Kangaroo Island Long-term Plan
2018 – 2043

SA Water

Disclaimer

The information and recommendations provided in the Long-term plan, including the assumptions, are based on information available at the time. While all care has been taken to validate the material presented in this plan, advice should be sought before any action is taken on the basis of material contained within this document.

SA Water, its key stakeholders or members of the Reference Group will not be liable, in any way, for any loss arising from reliance on the material contained in this plan by another person.

Images

Images are courtesy of the South Australian Tourism Commission and Tourism Kangaroo Island.

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Acknowledgement of Country

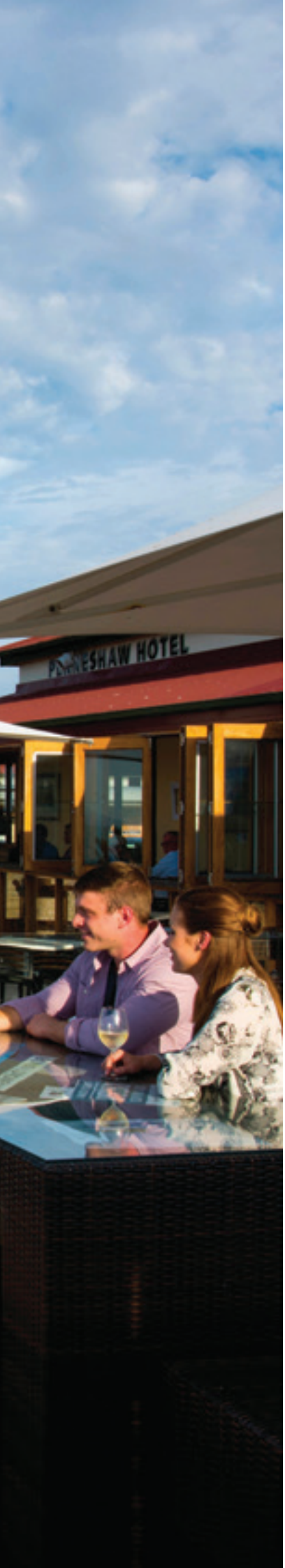
We acknowledge that Kangaroo Island, its land and waters are of cultural significance to a number of Aboriginal Nations. We acknowledge and pay respect to the Traditional Owners of the lands and waters of Kangaroo Island and we recognise their ongoing cultural and spiritual connection and its importance to cultural vitality, life and identity. We also recognised the cultural heritage, knowledge and skills are of critical value and importance to Australia's people, lands and waters.

Acknowledgements

A Reference Group was established to actively inform and support our work reviewing this plan. The Reference Group comprised of representatives from a wide range of key stakeholders and Kangaroo Island community groups. We acknowledge the significant commitment, collaboration and passion from our Reference Group throughout the process of updating this plan.

Advance Kingscote Progress Association	Graeme Connell
Agriculture Kangaroo Island Incorporated	Daniel Pledge
American River Progress Association	Graham Walkom
Baudin Beach Progress Association	No nomination
Business Kangaroo Island	Peter Davis
Eco Action KI	Fraser Vickery
Emu Bay Progress Association	Catherine Murphy
Harriet River Township Ratepayers Association Inc	Andy Young
Kangaroo Island Council	Andrew Boardman
Kangaroo Island Food & Wine Association	Tony Nolan
Kangaroo Island Industry and Brand Alliance	Tony Nolan
Kangaroo Island Natural Resources	Mike Greig
Kangaroo Island NRM Board	Richard Trethewey
Parndana Progress Association	Sue Florance
Penneshaw Progress Association	Jayne Bates
Regional Development Australia — Adelaide Hills, Fleurieu and Kangaroo Island	Damien Cooke
Sapphiretown Island Beach Residents Progress Association Inc	No nomination
Stokes Bay Hall Committee	John Owens
Tourism Kangaroo Island	Pierre Gregor

We also acknowledge the assistance, support and insight shared by staff at the Office of the Commissioner for Kangaroo Island, the Kangaroo Island Council, Natural Resources Kangaroo Island, Tourism Kangaroo Island and *The Islander* newspaper.



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EXECUTIVE SUMMARY

Our Long-term Plan (the Plan) for Kangaroo Island's water supply was first released in 2009. It outlined a framework that ensured water security for Kangaroo Island to meet increases in water demand for the following 25 years.

The Plan considered the then current and projected water supply and demand, as well as identifying possible upgrade options that would be required for the future to meet demand for both residential and commercial purposes.

A complete review and update of this Long-term Plan is timely in light of a number of major development aspirations for Kangaroo Island, apprehension regarding the security of water raised by the community, and our strategic and economic regulatory planning processes currently underway.

This updated Plan seeks to balance challenges and opportunities across a range of factors, both now and into the future. It is designed to ensure a safe, secure and reliable water supply for current and future customers while keeping prices as low and stable as possible for our customers right across the state.

As part of the review process we:

- updated the demand and supply projections
- revisited the previous identified upgrade options
- considered any new and innovative ideas
- worked with key stakeholders to provide a roadmap for how we will continue to service our customers on Kangaroo Island.

Stakeholder engagement has been integral to developing this update. In October 2017, we began talking to the Kangaroo Island community and identified the need for an island-based Reference Group to ensure that Kangaroo Island stakeholders and communities had significant input into the review of the Plan.

We worked together with the Reference Group to examine the various issues and opportunities proposed and to assist with information sharing with key stakeholders of progress of the review. It also enabled us to understand the issues of importance to all Kangaroo Island communities.

Seventy ideas were collected and assessed throughout the process. Through our meetings with the Reference Group, a multi criteria analysis process was undertaken. A number of options were identified that best meet the projected future water supply and demand. These options were scored and then ranked to identify the preferred augmentation option.

We held a number of drop-in sessions, presentations and opportunities for the Kangaroo Island community to review the preferred option, provide comment and identify any additional issues and opportunities relating to the security of the water supply for Kangaroo Island.

Based on the findings of our stakeholder engagement and the analysis undertaken together with our Reference Group, the recommended option to be further explored is an additional desalination plant at Penneshaw.

The following details are provided that outlines our process and methodology to reach this recommendation, as well as other options considered and the context in which the updated Plan has been developed.

This Plan is adaptive and can respond to changing environments to ensure security of water supply to Kangaroo Island through to 2043.

THE RECOMMENDED OPTION TO BE FURTHER EXPLORED IS AN ADDITIONAL DESALINATION PLANT AT PENNESHAW.

