoast Council (Council) is currently reviewing their IWCM Strategy and are currently finalising the IWCM *Issues Paper*. One of the key issues identified was insufficient secure yield within the Manning Water Supply Scheme.

The Manning Scheme supplies an area ranging from Crowdy Head to Smiths Lake, with a total permanent population of around 74,000 people. This scheme is subject to significant spikes in demand during holiday periods. The system is supplied by two water schemes. The Manning River via Bootawa Dam is located upstream of Wingham, where the Bootawa Water Treatment Plant (WTP) treats the raw water and pumps to reservoirs across the Manning scheme. Water is also supplied from the Nabiac Inland Dune Aquifer via the Nabiac WTP.

The Manning Water Supply Scheme is presented in Figure 1.

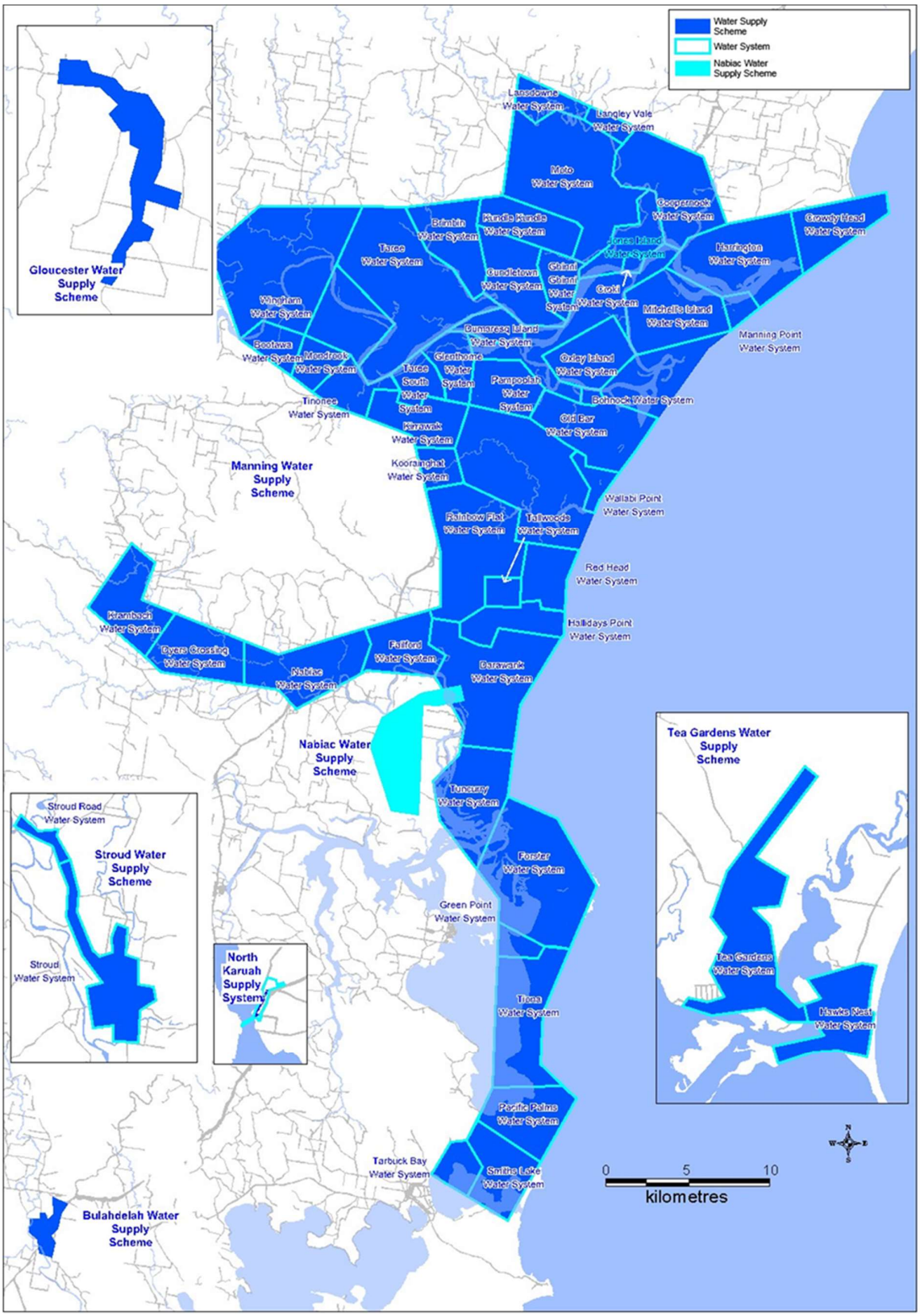

Figure 1 Manning Water Supply Scheme

Assessment Approach and Criteria

The coarse screening will be based on a fatal flaw approach. Each water security option will be 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 not scored due to lack of information, therefore progress for further investigation

The assessment criteria are provided in Table 1. The criteria were developed by the project team based on:

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

Table 1 Assessment Criteria

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	Available when it is needed, in drought or when demand is high (climate independent / dependent)
		Yield / beneficial to pursue / supply	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
		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 Project budget	Cost- capital	Capital costs
		Cost – O&M	Operating and maintenance costs
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)

Water Security Options

Fifteen water security options have been investigated, taking an “all options on the table” approach, which are as follows:

1. Increase storage yield via raised dam wall at Bootawa Dam
2. Increase storage yield via new Peg Leg Creek Dam
3. Desalination of estuarine water at Nabiac TWP (mobile unit)
4. Desalination of sea water at Hallidays Point
5. Desalination of sea water at Forster
6. Recycled water for municipal irrigation, agricultural and construction use
7. Recycled water for non-potable use via dual reticulation
8. Recycled water for environmental flow replacement
9. Recycled water for indirect potable reuse
10. Recycled water for direct potable reuse
11. Stormwater harvesting and use from new Tuncurry North development
12. Stormwater harvesting and use from other areas
13. Groundwater via Nabiac aquifer
14. Groundwater – Coastal strip
15. Interconnection with regional schemes

In addition, a water balance has been undertaken, to consider the potential benefits of both demand management and water conservation measures in a parallel with the source augmentation options.

A summary of the options considered is presented in Table 2.

Coarse Screening Workshop

During the coarse screening workshop, we will present the evaluation of each water security option that was investigated. We will present the outcome of a preliminary coarse screening completed by the project team for discussion with the workshop group. The outcome of this workshop will be an endorsed short-list of water security options for further investigation prior to development of the IWCM Strategy.

Next steps

Following the workshop, the project team will progress with preparation of the Coarse Screening Report.

In parallel, Council will proceed with procurement of a consultant to undertake Part 2 Options Assessment of the short-listed options.

Table 2 Long-list of Water Security Options

Option	Option Name	Option Description	Risks	Issues	Benefits and Opportunities
1	Augmentation of Bootawa Dam	Increasing storage at Bootawa Dam from 2,250 ML to 4,500 ML by raising bank embankment by 7m. Principal items include embankment raising, saddle dam, new spillway channel, penstock, valve house and intake and outlet works.	• Offtake water quality • Lowering of dam levels for construction • Compliance of proposed augmentation to current dam safety standards	• Long lead time • Not rainfall independent • Increased risk profile for Council • Cultural heritage artefacts	• Utilises existing infrastructure • Provision for future expansion
2	Increase storage yield via new Peg Leg Creek Dam	Additional off-river storage dam on Peg Leg Creek. Dam pump supplied from Manning River and water treated at Bootawa Water Treatment Plant. Additional storage provided from 7,000 ML to potentially 27,000 ML. Principal items include earth and rockfill embankment, spillway, intake tower, and inlet and outlet pipework.	• Environmental approvals and permits • Offtake water quality • Cultural heritage sites	• Long lead time • Not rainfall independent • Large carbon footprint • Complex geology	• Flexibility in staging • Provision for staging and future expansion • Increased reliability of supply • Hydropower
3	Desalination of estuarine water at Nabiac TWP (mobile unit procured only when needed)	Mobile desalination plant adjacent to Nabiac Water Treatment Plant with extraction of raw water from Wallamba River, and disposal of reject discharge to the ocean. Principal items include river intake and raw water pumping station, storage tanks, microfiltration, reverse osmosis, emergency power supply generator, and ocean outfall.	• Availability of units • Salinity levels • Approvals for ocean outfall • Energy requirements	• Construction through private property • Construction through environmental corridors • Not fully rainfall independent	• Solar farm for renewable energy • Easy integration into supply system
4	Desalination of sea water at Hallidays Point (operational when needed)	Desalination plant utilising sea water located on land at Hallidays Point Sewer Treatment Plant with treated water pumped to Darawank PS/reservoir for distribution and reject discharge to the ocean. Principal items include sea water intake and pumping station, storage tanks, screening and microfiltration, reverse osmosis, disinfection, and ocean outfall.	• Approvals and permits • Aquatic ecology – impingement and entrainment • Aquatic ecology – reject discharge • Construction – environmental corridors	• Large carbon footprint • High operation and maintenance costs • Long lead time	• Rainfall independent • Increased reliability • Proven technology • Operation flexible to demand
5	Desalination of sea water at Forster (baseload plus seasonal flexibility to meet demand for Forster and southern areas)	Desalination plant utilising sea water located on land at Forster Sewer Treatment Plant with treated water pumped to Forster reservoir for distribution and reject discharge to the ocean using the Forster STP ocean outfall. Principal items include sea water intake and pumping station, storage tanks, screening and microfiltration, reverse osmosis, disinfection, and bulk pipe to reservoir.	• Approvals and permits • Aquatic ecology – impingement and entrainment • Aquatic ecology – reject discharge • Forster outfall pipe capacity • Complicated distribution network	• Large carbon footprint • High operation and maintenance costs • Long lead time • Not supportive region-wide	• Rainfall independent • Increased reliability • Proven technology • Bifurcation of Manning Scheme • Operation flexible to demand
6	Recycled water for municipal irrigation, agricultural and construction use	Increased use of recycled water to offset potable water use. Principal items include expansion of Tuncurry Recycled Water Treatment Plant with diversion of flow from Forster Sewage Treatment Plant and upgrade of Taree effluent management scheme to Dawson Recycled Water Treatment Plant, suitable for unrestricted public access.	• Recycled water demand • Distribution infrastructure • Approvals and permits	• Rainfall dependent demand • Greenhouse gas emissions • High operation and maintenance costs	• Community participation • Effluent management
7	Recycled water for non-potable use via dual reticulation	Offset potable water use with dual reticulation network, supplying both potable water and recycled water to customers in new development areas. Principal items include expansion of Tuncurry Recycled Water Treatment Plant with diversion of flow from Forster Sewage Treatment Plant, upgrade of Taree effluent management scheme to Dawson Recycled Water Treatment Plant, suitable for unrestricted public access, and expansion of distribution network with recycled water mains to all connections included in the scheme.	• Water quality to meet ARWG • Public health • Community Acceptance • Approvals and permits • Recycled water demand	• Rainfall dependent demand (garden use) • Greenhouse gas emissions • High operation and maintenance costs relative to potable offset • Only suitable for new residential developments (no retrofit), discriminatory • Distribution infrastructure (dual reticulation network)	• Rainfall independent demand (internal use) • Community participation • Effluent management • Aesthetic values maintained