1 SCOPE

This Plan considers:

- the current and projected drinking water demand and supply
- the state of water resources from which the drinking water supply is drawn
- other critical factors in delivering a sustainable supply such as water quality, safety, whole-of-life cost, environment, heritage and social aspects.

Taking all these factors into consideration, the Plan outlines how we intend to serve the needs of the Kangaroo Island community through to 2043 and beyond.

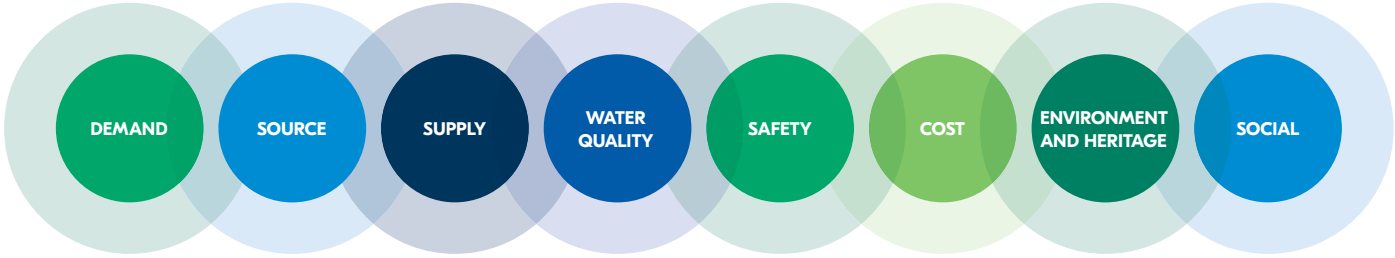


Figure 1: Criteria we need to understand and balance in our Long-term plans.

The Plan also provides strategic direction for our capital, maintenance and operational projects and is adaptable to meet the needs of current and future generations. These projects form part of our business planning which is submitted every four years to our economic regulator the Essential Services Commission of South Australia.

2 KANGAROO ISLAND REGIONAL SNAPSHOT

Covering almost 4,500 square kilometres, Kangaroo Island is Australia's third largest island, with one third of its area declared as Conservation or National Park. It is one of the eight Natural Resources Management regions established in South Australia under the *Natural Resources Management Act 2004*. The population is centred in and around the four larger townships, of which Kingscote is the largest, followed by Penneshaw, Parndana and American River.

The economy is based on natural resources with primary production, and nature- and farm-based tourism making up approximately 90 per cent of the gross regional product. Agriculture Kangaroo Island (AgKI) is one of the largest sectors in Kangaroo Island alongside the tourism industry, and will be one of the key water use areas in the future.

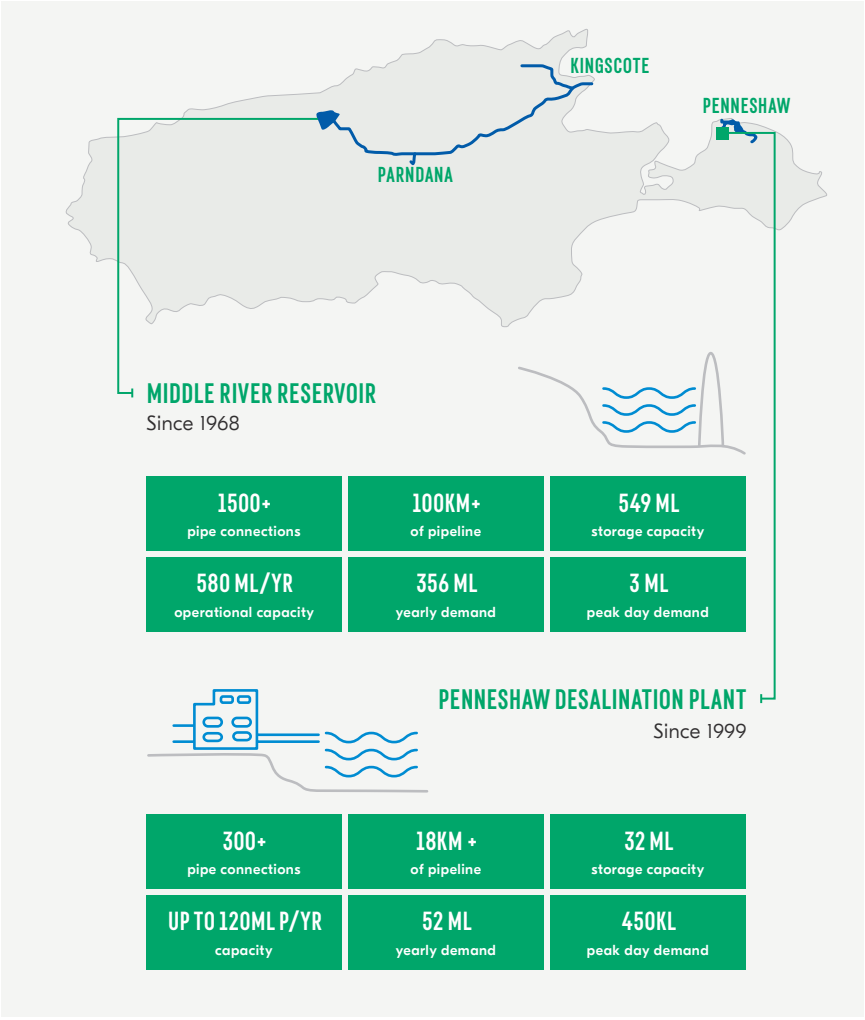


Figure 2: Snapshot of Kangaroo Island's Water

AgKI supports a sustainable approach to ensuring a reliable water supply which enables expanded industry on Kangaroo Island, a key objective of the AgKI Board.

More than 200,000 tourists visit Kangaroo Island each year, one third of which are international travellers.

2.1 Current water supply systems

We operate two water supply systems on Kangaroo Island:

1. The Middle River system supplies the townships of Kingscote, Brownlow and Parndana as well as the surrounding rural areas with water sourced from the Middle River reservoir. The current billed consumption demand on the Middle River system is approximately 356 megalitres (ML) per year.
2. The Penneshaw system supplies the township of Penneshaw with water sourced from the Penneshaw seawater desalination plant, which was commissioned in 1999 and upgraded in 2017. Between 2015 and 2017, the peak day demand has reached 450 kilolitres (kL) per day.

3 PROCESS AND METHODOLOGY

3.1 Process to update the Plan

A comprehensive review of the Plan began in July 2017 and finished in late 2018. We worked together with a customer Reference Group, other key stakeholders and the wider Kangaroo Island community during this time.

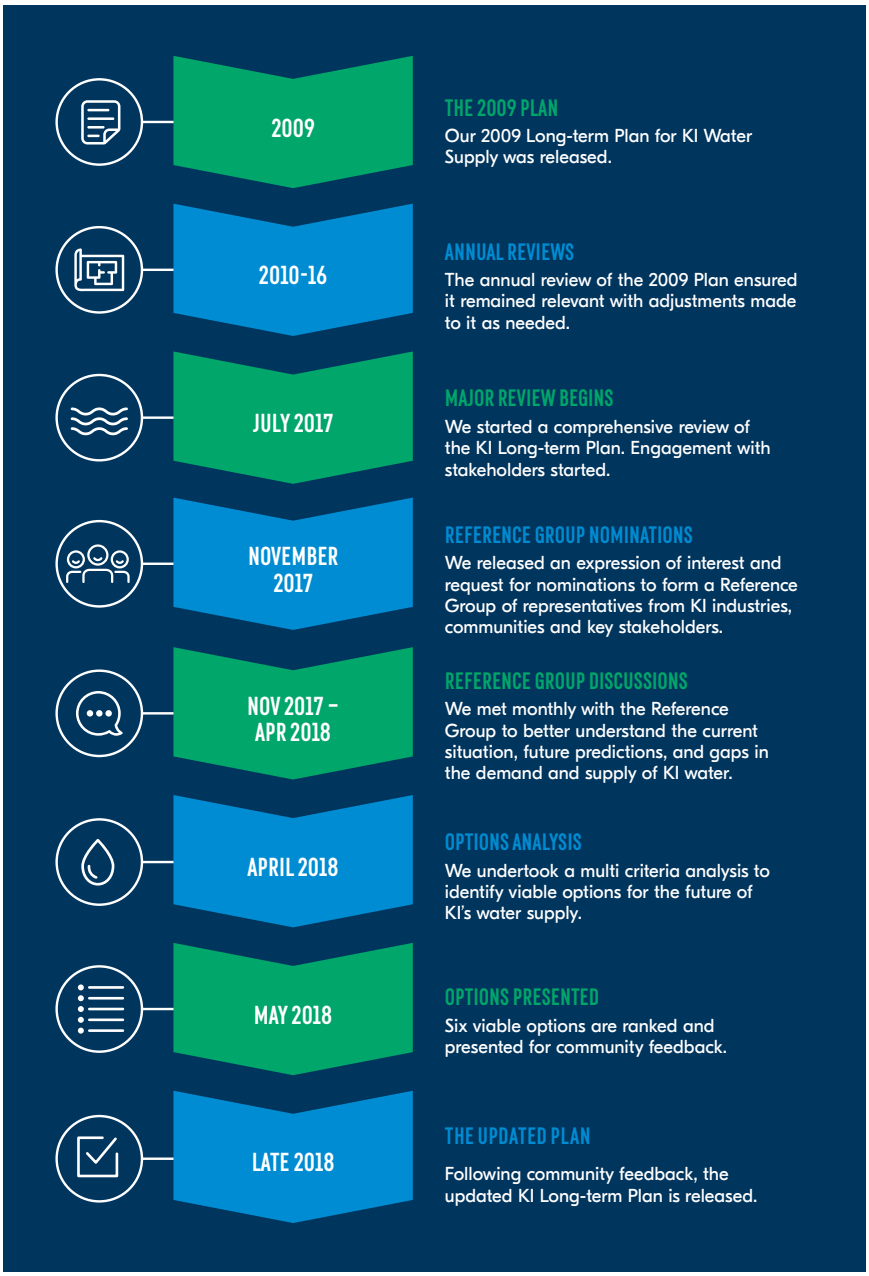


Figure 3: Timeline of activities to update the Plan.

Broadly, the process involved:

- understanding the current state, future needs and planning assumptions
- working with the Reference Group to agree the criteria and weightings to be used in decision making
- identifying and analysing options using a multi criteria analysis
- working with the Reference Group to test the analysis and endorse the recommended option
- consulting with the wider community to ensure the recommended option was considered reasonable, and that all critical factors had been considered.

The process was supported by robust methodologies and strategic approaches to:

- demand and supply analysis
- stakeholder engagement
- multi criteria analysis
- whole-of-life costing.

3.2 Demand and supply analysis

In updating our Long-term plans we use the best analytical and scientific methods for South Australian weather and climatic conditions. These are matched against long-term forecasts of resources availability and customer demand. Our research complements work by the Department of Environment and Water and the Goyder Institute.

Water availability and historic customer demand analysis helps to quantify and project future water supply requirements. We consider a wide variety of potential influences to water demand patterns and use these to build models to forecast demand in each water supply system. The models consider residential and non-residential (commercial and industrial) water use to reflect potential differences in demand patterns.

The demand model provides a range of demands that can be expected between dry and wet years, and accounts for a range of potential climate change futures. Asset planning and water systems must be capable of delivering the upper limit of the range (the 95th percentile).

The demand forecast does not account for step changes in demand such as large developments.

We check our approach against a modest demand projection which assumes current growth and demand per connection remain constant.

See Section 7 — Insights, challenges and opportunities, for detailed results of the demand and supply analysis.

3.3 Stakeholder engagement

Productive, respectful relationships with our customers, regulators and stakeholders are key to delivering services our customer's value.

Stakeholder engagement was integrated into the Plan review process through two phases:

1. Reference Group

Our Reference Group had 16 representatives from a wide range of Kangaroo Island industry, community and stakeholder groups. The group met with our project team regularly and actively worked with us to represent the views of the community and provide information back to those they represented.

2. Open consultation with the broader community

Throughout the review process we communicated with the wider community and invited people to get in touch with the project team or their Reference Group representative. In addition, we held a series of drop-in information sessions across the island and in Adelaide in May 2018 for property owners to discuss the draft with us and identify any additional opportunities or issues.

3.4 Multi criteria analysis

To support complex decision making, we adopt a multi criteria analysis (MCA) approach. This approach allows decision makers to compare different actions or solutions on a range of criteria that can be weighted based on what is more or less important.