Option	Option Name	Option Description	Risks	Issues	Benefits and Opportunities
8	Recycled water for environmental flow replacement	Substitution of flows downstream of Bootawa Dam river offtake point to enable greater extraction upstream. Replacement flows supplied from Dawson Recycled Water Treatment Plant (as per Option 5).	• River health and ecology – substitution flow • River health and ecology – increased offtake • Approvals and permits	• High capital costs • Greenhouse gas emissions • High operation and maintenance costs • May not improve yield/supply	• May improve river flow • Effluent management • Adaptable to growth
9	Recycled water for indirect potable reuse	Increased extraction from Nabiac borefield. Replenishment of groundwater for Nabiac borefield through managed aquifer recharge. Tuncurry Recycled Water Treatment Plant upgraded with advance water treatment processes for recharging aquifers.	• Recharge flow impacts • Contamination – salinity • Contamination – emerging contaminants • Water clogging • Approvals and permits	• Water quality • Injection points • Licencing for increased extraction	• Rainfall independent • Increased reliability • Effluent management
10	Recycled water for direct potable reuse	Direct potable reuse of treated water from Dawson and Tuncurry Recycled Water Treatment Plants (as per Option 5). Additional advanced water treatment processes at both plants, and a new reservoir for distribution to southern Manning region.	• Community acceptance • Severe public health consequences	• Supporting legislation • Greenhouse gas emissions • High operation and maintenance costs	• Rainfall independent • Adaptable to growth • Effluent management • Utilises existing infrastructure
11	Stormwater harvesting and use from new Tuncurry North development	Offset potable water use with recycled water from North Tuncurry development's stormwater harvesting. Collected stormwater is directed to Tuncurry Recycled Water Treatment Plant.	• Wet weather storage • Recycled water demand • Ground profile	• Developer led stormwater management plan • Rainfall dependent demand	• Setting example • Developer contributed assets
12	Stormwater harvesting and use from other areas	Offset potable water use with decentralised scheme for stormwater collection, storage and/or treatment for localised opportunities.	• Sparse catchment • Demand • Numerous catchments	• Rainfall dependent demand • Coastal ground profile • Storage	•
13	Groundwater via Nabiac aquifer	Expansion of Nabiac borefield for total yield of 18ML/D. Works already underway.	• Saline intrusion	• Drought extraction only	• Rainfall independent • Utilises existing infrastructure • Short lead time • Reliable source
14	Groundwater – Coastal strip	New borefield from potential other Great Lakes Coastal Sands sites. Principal items include borefield, water treatment plant, and pipeline to nearest reservoir.	• Groundwater availability • Environmental impacts • Approvals and permits	• Distance to Manning Scheme	• Flexibility with staging
15	Interconnection with regional schemes	Water carting from neighbouring service providers when in need through rail freight or trucks.	• Supply dependent • Availability of transport	• High costs • Not a permanent solution • Can't transport total daily demand • Transportation distances	• No additional infrastructure • Scalable to requirements

IWCM Strategy: Coarse Screening of Water Security Options for the Manning Water Supply Scheme

Coarse Screening Workshop

Workshop facilitated by Daniel Brauer, AECOM

Art by
Bianca Gardiner Dodd

Acknowledgment of Country

We acknowledge the
Gathang-speaking (Biripi and Worimi)
people as the Traditional Custodians of the land on which we meet today, and recognise their connections to land, sea and community.

We pay our respect to their elders past and present and extend that respect to all Aboriginal and Torres Strait Islander peoples today.

Art by
Bianca Gardiner Dodd

Workshop Agenda

1.	Welcome	1:00
2.	ESG Moment	1:02
3.	Introductions	1:05
4.	Workshop Objectives and Outcomes	1:10
5.	Project Background	1:15
6.	Assessment Approach and Criteria	1:30
7.	Long-List of Water Security Options	1:40
8.	Short break	2:20
9.	Coarse Screening of Options - Interactive	2:30
10.	Discussion	3:00
11.	Conclusion	3:50
12.	Close	4:00

ESG Moment – Cultural Value of Water

Fraser Coast Integrated Urban Water and Sewerage Growth Strategy

Importance of incorporating First Nations knowledge and values

Recognising the three laws of the Butchulla People:

- What is good for the land comes first
- Do not take or touch anything that does not belong to you
- If you have plenty, you must share

Indigenous Weather Knowledge - Bureau of Meteorology (bom.gov.au)

Introductions

- What is your name and role?
- What are you hoping to contribute to the workshop?
- What would you like to achieve today?

Workshop Objectives and Outcomes

The objective of the workshop is to:

- Present the long-list of water security options for discussion
- Undertake a coarse screening of the long-list of options
- Agree the short-list of options for further investigation

The outcome of this workshop will be to an endorsed short-list of water security options for further investigation prior to development of the IWCM Strategy

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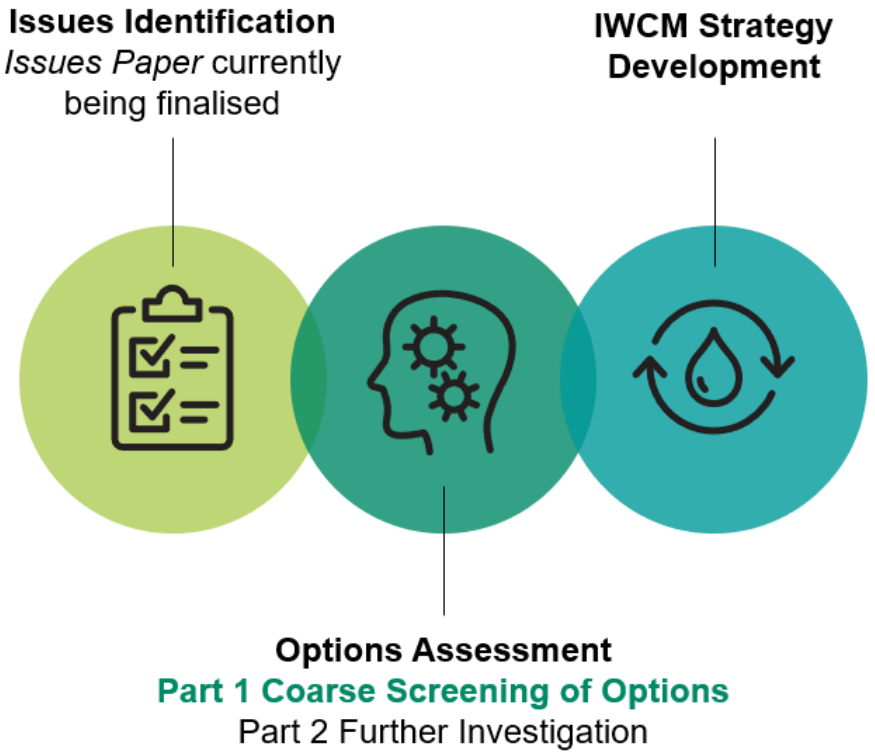
Project Background

Project Background – Integrated Water Cycle Management

- IWCM integrates water supply, sewerage and stormwater services within 30-year whole-of-catchment strategy
- Sets the objectives, performance standards and associated performance indicators for the water and sewer business
- Identifies needs and issues based on evidence and sound analysis
- Ensure infrastructure matches need
- Determines investment priority in consultation with community and stakeholders
- Identifies the ‘best value 30-year’ IWCM scenario on a social, environmental and financial basis