An MCA provides a structured and replicable framework to:

- compare a diverse range of often conflicting options
- combine technical expertise and stakeholder preferences
- collect and analyse large amounts of information
- combine quantitative and qualitative aspects
- highlight strengths and weaknesses of the options
- provide an open and transparent method to reach a consensus on trade-offs between conflicting priorities
- undertake sensitivity analysis to understand the impact on recommendations of changes in preferences, conditions and assumptions
- compare any options to the 'business as usual' or 'base case' scenario to ensure they provide a superior and sustainable solution.

In general, MCA methodologies are very well suited when considering the following four categories to indicate the most sustainable and practical solution:

- environment
- social
- economic
- technology/functionality.

These categories are considered equally important and are assigned an equal weight of 25 per cent to test a theoretical balanced decision.

Under each of these categories, criteria and sub-criteria are developed and assigned weightings. Each option is then scored in terms of its performance against each of the criteria. The option with the highest combined weighted score is considered to be the preferred option.

In updating the Plan, the Reference Group was empowered to add and modify criteria and weightings for the environment and social categories, and gave feedback and advice on the reasonableness of the economic and technical categories we specified. The Reference Group also gave feedback on the sensitivity analysis and reasonableness of grading of each option against the criteria.

QUICK OVERVIEW OF MULTI CRITERIA ANALYSIS

Agree on the list of criteria and sub-criteria that matter for the choice.

Give a weight to each of the different criteria representing the relevance of those criteria for the decision and the stakeholders, generally ranging from 1 to 100.

Draw up the matrix of options and score/grade each option's performance against each criterion using an agreed scoring range (in this case one to five).

The average score is then calculated. The grade for each option is multiplied by the weight of each. The score for each option is found by adding the grades multiplied by the weight of each criterion.

The option with the highest score fits the MCA best.

3.5 Whole-of-life costing

As an asset intensive business, in order to make decisions to keep the cost of water as low and stable as possible, our asset planning is based on analysis of whole-of-life cost to build, own, operate and maintain our assets.

Some of our assets are designed, constructed and managed to have lifespans of 100 years or more to ensure they present the lowest cost over the whole life of the asset while continuing to provide reliable services to our customers.

To achieve this, we use the net present value (NPV) financial evaluation tool to estimate and analyse the financial and commercial aspects of options and decisions. We estimate the costs associated with capital investment and ongoing operations and maintenance over the life of an asset, which includes all of the future cash flows, costs, benefits and residual value. These are entered into the NPV model which discounts these to today's dollars to establish a cost in today's terms of pursuing various investment opportunities.

WEIGHTS

Criteria weights were originally developed using experts' assessments of the relative importance of the criteria to reach the overall project objectives. These original weights are referenced in findings as Our MCA weighting preferences in Table 5.

Overall, experts expressed equal preference to minimise any environmental impacts and to maximise any benefits. The environmental sub-criteria of all weights were considered equally important.

The experts' weights for environmental and social categories/criteria were tested with the Reference Group which was asked to reflect their priority values in these weights.

For the social criteria:

- to represent their aspirations for water to facilitate economic development
- their second priority was to ensure the solution did not compete with the power supply to the island
- their concerns on water quality and amenity were low.

For environmental criteria:

- the key value of the group was the protection of the natural environment
- they expressed their trust in us and our administration of and planning instruments that protect heritage
- greenhouse gases were considered secondary to other priorities for community.

PRODUCTIVE, RESPECTFUL RELATIONSHIPS WITH KANGAROO ISLAND'S COMMUNITIES ARE KEY TO DELIVERING OUR LONG-TERM PLAN.

4 OPTIONS ASSESSMENT

The options assessment process is outlined in the figure below and involved:

- identifying viable drinking water supply options to meet increased demand, whether in the future as per scenario one demand or as per the potential demand in scenario two (see section 7.2)
- ranking those options using our multi criteria analysis methodology
- seeking feedback from the Reference Group and wider community on the reasonableness of the recommended option.

LONG LIST OF IDEAS IDENTIFIED	Unconstrained brainstorm of all ways to serve Kangaroo Island	**Outcome:** 70 ideas identified
HIGH LEVEL ASSESSMENT TO IDENTIFY VIABLE OPTIONS	Categorised each idea and tested for 'fatal flaws'	**Outcome:** Six options deemed viable
REFERENCE GROUP FEEDBACK ON VIABLE OPTIONS	Discussed reasonableness of assessment	**Outcome:** Six viable options agreed
ANALYSIS AND RANKING OF VIABLE OPTIONS	High level design and estimates of each option against our agreed criteria	**Outcome:** Draft ranking of the six options
REFERENCE GROUP FEEDBACK ON RANKING	Discuss the outcome and final ranking	**Outcome:** One preferred option

Figure 4: Options assessment overview.

4.1 Viable options assessed

The six viable options analysed and ranked (including the Base Case), are:

1. Base Case ('BaseCase'*): continue operation with the existing system configuration
2. Expand Penneshaw to serve the entire island with an additional desalination plant ('ExpPenn')
3. New source — desalination to meet all Middle River demand ('NewDesAllDem')
4. New source — desalination to supplement existing Middle River supply ('NewDesalSupMR')
5. New raw water storage — Middle River
   - **5a** New storage near Water Treatment Plant ('NewMRRawSto')
   - **5b** Upgrade Middle River reservoir ('MRDamUp')
6. New storage — treated water covered lined storage ('NewTrWatStor').

**Abbreviations in brackets are intended to facilitate the results interpretation in figures below.*

4.2 Scoring

The assessment of performance by stakeholders and experts is expressed as a numerical score using a simplified scale of one to five:

- five represents the highest possible score (lower impacts and/or higher benefits/strengths)
- one represents the lowest possible score (higher impacts and lower overall benefits/higher weaknesses).

4.3 Results

Under both the Reference Group and our adjusted weightings, the ExpPenn option is the most favourable compared to the other options and there may be an opportunity to stage this approach.

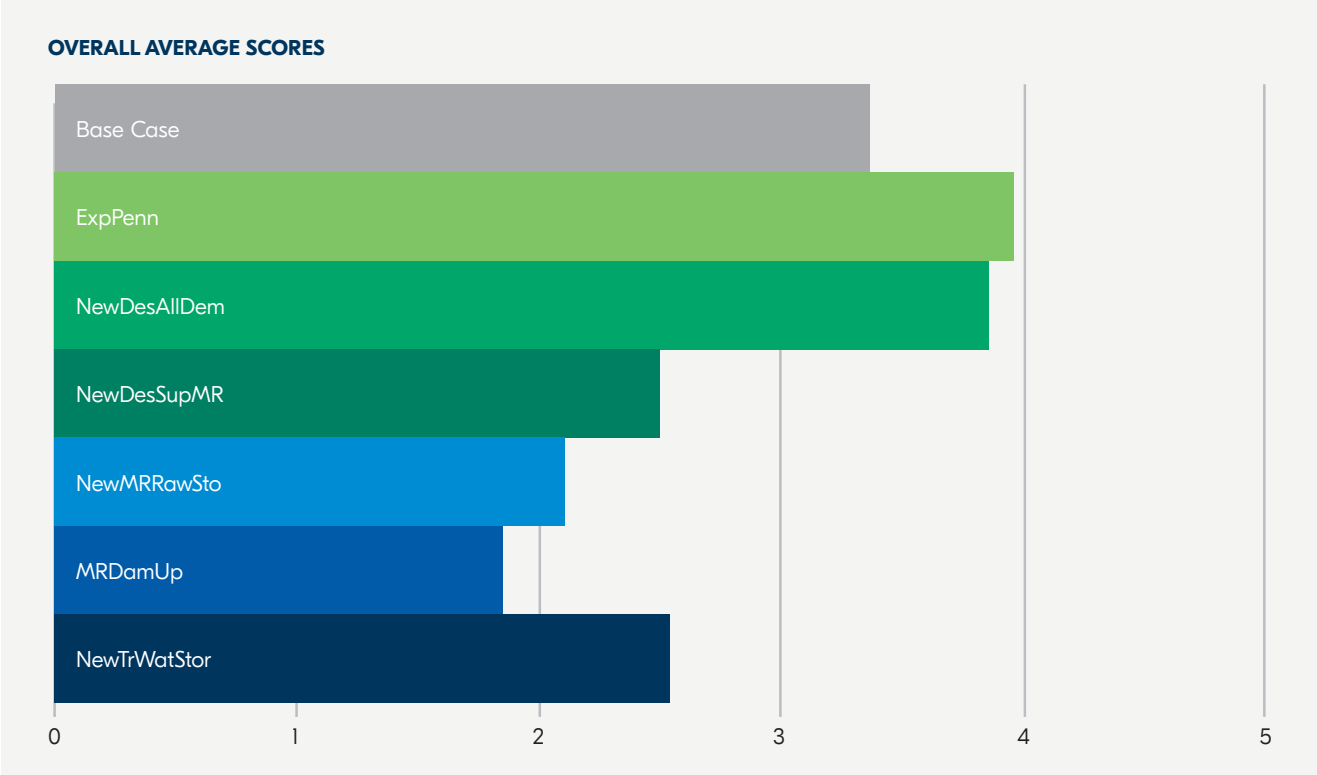


Figure 5: Overall average scores of the preferred options.

A summary of these results is in the table below followed by an outline of the advantages and trade-offs for each option.

OPTION	ADVANTAGES	TRADE-OFFS	AGREED SCORE – INC REFERENCE GROUP VALUES	OVERALL RANK
Base Case *(BaseCase)*	No upfront capital No change to current greenhouse gas footprint	No community aspiration and economic growth opportunity	3.430	3
Additional desalination plant at Penneshaw *(ExpPenn)*	Climate independent source Community aspiration and economic growth Minimise any risks to public health Increase operational flexibility	Manage the desalination plant discharge Larger greenhouse gas footprints Impact from pipeline installation on roadside vegetation Potential amenity impact High upfront cost	3.985	1
New source – desal to meet all Middle River demand *(NewDesAllDem)*	Climate independent source Community aspiration and economic growth Minimise any risks to public health Increase operational flexibility	Manage the desalination plant discharge Larger greenhouse gas footprints Impact from pipeline installation on roadside vegetation Potential impact to aquatic ecosystem Potential amenity impact High upfront cost	3.868	2
New source – desal to supplement existing Middle River supply *(NewDesalSupMR)*	Climate independent source Some community aspiration and economic growth Increase operational flexibility	High system complexity Partial reliance on surface water yields Lower potential to maintain compliance with drinking water quality targets Manage the desalination plant discharge Larger greenhouse gas footprints Potential amenity impact High upfront cost and ongoing cost of multiple systems	2.667	4
New raw water storage – Middle River (New storage near Water Treatment Plant) *(NewMRRawSto)*	Minimise greenhouse gas footprint	No support for economic growth and community aspiration Higher costs Increased operational burden	2.106	6
New raw water storage – Middle River (Upgrade Middle River reservoir) *(MRDamUp)*	Minimise greenhouse gas footprint	No support for economic growth and community aspiration Higher costs Increased operational burden	1.860	7
New storage – treated water covered lined storage *(NewTrWatStor)*	Greenhouse gas footprint is minimised	No support for economic growth and community aspiration Higher costs Increased operational burden	2.544	4

Table 1: A summary of the options with advantages and trade-offs.

4.3.1 Desalination options

The relative performances for the top performing options against the agreed criteria are depicted in the graph in Figure 6.

The closer the lines are to the centre of the radar, the more disadvantages there are in that criteria and the closer the line is to the outside, the better performance or higher the benefits.

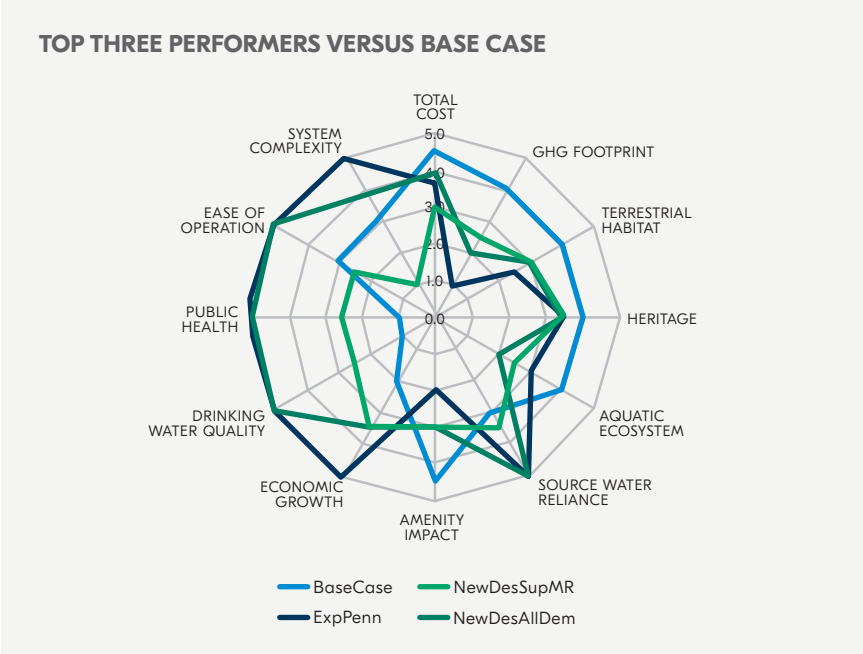


Figure 6: Desalination options performance versus Base Case.