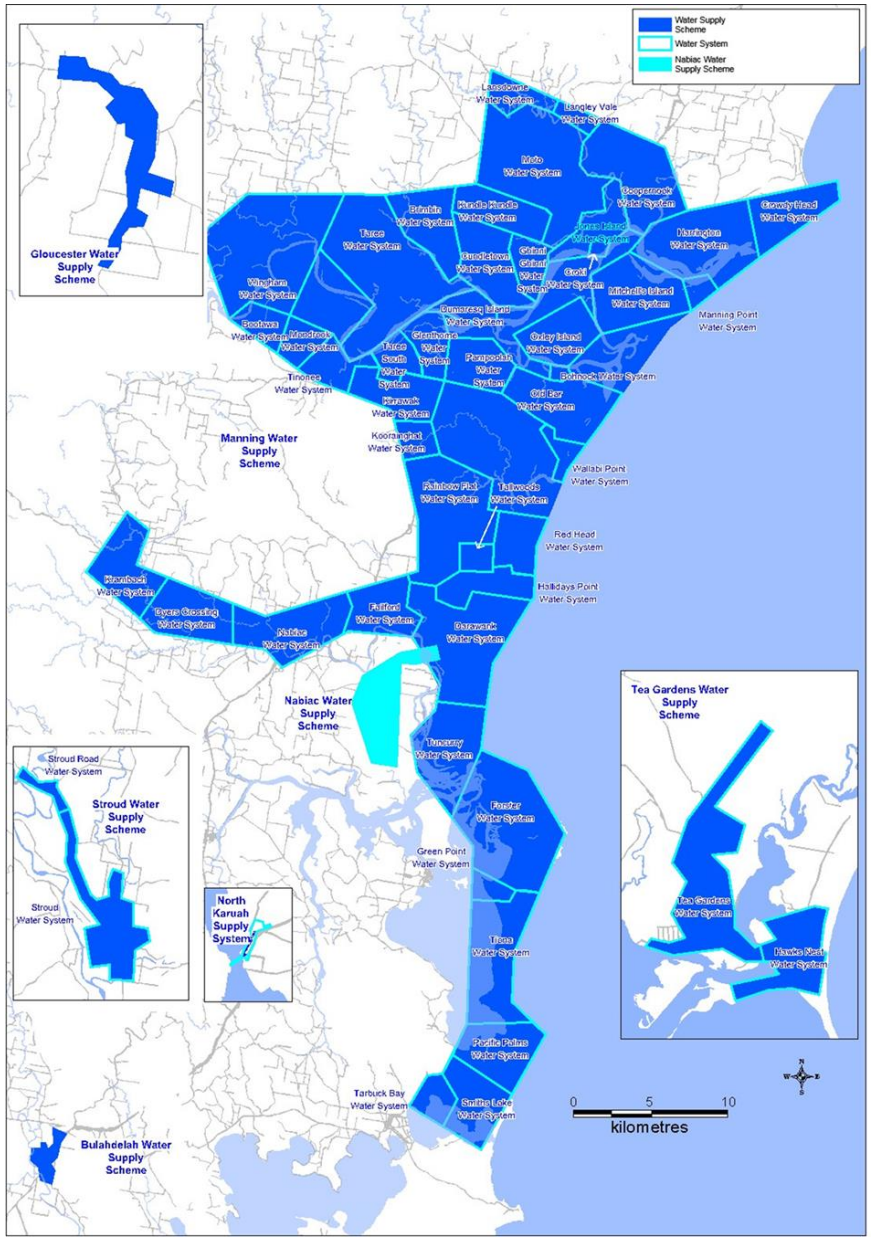
Project Background – MidCoast IWCM Journey to date

- MidCoast Water prepared ‘Our Water Our Future 2045’ in 2015 (water and sewerage only).
- Council is currently reviewing the IWCM, with final IWCM Strategy due May 2023
- Key outcome of the Issue Identification Phase: ***Manning Water Supply Scheme does not have sufficient secure yield for supply – does not meet 5-10-10 rule***



Project Background – Manning Water Supply Scheme

- Supplies area from Crowdy Head to Smiths Lake
- ~90% customers serviced by Manning Scheme
- Total permanent population of ~74,000 people, with significant seasonal increase
- Scheme supplies current ADD ~19 ML/day, expected to increase to ~40ML/day by 2050
- Supplied by Manning River via Bootawa Dam and Nabiac borefields (up to 10 ML/day)
- Bootawa Dam storage capacity ~2.2 GL or ~100 days.



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Assessment Approach and Criteria

Assessment Approach

Each option assessed against the criteria and assigned a score:

- Pass: Option meets the criteria and should progress to Stage 2
- Fail: Option does not meet criteria and should not progress to Stage 2
- Unknown: Option cannot be scored and further investigation is required

Assessment criteria developed based on:

- Council Vision and Mission statements
- Risk Management Framework
- AECOM experience with similar projects
- Advice from DPE

Assessment Criteria

Council Values	Council Risk Category	Indicator	Description and Objectives of Indicator
Wellbeing	Worker & public health and 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 and infrastructure	Availability	Available when it is needed, in drought or when demand is high (climate independent / dependent)
		Yield / beneficial to pursue / supply	Option will give either 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
		Practically viable	Option can be delivered by Council / 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 Project budget	Cost - capital	Capital costs
		Cost - O&M	Operating and maintenance costs
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)

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Water Security Options

Long-list of Water Security Options

- Increase storage yield via raised dam wall at Bootawa Dam
- Increase storage yield via new Peg Leg Creek Dam
- Desalination of estuarine water at Nabiac WTP (mobile unit)
- Desalination of sea water at Hallidays Point (permanent)
- Desalination of sea water at Forster (permanent)

Long-list of Water Security Options continued

- Recycled water for municipal irrigation, agricultural and construction use
- Recycled water for non-potable use via dual reticulation
- Recycled water for environmental flow replacement
- Recycled water for indirect potable reuse
- Recycled water for direct potable reuse

Long-list of Water Security Options continued

- Stormwater harvesting and use from new Tuncurry development
- Stormwater harvesting and use from other areas
- Groundwater via Nabiac aquifer
- Groundwater via alternative aquifer (coastal strip)
- Interconnection with regional schemes

Augmentation of Bootawa Dam

- Increasing storage at Bootawa Dam by raising bank embankment by 7m
- Based on 2011 concept design
- Principal items include embankment raising, saddle dam, new spillway channel, penstock, valve house and intake and outlet works
- Total storage increased to 4,500 ML (an additional 1,950 ML)
- Indicative costs for additional yield
  - CAPEX $40.3 M
    - $20,661 / ML
  - OPEX $742,950 / annum

Source: NSW Department of Services, Technology & Administration, 2011. *Bootawa Dam 7m Raising Concept Design Report*. Midcoast Water.

Augmentation of Bootawa Dam

Risks

- Offtake water quality
- Lowering of dam levels for construction
- Compliance of proposed augmentation to current dam safety standards
- Stakeholder consultation – disputes amongst Aboriginal stakeholders

Issues

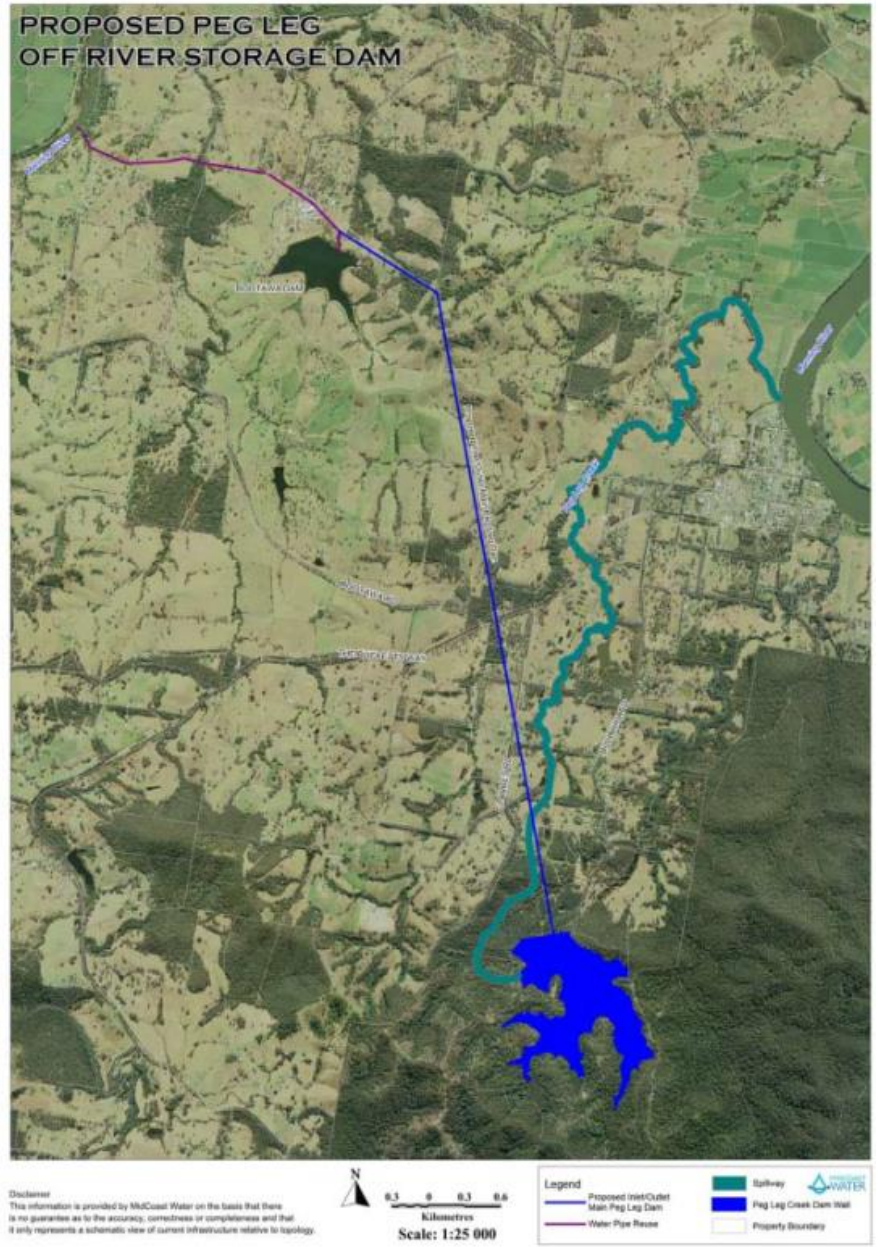
- Long lead time
- Not rainfall independent
- Increased risk profile for Council
- Cultural heritage artefacts
- Site geology – weathered rock
- Management of identified aboriginal artefacts

Opportunities

- Utilises existing infrastructure
- Provision for future expansion
- Improvement in river flow

New Peg Leg Creek Dam

- Additional off-river earth storage dam on Peg Leg Creek
- Pump supplied from Manning River
- Raw water treated at Bootawa WTP
- Principal items include earth and rockfill embankment, spillway, intake tower, and inlet and outlet pipework
- Total additional storage provided 7,000 ML to 27,000 ML depending on preferred option
- Indicative costs for additional yield
  - CAPEX $100.6 – 268 M
    - $13,775 - $13,082 / ML (respectively)
  - OPEX $2.78 – 7.8 M / annum



Source: Smec, 2016. *Peg Leg Creek Preliminary Options Investigation*. Midcoast Water.