Overall, desalination options have the following advantages:

- Provide for a climate independent source that does not significantly compete with other users. This is particularly valuable to supporting water security on the island under a scenario of high demand and low surface water yields.
- ExpPenn has a higher potential to meet community aspiration to actively support economic growth associated to its distribution system. The other desalination options deliver a volumetric increase but lack the distribution systems.
- A higher potential to minimise any further risks to public health by maintaining compliance to legislative drinking water quality requirements, in particular a higher potential to reduce concentrations of potentially harmful disinfection by-products. This is particularly relevant for Middle River treated water which contains relatively high concentrations of dissolved organic carbon that, when in contact with chlorine for an extended period, can lead to disinfection by-products forming.
- Building a new desalination source at Penneshaw could meet all Middle River demand into the future. It would provide increased operational flexibility, simplicity and reliability.

A new desalination plant to supplement Middle River is the least preferred desalination option, and is marginally better than options involving additional storages due to:

- lower water demand leading to increased water ages in some parts of the Middle River supply system as a result of the addition of desalinated water into the Kingscote storages. This may likely result in difficulties with disinfection by-product and microbial compliance
- high system complexity
- partial reliance on surface water yields.

The disadvantages (trade-offs) are:

- As stated in the 2009 report, the primary environmental issues associated with seawater desalination are generally considered to be the management of the plant discharges (brine stream) and energy usage associated with plant operation. Strategies to manage the brine stream fall within two broad options:

1. land-based disposal, such as evaporation basins, deep-well injection
2. marine-based disposal, such as a marine outfall.

These options involve different environmental risk mitigation strategies that would need to be carefully addressed in the design of the plant.

- Larger greenhouse gas (GHG) footprints in particular for a new desalination plant.
- Potential impact from pipeline installation on roadside vegetation associated with the ExpPenn option.
- Potential impact to aquatic ecosystem. The ExpPenn option has an overall lower impact from its increase in brine discharges compared to a new desalination plant.

Further work developing strategies for the management of the listed trade-off to minimise impact to the environment are considered at the project planning and delivery phase as part of our planning processes, such as for GHG, vegetation and impact from brine discharges.

4.3.2 Storage options

Overall, storage options are limited by the ability to store large volumes of treated water for extended periods of time which require additional measures to ensure the level of disinfection by-products is not increased (refer to Figure 7 for detailed performance).

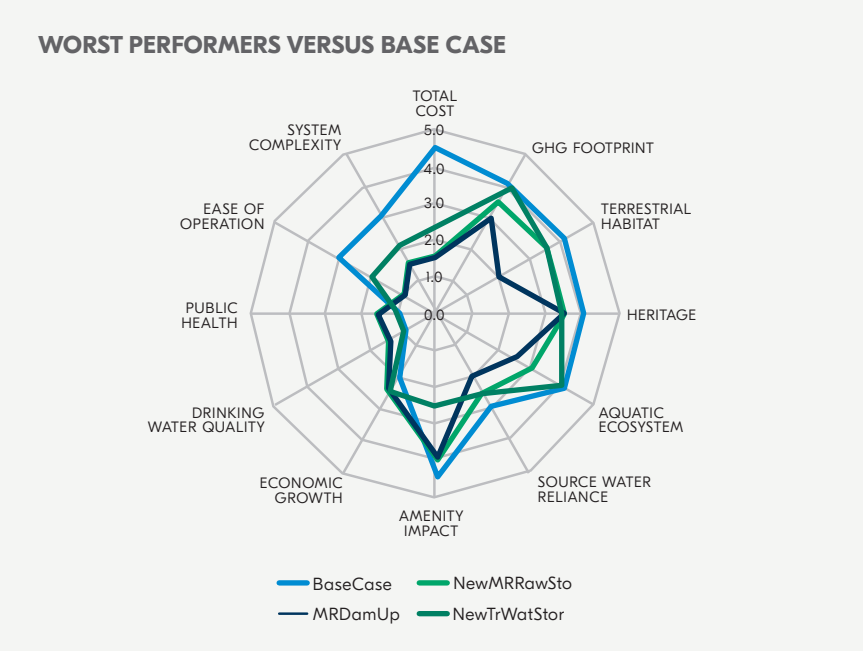


Figure 7: Storage options versus Base Case.

Other factors affecting the performance of these options include:

- the complexity of treatment processes and increased operational burden
- limited support for economic growth
- a new, larger reservoir would be more visually intrusive in the reservoir reserve area
- higher costs
- the large dam was scored as likely to have a similar impact on terrestrial ecosystems as the desalination plant options due to the flooding of native vegetation by the dam and the potential impact on threatened species by construction required by the desalination plants.

4.3.3 Comparison of relative cost of options

Financial evaluations of the preferred options were completed in alignment with our whole-of-life costing method. The evaluation used the estimated net present value (NPV) including capital and operational costs over the 30 year financial planning cycle range.

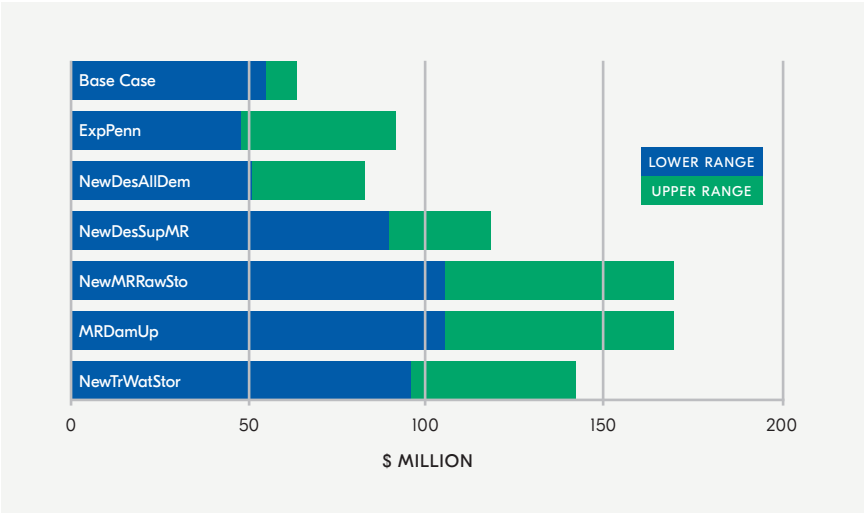


Figure 8: Relative cost of options.