New Peg Leg Creek Dam

Risks

- Environmental approvals and permits
- Offtake water quality
- Cultural heritage sites
- Local ecology – land clearing
- Stored water quality

Issues

- Long lead time
- Not rainfall independent
- Large carbon footprint
- Complex geology
- Fill material

Opportunities

- Provision for staging and future expansion
- Flexibility in staging
- Increased reliability of supply
- Energy resource - hydropower

Desalination of estuarine water at Nabiac WTP

- Mobile desalination unit located adjacent to Nabiac WTP
- Raw water extraction from Wallamba River
- Reject discharge via ocean outfall
- Principal items include river intake and raw water pumping station, storage tanks, desalination unit, emergency power supply generator, and ocean outfall
- Yields 5 ML/day
- Indicative costs for additional yield
  - CAPEX $15.6 M
    - $3.1 M / ML/D
  - OPEX $538,000 / annum

Desalination of estuarine water at Nabiac WTP

Risks

- Availability of units
- Salinity levels
- Approvals for ocean outfall
- Energy requirements

Issues

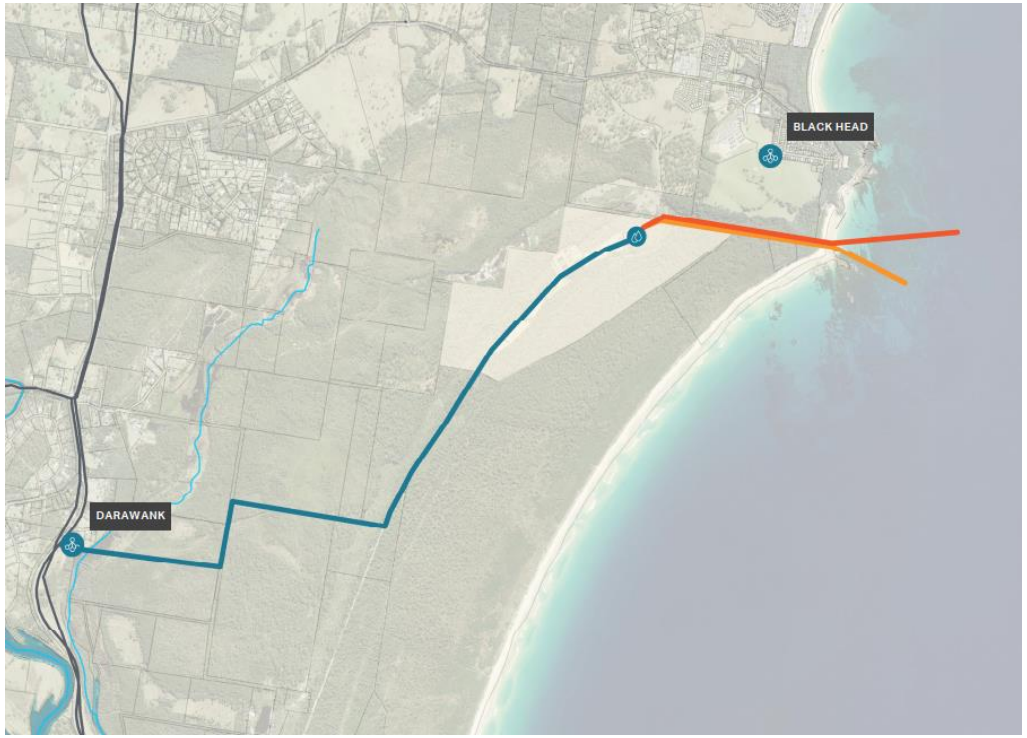
- Construction through private property
- Construction through environmental corridors
- Not fully rainfall independent

Opportunities

- Solar farm for renewable energy
- Easy integration into supply system

Desalination of sea water at Hallidays Point

- Desalination plant located at Hallidays Point STP, operational when required
- Raw water intake and reject discharge via ocean
- Treated water pumped to Darawank reservoir for distribution
- Principal items include sea water intake and pumping station, storage tanks, screening and microfiltration, reverse osmosis, disinfection, and ocean outfall
- Yields 40 ML/day
- Indicative costs for additional yield
  - CAPEX $102.9 M
    - $ 2.57 M / ML/D
  - OPEX $4.3 M / annum



Desalination of sea water at Hallidays Point

Risks

- Approvals and permits
- Aquatic ecology – impingement and entrainment
- Aquatic ecology – reject discharge
- Construction – environmental corridors

Issues

- Large carbon footprint
- High operation and maintenance costs
- Long lead time
- Community support

Opportunities

- Rainfall independent
- Increased reliability
- Proven technology
- Operation flexible to demand
- Remote location

Desalination of sea water at Forster

- Desalination plant located at Forster STP, operating permanently
- Separates Forster region from Manning scheme
- Raw water intake and reject discharge via ocean
- Treated water pumped to Forster reservoir for distribution
- Principal items include sea water intake and pumping station, storage tanks, screening and microfiltration, reverse osmosis and disinfection
- Yields 10 ML/day
- Indicative costs for additional yield
  - CAPEX $26.8 M
    - $2.68 M / ML/D
  - OPEX $1.1 M / annum

Desalination of sea water at Forster

Risks

- Approvals and permits
- Aquatic ecology – impingement and entrainment
- Aquatic ecology – reject discharge
- Forster outfall pipe capacity
- Complicated distribution network

Issues

- Large carbon footprint
- High operation and maintenance costs
- Long lead time
- Not supportive region-wide
- Community support

Opportunities

- Rainfall independent
- Increased reliability
- Proven technology
- Bifurcation of Manning Scheme
- Operation flexible to demand

Recycled water for municipal irrigation, agricultural and construction use

- Offset potable water use with increased use of recycled water
- Farming, dust suppression, road maintenance, sewer mains flushing, industrial, commercial, etc.
- Principal items include expansion of Tuncurry RTP with diversion of flow from Forster STP and upgrade of Taree effluent management scheme to Dawson RTP, suitable for unrestricted public access
- Expansion of recycled water network and/or offtake points for distribution
- Indicative costs for additional yield
  - CAPEX $20.1 M (excludes distribution infrastructure)
    - $1.9 M / ML/D
  - OPEX $3.2 M / annum minimum

Recycled water for municipal irrigation, agricultural and construction use

Risks

- Recycled water demand
- Distribution infrastructure
- Approvals and permits
- Insufficient yield to offset for entire region

Issues

- Rainfall dependent demand
- Greenhouse gas emissions
- High operation and maintenance costs

Opportunities

- Community participation
- Effluent management

Recycled water for non-potable use via dual reticulation

- Offset potable water use with recycled water for new development areas with dual reticulation network
- Principal items include expansion of Tuncurry RTP with diversion of flow from Forster STP, upgrade of Taree effluent management scheme to Dawson RTP, suitable for unrestricted public access, and expansion of distribution network with recycled water mains to all connections included in the scheme
- Indicative costs
  - CAPEX $16,000 / dwelling based on 161 L/d consumption of recycled water (costs inclusive of full treatment and transfer infrastructure, does not include internal plumbing and connection; cost based on 900 dwellings with low and medium density dwellings)

Recycled water for non-potable use via dual reticulation

Risks

- Water quality to meet ARWG
- Public health
- Community Acceptance
- Approvals and permits
- Recycled water demand
- Cross-connections