4.4 Recommended option

Based on the findings of the MCA, the preferred option to be further explored is to expand the desalination capacity at Penneshaw with an additional desalination plant.

A comparison of the preferred option's performance against the Base Case is provided in Figure 9 to better understand the trade-offs of not maintaining the Base Case, that is, continuing current operation.

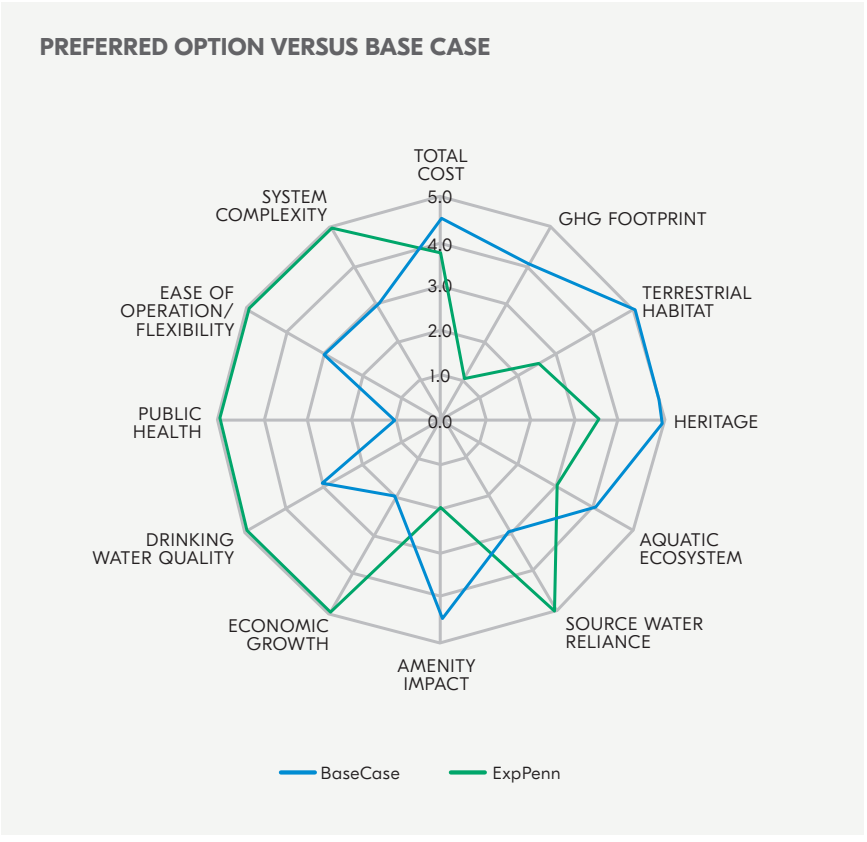


Figure 9: Non-weighted performance Base Case versus ExpPenn.

CRITERIA	BASE CASE	EXPAND PENNESHAW
Cost	Includes costs associated with ongoing maintenance as driven by asset age profiles (such as replacing assets as they age)	Higher costs associated with water distribution (such as pipework)
Economic growth	Not well situated to respond to significant growth/community aspirations (in practical terms it does not allow for other expansion of transfer)	The transfer system associated with this option allows for an increase in potential new connections and economic growth
Environmental	Less risk for terrestrial ecosystems Lower GHG footprint	Higher GHG footprint Further works required to extend pipework may have a potential higher impact on terrestrial ecosystems
Water security	Does not fully address water security in the long term	Climate independent source
Public health	Higher potential of not meeting water quality targets, in particular under a high growth scenario	Infrastructure associated with this option allows for a higher likelihood of compliance with water quality targets
Technical aspects	No change to current levels of complexity Increased operational burden as assets age Decreased water quality over time	Reduced operational burden Reduced system complexity Increased water quality performance and consistent water quality

Table 2: Base case versus ExpPenn performance and trade-offs.

4.5 Community engagement on options

Community engagement in May 2018 provided an opportunity for the broader Kangaroo Island community to engage with us about how we had updated the Plan, the assumptions and options analysed, the recommended option and other features of the updated Plan.

More than 160 people were directly engaged through eight community drop-in sessions on Kangaroo Island; and two formal presentations for Kangaroo Island rate-payers, one in Kingscote and one in Adelaide. These sessions provided an opportunity for the community to ask questions about water and our services, as well as provide feedback.

The majority of people engaged thought:

- the decision making criteria were fair and reasonable
- there were social benefits of connecting the two existing water supply systems.

As we experienced with our Reference Group, there were mixed opinions about:

- proposed major developments on Kangaroo Island
- desalinated water being corrosive
- whether the water spilled over Middle River in winter was going to waste
- the rate-on-abuttal approach that is common in the national water industry, where property owners abutting reticulated water mains pay a yearly supply charge whether connected or not
- extension of our supply systems to additional communities such as American River, Emu Bay, Stokes Bay, Sapphiretown and Island Beach.

Other discussion topics raised and questions explored (from most to least common) included:

- access to water for agricultural requirements
- energy concerns and renewable energy opportunities
- water carting and standpipes
- the cost of water and connecting to a mains supply
- water pressure concerns, particularly in Penneshaw
- ethics of demand management and encouraging reduced use
- taste.

4.6 Key assumptions

The multi criteria analysis (MCA) conducted was a high level options assessment with the following assumptions:

- Nominal sites for treatment and storage facilities and nominal pipeline routes have been selected. Site-specific assessment will be further investigated for the preferred option during the next stage of project development for a number of criteria including environment, heritage, cost and amenity.
- Marine brine disposal for desalination by-product.
- Within the financial criteria, a broad cost analysis was undertaken on high level concepts for comparative purposes only and should be considered as indicative only. Actual costs can only be determined on the basis of detailed design and competitive tender.
- Grid-energy would be used and allowances were made for provision of necessary power network augmentations. The nominal sites were selected where there was potential for renewable solar power and/or proximity to other potential future renewable energy generation. Renewable energy has not been included in the costs or greenhouse gas emission scoring.