Issues

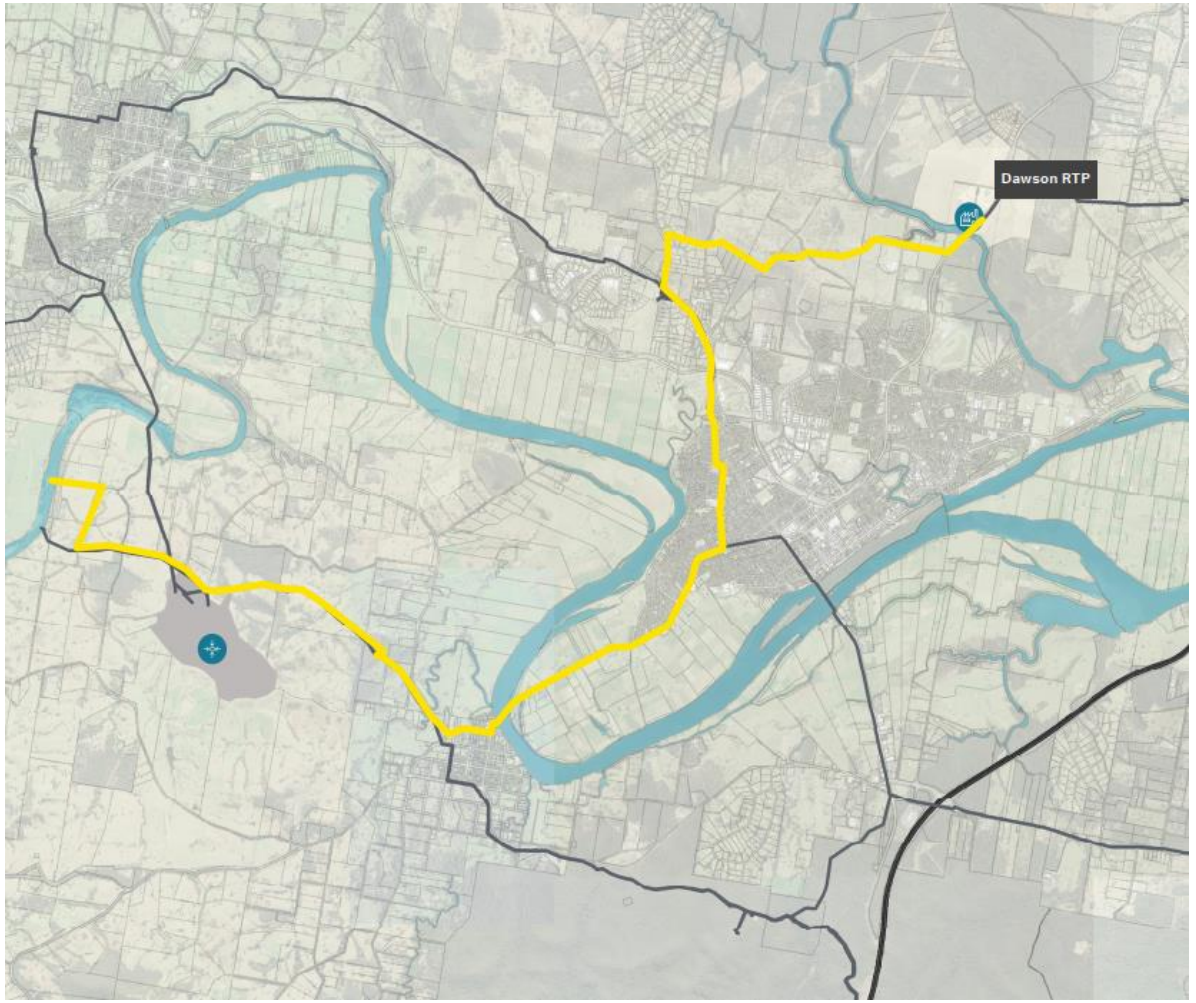
- Rainfall dependent demand (outdoor use)
- Greenhouse gas emissions
- High operation and maintenance costs relative to potable offset
- Only suitable for new residential developments (no retrofit), can be discriminatory
- Distribution infrastructure (dual reticulation network)

Opportunities

- Rainfall independent demand (internal use)
- Community participation
- Effluent management
- Aesthetic values maintained

Recycled water for environmental flow replacement

- Substitution of flows downstream of Bootawa Dam river offtake point
- Replacement flows supplied from Dawson RTP
- Principal items include upgrade of Taree effluent management scheme to Dawson RTP and pipeline from plant to near Bootawa Dam offtake point
- Indicative costs
  - CAPEX $15.5 M (minimum for upgrade of Dawson RTP, dependent on required water quality)
  - OPEX $1.8 M minimum



Recycled water for environmental flow replacement

Risks

- River health and ecology – substitution flow
- River health and ecology – salinity levels
- Approvals and permits

Issues

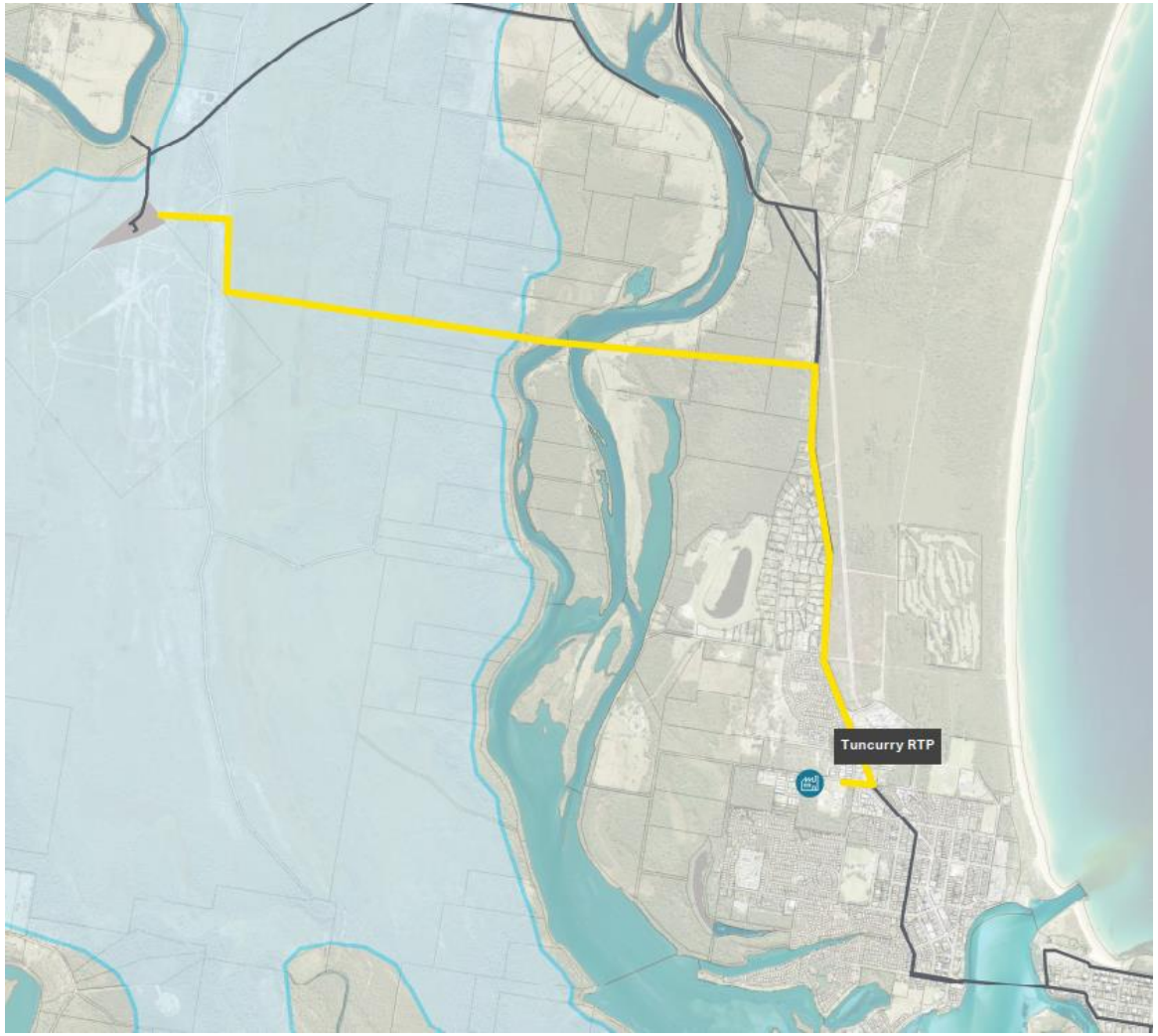
- High capital costs
- Greenhouse gas emissions
- High operation and maintenance costs
- May not improve yield/supply

Opportunities

- May improve river flow
- Effluent management
- Adaptable to growth

Recycled water for indirect potable reuse

- Increased extraction from Nabiac borefield
- Replenishment of groundwater for Nabiac borefield through managed aquifer recharge
- Principal items include upgrade of Tuncurry RTP to advanced water treatment and pipeline from plant to borefield
- Indicative costs
  - CAPEX $14.2 M (minimum, dependent on required water quality)
  - OPEX $1.6 M minimum



Recycled water for indirect potable reuse

Risks

- Recharge flow impacts
- Contamination – salinity
- Contamination – emerging contaminants
- Water clogging
- Approvals and permits

Issues

- Water quality
- Injection points
- Licencing for increased extraction
- Increased operational costs

Opportunities

- Rainfall independent
- Increased reliability
- Effluent management
- Potentially flexible – adaptable to growth

Recycled water for direct potable reuse

- Direct potable reuse of treated water from Dawson and Tuncurry Recycled Water Treatment Plants
- Principal items include upgrade of Tuncurry RTP and Taree Effluent Management Scheme to advanced water treatment, and new reservoir for distribution to southern Manning
- Indicative costs
  - CAPEX $33.3 M (minimum, additional costs for reticulation infrastructure)
  - OPEX $4.4 M (minimum across both plants)

Recycled water for direct potable reuse

Risks

- Community acceptance
- Severe public health consequences

Issues

- Supporting legislation
- Greenhouse gas emissions
- High operation and maintenance costs

Opportunities

- Rainfall independent
- Adaptable to growth
- Effluent management
- Utilises existing infrastructure

Stormwater harvesting and use from new Tuncurry North development

- Offset potable water use with recycled water from North Tuncurry development's stormwater harvesting
- Collected stormwater is directed to Tuncurry Recycled Water Treatment Plant for treatment and distribution
- Indicative cost
  - CAPEX $2.1 M

Stormwater harvesting and use from new Tuncurry North development

Risks

- Wet weather storage
- Recycled water demand
- Ground profile
- Insufficient yield

Issues

- Developer led stormwater management plan
- Rainfall dependent demand

Opportunities

- Setting example
- Developer contributed assets

Stormwater harvesting and use from other areas

- Offset potable water use with decentralised scheme for stormwater collection, storage and/or treatment for localised opportunities
- Ideal for new development areas

Stormwater harvesting and use from other areas

Risks

- Sparse catchment
- Demand
- Numerous catchments
- Mosquito breeding

Issues

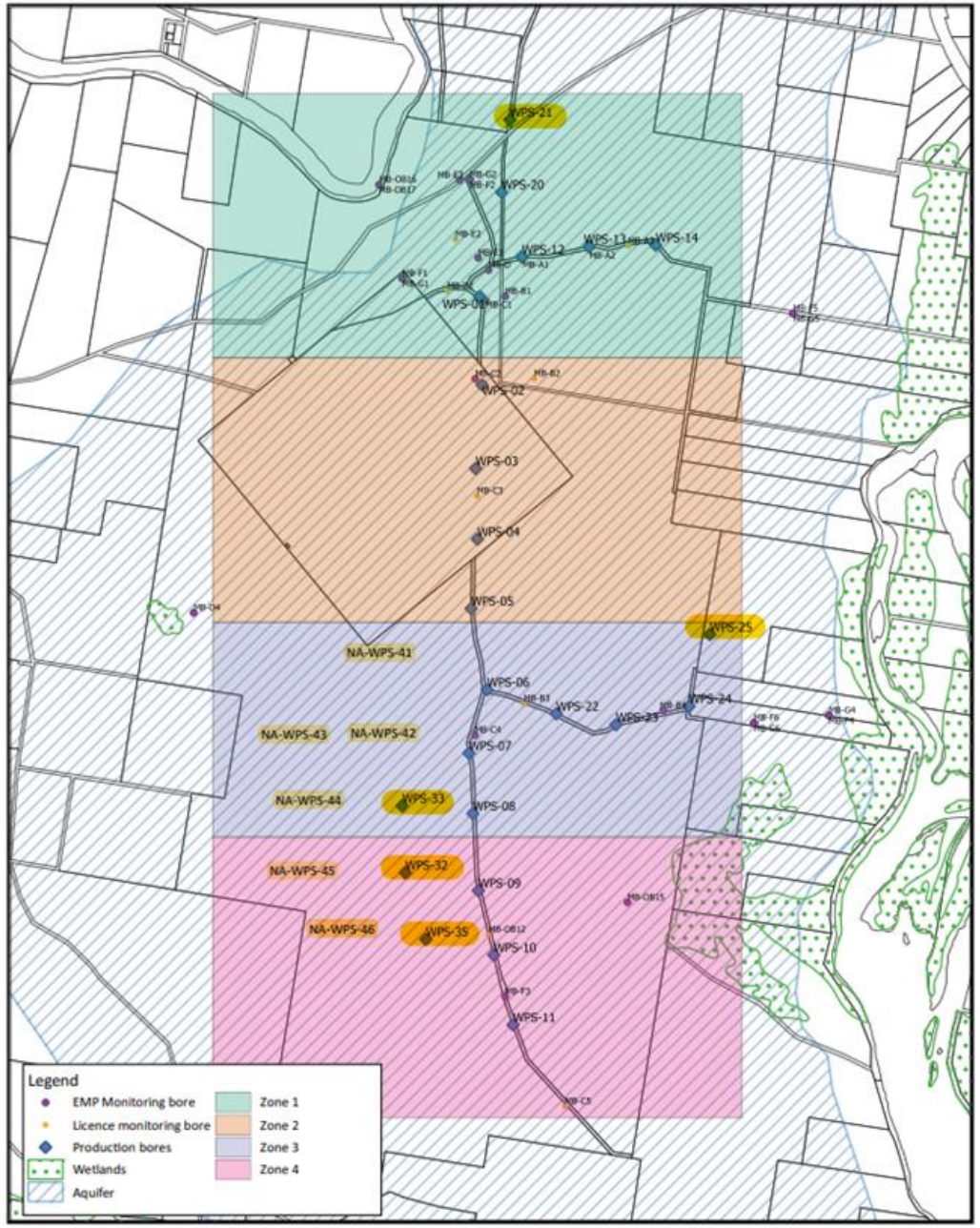
- Rainfall dependent demand
- Coastal ground profile
- Storage

Opportunities

- Reduced pollutants
- Flow attenuation

Groundwater via Nabiac aquifer

- Expansion of Nabiac borefield
- Works already underway
- No further extraction from borefield based on environmental constraints and current licencing arrangements
- Total yield 18 ML/day, under drought conditions only



Source: MCC, Nabiac Borefield Expansion Investigations, 2022

Groundwater via Nabiac aquifer

Risks

- Saline intrusion

Issues

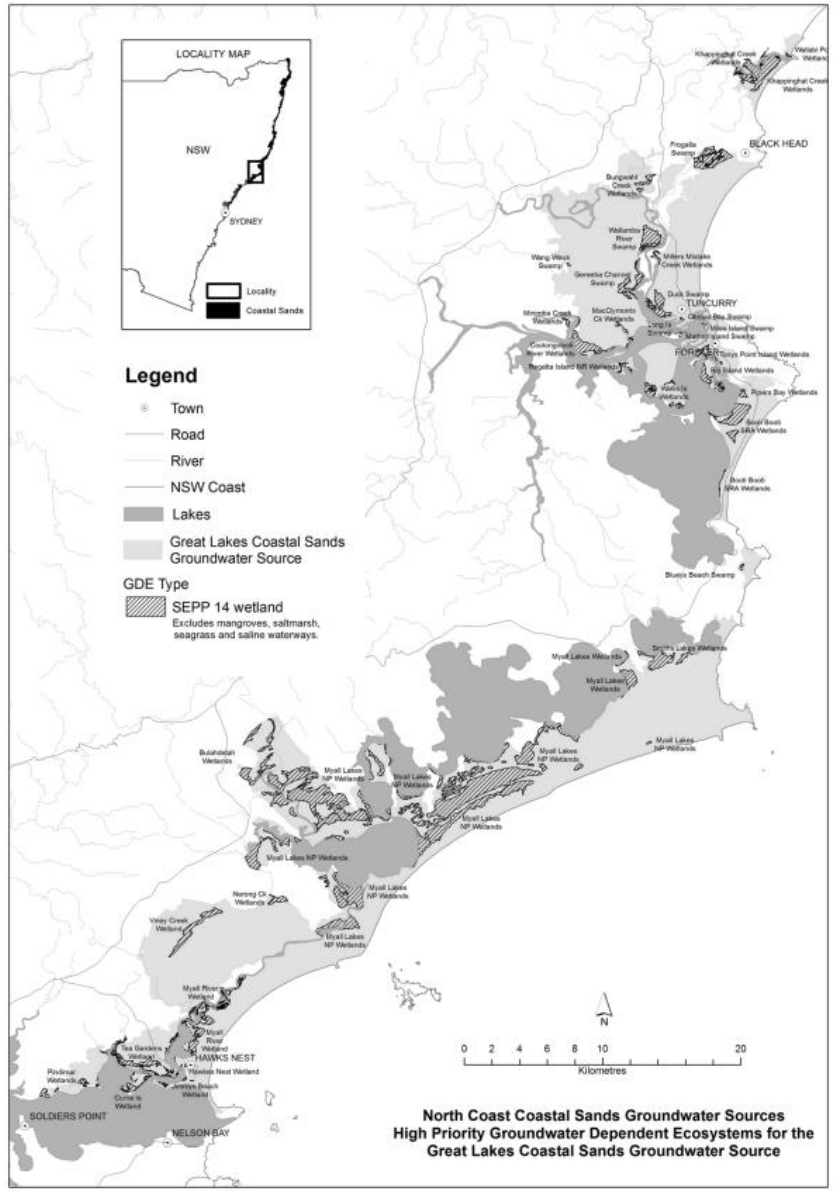
- Drought extraction only

Opportunities

- Rainfall independent
- Utilises existing infrastructure
- Short lead time
- Reliable source

Groundwater – Coastal strip

- New borefield from potential other Great Lakes Coastal Sands sites
- Further investigation required to identify viability of sources
- Principal items may include borefield, water treatment plant, and pipeline to nearest reservoir
- Indicative costs
  - CAPEX $57.9 M (assuming duplication of Nabiac WTP and borefield system)
  - OPEX $836 / ML



Source: NSW Department of Primary Industries. *Water Sharing Plan for the North Coast Coastal Sands Groundwater Sources 2016*. 2017.

Groundwater – Coastal strip

Risks

- Groundwater availability
- Environmental impacts
- Approvals and permits
- Water quality

Issues

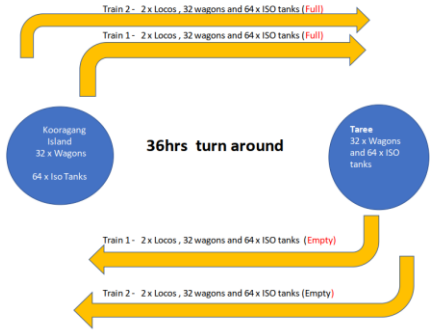
- Distance to Manning Scheme

Opportunities

- Potential for staging

Interconnection with regional schemes

- Acquire potable water as needed through water carting
- Sourced from neighbouring service providers via rail freight or trucks



Source: CFCL Australia, 2019. Water Train 16th December 2019. Hunter Australia.

Interconnection with regional schemes

Risks

- Supply dependent
- Availability of transport

Issues

- High costs
- Not a permanent solution
- Can’t transport total daily demand
- Transportation distances

Opportunities

- No additional infrastructure
- Scalable to requirements

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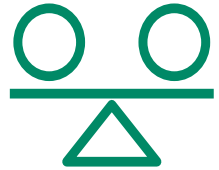
Coarse Screening of Options

Coarse Screening of Options - Interactive

Break into 3 groups.

Each group to evaluate 5 options based on the assessment criteria.



Present findings to the group for challenge and discussions.

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Art by
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Gardiner
Dodd

Discussion

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Next Steps

Next Steps

- AECOM to prepare Draft Coarse Screening Report for Council review (date)
- Council to progress with procurement for Options Assessment

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Bianca
Gardiner
Dodd

Thank You!

About the artwork

Sydney CBD stands on the Traditional Lands and waterways of the Gadigal people of the Eora nation. AECOM's Sydney office resides over these lands and waterways, and we also respectfully pay homage to the memories and Traditional spirits within the land, and pay respect to those from the past, those in the present and those to come.

The palette of this work reflects both AECOM's interior design vision and the artist's own tonal impression of the lands and waterways of the Gadigal People. The six rings around the AECOM site represent AECOM's six core values. These core value rings can be seen radiating southwest along George Street out of the city into the broader community.

Today, George Street gently aligns itself over the path of the 'Tank Stream'. Its intersections often follow the pathways, eons in formation, from the passage of the Gadigal People. Having supplied fresh water and fish to the original Gadigal People for tens of thousands of years, it would serve as the main fresh water supply for the first 40 years of Sydney's European life.

The design respectfully acknowledges the 29 clans of the Eora nation represented by the various circles depicting meeting places, connecting them spiritually and physically over the Traditional paths and landforms that intertwine their worlds.

Here in the Sydney region, the 29 Eora clans share the land and its bounty. Each clan is unique, yet intrinsically linked, existing in perfect harmony with the spiritual & natural world.

Images of spears represent local Warriors, particularly Bennelong standing proudly over his Traditional Lands. Further down the stream, are the areas of Women's Business - birthing, celebrating, sharing & embracing their unique world. The sandy pebbles on the left bank signify the sandstone cliffs and ledges upon which Barangaroo now proudly sits, further identifying the connection between one of the wives of Bennelong with the land and water of the Gadigal People.

Bianca Gardiner Dodd

AECOM

Delivering a better world

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Minutes of Meeting

IWCM Strategy Coarse Screening of Water Security Options for the Manning Water Supply Scheme

Subject	Coarse Screening Workshop	Page	3
Venue	Yalawanyi Ganya & Microsoft Teams	Time	13:00 - 16:00
Participants	Rachael Abberton, MidCoast Project Manager and Planning Engineer Shane Beeton, MidCoast Operations Manager Marnie Coates, MidCoast Executive Manager Louise Duff, MidCoast Catchment Coordinator Tracey Hamer, MidCoast Water Planning & Assets Manager Mitchell Stace, MidCoast Water Project Delivery Manager Sara Wilson, MidCoast Community and Stakeholder Engagement Chenxi Zeng, Water Management and Treatment Manager Daniel Brauer, AECOM Project Director and Workshop Facilitator Zena Smith-White, AECOM Project Manager and Technical Lead Lakshu Suri, AECOM Water Planner		
Apologies			
File/Ref No.	60685841	Date	21-Jul-2022
Distribution	As above		

No	Item	Action	Date
1.	**Opening – acknowledgement of Country and workshop agenda**		
2.	**Values Moment** AECOM shared an ESG moment for Cultural Value of Water from a recent project, sharing the importance of incorporating cultural influence and values in projects.		
3.	**Introductions and workshop objectives and outcomes** Workshop objectives: • Present the long-list of water security options for discussion • Undertake a coarse screening of the long-list of options • Agree the short-list of options for further investigation Workshop outcome: • To endorse a short-list of water security options for further investigation prior to development of the IWCM Strategy.		
4.	**Project background** An overview of the Manning Water Supply Scheme and journey to date for the Integrated Water Cycle Management strategy was provided.		

No	Item	Action	Date
5.	**Assessment Approach and Criteria** The assessment criteria and assessment methodology were shared. Scoring descriptors, Pass, Fail or Unknown were described for application in assessing each category of the criteria. Council requested further clarity in the criteria with regards to environmental impacts on water source and water quality, both for the duration of construction and ongoing thereafter.	**AECOM** to update criteria	Updated and attached
6.	**Long List of Water Security Options** The 15 options were each presented in detail with a short description, and identified risks, issues, and opportunities. During the discussion, an additional option was identified: *Regional transfer from Port Macquarie – Hastings via a new pipeline*.		

7.	**Coarse Screening of Options**
	Interactive discussions in three groups were undertaken for assessing options before presenting the findings to the wider group for challenge and acceptance.
	Key outcomes from the coarse screening are presented in the attached table and summarised below:
	• The following options are to be progressed to Stage 2.
	  ○ Increase storage yield via new Peg Leg Creek Dam (pending information on dam safety standards and lowered level capacity)
	  ○ Desalination of estuarine water at Nabiac WTP (mobile unit) – applicable only in an emergency scenario
	  ○ Desalination of sea water at Hallidays Point
	  ○ Recycled water for municipal irrigation, agricultural and construction use – applicable only as a supplementary option
	  ○ Purified recycled water – single option combined from recycled water for indirect potable use and direct potable use
	  ○ Groundwater via Nabiac Aquifer
	  ○ Interconnection with regional schemes – connection to Port Macquarie Hastings
	  ▪ New option established through workshop discussions
	  ▪ Option to proceed to next phase for further consideration
	• The following options did not pass the coarse screening and will not progress to Stage 2:
	  ○ Increase storage yield via raised dam wall at Bootawa Dam – pending information on dam safety standards and lowered level capacity
	  ○ Desalination of sea water at Forster – pending confirmation on capacity of existing STP outfall
		MCC to provide information on:
		• impacts of lowered dam levels at Bootawa Dam (received)
		• Forster STP ocean outfall hydraulic capacity
		
		Project team to close out Bootawa Dam and Forster desalination options as appropriate
			03/08/2022

No	Item	Action	Date
	○ Recycled water for non-potable use via dual reticulation ○ Recycled water for environmental flow replacement ○ Stormwater harvesting and use from new Tuncurry development ○ Stormwater harvesting and use from other areas ○ Groundwater via alternative aquifer ○ Interconnection with regional schemes – water carting		
8.	**Next Steps** AECOM to prepare and issue draft coarse Screening Report for Council review Council to progress procurement for next phase in IWCM	**AECOM** **MCC**	05/08/2022

Coarse Screening Assessment Criteria (Updated)

Council Values	Council Risk Category	Indicator	Description and Objectives of Indicator
Wellbeing	Worker & public health and 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 and infrastructure	Availability	Available when it is needed, in drought or when demand is high (climate independent / dependent)
		Yield / beneficial to pursue / supply	Option will give either 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
		Practically viable	Option can be delivered by Council / 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 Project budget	Cost - capital	Capital costs
		Cost - O&M	Operating and maintenance costs
Sustainability	Environment	Environmental impact	Impact to environment (during construction/delivery), including footprint of asset, clearing, flora/fauna, disturbance to and impacts of source water and water quality, 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)

				1	2	3	4	5
Council Values	**Council Risk Category**	**Measure Indicator for Coarse Screening**	**Description & objectives of indicator**	**Augmentation of Bootawa Dam**	**Increase storage yield via new Peg Leg Creek Dam**	**Desalination of estuarine water at Nabiac TWP (mobile unit)**	**Desalination of sea water at Hallidays Point (permanent, when required)**	**Desalination of sea water at Forster STP (permanently in operation)**
Wellbeing	Worker and public health & wellbeing	Health and wellbeing	Fit for purpose water quality- meetings legislative requirements	Unknown - dam safety considerations in design potentially not up to date	Pass - new dam can be designed and delivered to current standards and regulations	Pass	Pass - new plant can be designed and managed to current standards and regulations	Pass - new plant can be designed and managed to current standards and regulations
	Service delivery and infrastructure	Availability	Available when it is needed, in drought or when demand is high (climate independent / dependent)	Pass - limited supply available in drought conditions, rainfall dependent; dependent on river water quality; low on resilience with no additional source flexibility	Pass - boosts resilience for Bootawa dam; limited supply available in drought conditions, rainfall dependent; dependent on river water quality	Unknown - fit-for-purpose only as an emergency response and operational only in drought conditions; trigger points and timeframes for operation need defining; consideration for lock-in contracts	Pass - rainfall independent	Pass - permanently in operation for supplying to Southern Manning region
		Yield / beneficial to pursue / supply	Option will give either 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	Unknown - yield for water security needs to be defined	Pass - can be designed to optimal solution	Pass - limited extraction from estuarine due to impacts on river system, and limited availability of power supply to site	Pass - fully operational only in drought conditions	Unknown - does not supply to entire region, only benefits Southern Manning
		Practically viable	Option can be delivered by Council / external support	Fail - pending information on lowering of dam levels for duration of construction	Pass	Unknown - competition for units across the state and/or nation in drought conditions	Pass	Unknown - existing outfall from STP potentially insufficient hydraulic capacity, further investigation required; potential discharge to Marine Park
		Integration with existing network	Project can be integrated into the existing and/or (planned) future supply network, based on built environment and operations	Pass	Pass	Pass	Pass - in close proximity to Darawank reservoir based on assessed location at Hallidays Point STP	Fail - operational complexity with connectivity of reservoirs; does not support northern Manning region
Integrity	Compliance	Regulatory and governance	Option is achievable or supported by existing legislation and framework	Unknown - impact of current dam safety standards, and envrionmental approvals for site clearing needs defining, specifically for koala habitation	Pass - risks associated with building a new dam, but manageable	Unknown - approvals and permits for ocean outfall need investigating	Unknown - approvals and permits for new desalination plant, specfically for seawater intake, ocean outfall and site specific requirements	Unknown - approvals and permits for new desalination plant, specfically for seawater intake and site specific requirements
	Project timeline	Timeline for planning and delivery	Capital costs	Pass - potential sequencing issues for construction with regards to lowering of dam levels in dry period	Unknown - long lead time; potential for political interference given the long lead time; flexibility in delivery with opportunity for staging	Unknown - lead time for ocean outfall approvals and permits need defining; availability of mobile desalination units cannot be guaranteed until required	Unknown - planning pathway needs to be defined	Unknown - planning pathway needs to be defined
	Financial Project budget	Cost - Capital	Operating and maintenance costs	Pass	Pass	Pass	Pass	Pass
		Cost - O&M	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?	Pass	Pass - potential for offsetting costs with hydropower	Unknown - potential for offsetting costs with solar farm on site; specialised and additional resources required to operate plant when required	Pass - opportunity to operate plant at a minimum optimal level to avoid maintenance issues on standby mode; periodic membrane replacement costly	Pass
Sustainability	Environment	Environmental impact	Impact to environment (during construction/delivery), including footprint of asset, clearing, flora/fauna and heritage impacts	Unknown - impact on koala habitat from clearing of vegetation	Unknown - environmental impacts need to be fully defined and an assessment undertaken	Unknown - construction corridor for reject discharge pipeline and ocean outfall impacts need defininig	Unknown - environmental impact statement needs to be defined	Unknown - environmental impact statement needs to be defined; existing STP outfall dishcarges into Marine Park
		Sustainability and resource consumption	Resource consumption, including carbon emissions, power use, resource consumption and recovery (ongoing environmental impact)	Unknown - potential loss of koala habitiat needs to be investigated	Unknown - decrease in resoure consumption following construction; intergenerational equity dependent on chosen option	Pass - opportunity to offset resource consumption with solar farm	Unknown - environmental impact statement needs to be defined; potential for offsetting some energy consumption with renewable energy	Unknown - environmental impact statement needs to be defined; potential for offsetting energy consumption with renewable energy; potential discharge to Great Lakes Marine Park
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)	Pass - existing Aboriginal disputes, reputational risk to Council, but manageable with appropriate measures	Unknown - aboriginal and cultural heritage assessment needs to be updated in detail for preferred dam site option; sites encroach state forest which Council is in the process of acquiring	Unknown - community acceptance of ocean outfall needs investigating	Unknown - community acceptance of desalination plant and ocean outfall needs investigating	Unknown - community acceptance of desalination plant
Outcome				TBD - pending further clarifications on dam safety standards	Pass	Pass	Pass	TBD pending further information on STP outfall capacity

				6	7	8	9	10
Council Values	**Council Risk Category**	**Measure Indicator for Coarse Screening**	**Description & objectives of indicator**	**Recycled water for municipal irrigation, agricultural and construction use**	**Recycled water for non-potable use via dual reticulation**	**Recycled water for environmental flow replacement**	**Recycled water for indirect potable reuse**	**Recycled water for direct potable reuse**
Wellbeing	Worker and public health & wellbeing	Health and wellbeing	Fit for purpose water quality- meetings legislative requirements	Pass - offset for potable use	Pass - high level of treatment requried	Unknown - water quality dependent on end-user, needs further investigating	Pass - treatment for emerging contaminants	Pass - high level treatment required, severe public health risk
	Service delivery and infrastructure	Availability	Available when it is needed, in drought or when demand is high (climate independent / dependent)	Unknown - Limitations on availability and demand; demand dependent on weather, potentially negligible demand in wet weather	Pass	Fail - no net impact on additional yield as substitution downstream of offtake point	Pass - independent of rainfall	Pass - independent of rainfall
		Yield / beneficial to pursue / supply	Option will give either 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	Fail - dependent on customer demand; insecure yield; localised opportunities only	Fail - suitable for new developments; very limited benefit on yield	Fail - no net impact on additional yield as substitution downstream of offtake point	Unknown - ideally increased extraction with replenishment of flows to aquifer	Unknown
		Practically viable	Option can be delivered by Council / external support	Pass	Pass	Fail - no net impact on additional yield as substitution downstream of offtake point	Pass	Pass
		Integration with existing network	Project can be integrated into the existing and/or (planned) future supply network, based on built environment and operations	Pass	Pass - back up potable supply required regardless	Pass	Pass	Pass
Integrity	Compliance	Regulatory and governance	Option is achievable or supported by existing legislation and framework	Pass	Pass	Unknown	Unknown	Unknown - clear and supporting legislation for purified recycled water currently a gap in existing legislation
	Project timeline	Timeline for planning and delivery	Capital costs	Pass	Pass	Unknown	Unknown	Fail - long term option
	Financial Project budget	Cost - Capital	Operating and maintenance costs	Unknown - distribution mains not costed, demand not quantified	Fail - high cost for low impact	Unknown - indicative; further information required to determine extent of advanced water treatment for substitution flow	Unknown	Pass
		Cost - O&M	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?	Pass - requires additional network and treatment	Fail - high cost for limited benefit	Unknown - indicative; further information required to determine extent of advanced water treatment for substitution flow	Unknown	Pass - advanced treatment required
Sustainability	Environment	Environmental impact	Impact to environment (during construction/delivery), including footprint of asset, clearing, flora/fauna and heritage impacts	Pass - effluent management	Pass - effluent management	Unknown - river ecology impacts of substitution flow water quality	Unknown - sustainable recharging volumes; injection points; water quality; treatment of emerging contaminants	Pass
		Sustainability and resource consumption	Resource consumption, including carbon emissions, power use, resource consumption and recovery (ongoing environmental impact)	Unknown - risk of increased water usage with availability of recycled water	Unknown - risk of increased water usage with availability of recycled water	Unknown	Unknown - raw water quality impacts	Pass
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)	Unknown - highly likely developer driven, community acceptance not known	Unknown - highly likely developer driven, community acceptance not known	Pass	Unknown	Unknown - consultation required to determine community's appetite for option
Outcome				Pass - suited as a supplementary option for expansion of existing schemes	Fail	Fail	Pass - to be combined into single Purified Recycled Water Option	Pass - to be combined into single Purified Recycled Water Option

				11	12	13	14	15
Council Values	**Council Risk Category**	**Measure Indicator for Coarse Screening**	**Description & objectives of indicator**	**Stormwater harvesting and use from new Tuncurry North development**	**Stormwater harvesting and use from other areas**	**Groundwater via Nabiac aquifer**	**Groundwater – Coastal strip**	**Interconnection with regional schemes**
Wellbeing	Worker and public health & wellbeing	Health and wellbeing	Fit for purpose water quality- meetings legislative requirements	Pass - treatment level dependent on end-use	Unknown - water quality dependent on site characteristics, highly likely manageable through appropriate treatment	Pass	Unknown - water quality of groundwater varies site to site	Unknown - dependent on supply
	Service delivery and infrastructure	Availability	Available when it is needed, in drought or when demand is high (climate independent / dependent)	Fail - climate dependent	Fail - climate dependent	Pass - extraction limits defined in licencing agreement for drought conditions	Fail - climate dependent	Unknown - dependent on availability
		Yield / beneficial to pursue / supply	Option will give either 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	Fail - insufficient for material impact on required yield	Fail - insufficient for material impact on required yield	Pass - cannot be expanded beyond current licence arrangements	Unknown	Fail - does not provide permanent secure yield
		Practically viable	Option can be delivered by Council / external support	Fail - no intent from developer to harvest stormwater from site	Fail - significant infrastructure required for collection, treatment, storage and distribution for each catchment	Pass - expansion of borefield investigation underway	Fail - significant infrastructure required to source and distribute to either closest reservoir or treatment plant	Fail - not viable to provide required yield for prolonged periods
		Integration with existing network	Project can be integrated into the existing and/or (planned) future supply network, based on built environment and operations	Pass	Fail - significant infrastructure required for collection, treatment, storage and distribution for each catchment	Pass	Fail - significant infrastructure required to source and distribute to either closest reservoir or treatment plant	Fail - additional infrastructure potentially required to convey flow from rail to reservoir or WTP with risk of contamination
Integrity	Compliance	Regulatory and governance	Option is achievable or supported by existing legislation and framework	Pass	Pass	Pass	Pass	Pass
	Project timeline	Timeline for planning and delivery	Capital costs	Pass	Unknown - dependent on urban growth and developments	Pass	Unknown - Nabiac supply system required 20+ years in planning and delivery	Pass - availability of rail freight is potentially an obstacle depending on supply
	Financial Project budget	Cost - Capital	Operating and maintenance costs	Pass - high cost for small yield	Unknown - dependent on urban growth and developments	Pass	Unknown	Fail - high costs for daily transportation
		Cost - O&M	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?	Pass	Unknown - dependent on urban growth and developments	Pass	Unknown	Unknown - increased efforts in treatment if risk of contamination
Sustainability	Environment	Environmental impact	Impact to environment (during construction/delivery), including footprint of asset, clearing, flora/fauna and heritage impacts	Pass	Unknown	Pass	Unknown	Unknown - risk of contamination; daily carting emissions
		Sustainability and resource consumption	Resource consumption, including carbon emissions, power use, resource consumption and recovery (ongoing environmental impact)	Pass	Unknown	Pass	Unknown	Fail - does not provide security for 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)	Pass	Pass	Pass	Pass	Pass
Outcome				Fail	Fail	Pass - option already underway	Fail	Fail