4.7 Other considerations

Seventy ideas were collected and assessed throughout the process. Many of these ideas had merit and will be explored as opportunities outside of the MCA process. The recommendations below include activities that will be progressed that relate to these ideas.

KANGAROO ISLAND LONG-TERM PLAN
OPTIONS SHORT-LISTING ASSESSMENT

MCA Option	Count of Idea #
No	**58**
Already underway	**6**
Design consideration	**9**
Energy consideration	**3**
Not viable	**23**
Explore but not though MCA	**17**
Demand management	3
Innovation	1
New services	5
New services & new supply areas	2
New supply areas	4
System management	2
Yes	**12**
Expand Penneshaw and serve all from there	**1**
New source – desal to supplement existing Middle River supply	**1**
New storage – raw water Middle River	**3**
New storage – raw water other than Middle River	**3**
New storage – treated water	**3**
New source – desal to meet all MR demand	**1**
Grand Total	**70**

Table 3: Options short-listing assessment.

5 DECISION MAKING CRITERIA AND WEIGHTING

We worked with the Reference Group to develop the criteria and weightings that were used in the multi criteria analysis to grade and score options. Criteria with higher weighting are of higher value or relative importance and therefore options with high scores in these areas are more preferred.

CATEGORY/CRITERIA	INTENT	JUSTIFICATION
FINANCIAL		
Total cost	NPV to represent the cost to consumer/utility and government	Options have different investment profiles, infrastructure needs and operational expenditure
SOCIAL		
Security of supply	Maximise ability to access water source without precluding other stakeholders and uses, e.g. agriculture, non-customers and key critical services	Options differ on existing water allocation, future restrictions under climate restricted supplies or changes in legislation competing with sources
Amenity	Minimise potential for ongoing and/or emerging impacts from by-products from operation and construction	Implementation of the options has potential to change the aesthetic value of the landscape, e.g. dust, noise, light pollution, amenity loss, impacts on tourist experiences, etc
Impact on access to energy (l)	Minimise the risk of further impacting the constrained energy (power) available to the island	Community expressed their concern on any options that may stress the already constrained power load further
Economic growth	Maximise opportunity for economic growth and water security, and facilitate access potential for new customers/communities	Identified as a key community value: community aspirations are for a water supply to support economic growth on the island
Acceptability of drinking water quality	Minimise the potential for customer dissatisfaction with drinking water taste and odour	Concerns about water taste and odour were expressed in the previous plan (2009)
Public health	Minimising the risk of health impacts to customers and community from formation of disinfection by-products and chlorination	We operate under strict health and water quality guidelines and, depending on the water source, some options may increase risks associated with water treatment
TECHNICAL		
Operability	Minimise operational risks from complexity of systems (current and future) including management of failure modes	Level of operational complexity and effort based on expert analysis of high level design
Complexity	Minimise functionality and reliability risks due to complexity of systems (current and future)	Level of design complexity based on expert analysis of high level design (how many systems, storage capacity, their interface, risk transfer etc)
ENVIRONMENTAL		
Greenhouse gas emissions	Minimise emissions	Options will have different emissions from both construction and operation
Ecosystems terrestrial and aquatic	Minimise impacts on significant vegetation and fauna and aquatic ecosystems	Options may have an impact on existing terrestrial ecosystems and aquatic environs from increased flows/waste into receiving aquatic ecosystem including sea and inland waters, such as brine disposal
Heritage	Minimise impacts on significant heritage	Federal, State, Local and indigenous heritage and values

Table 4: Agreed decision making criteria.

(1) An update from SA Power Networks indicates there are no anticipated issues with current nor future energy supply for any of the options assessed. This conclusion can be drawn from the following key findings:

- An upgrade is imminent for Kangaroo Island. Capacity will be doubled, further securing access to energy to all island users
- Localised issues that may arise at substations will be address by our investment to maintain operable water treatment and distribution services.

Criteria of high importance to us:

- financial — minimising cost to supply customers to keep state-wide prices as low and stable as possible
- social — public health for our customers.

Criteria of high importance to the Reference Group:

- environment — minimising harm to significant habitat, vegetation and fauna
- social — enabling economic growth, security and lower barriers to access for new communities/customers
- social — minimising negative impact or maximising positive impact on communities' access to energy (power).

The relative importance of criteria was converted to relative weights through direct weighting.

CATEGORY	%	MAIN CRITERIA	%	SUB-CRITERIA	%
ENVIRONMENT	25	GHG emissions	25	GHG footprint	100
		Terrestrial and aquatic ecosystem	25	Significant vegetation and fauna	100
		Aquatic ecosystem	25	Inland and marine	100
		Heritage	25	Significant heritage	100
SOCIAL	25	Security of supply	40	Peak system demands	50
				Source water accessibility	50
		Customer and community acceptability of options	40	Impact on amenity	25
				Impact on access to energy	25
				Economic growth, security and new customers	25
				Acceptability of drinking water taste and odour	25
		Customer and community safety	20	Public health	100
ECONOMIC	25	Cost	100	Total cost to utility	100
TECHNICAL	25	Operational complexity	25	Ease of operation and flexibility	100
		Complexity	25	System complexity	100
		Reliability	50	Functionality/redundancy	100

Table 5: Our MCA weighting preferences

The following is the final list of criteria endorsed by the Reference Group at the meeting at American River in February 2018.

CATEGORY	%	MAIN CRITERIA	%	SUB-CRITERIA	%
ENVIRONMENT	25	GHG emissions	10	GHG footprint	100
		Terrestrial and aquatic ecosystem	75	Significant habitat, vegetation and fauna	50
				Inland and marine	50
		Heritage	15	Significant heritage	100
SOCIAL	25	Security of supply	40	Peak system demands	50
				Source water accessibility	50
		Customer and community acceptability of options	40	Impact on amenity	10
				Impact on access to energy	30
				Economic growth, security and new customers	40
				Acceptability of drinking water taste and odour	20
		Customer and community safety	20	Public health	100
ECONOMIC	25	Cost	100	Total cost to supply customer	100
TECHNICAL	25	Operational complexity	25	Ease of operation and flexibility	100
		Complexity	25	System complexity	100
		Reliability	50	Functionality/redundancy	100

Table 6: Criteria and weighting reflecting Reference Group preferences.

6 CONTEXT

We are committed to providing safe, clean water supplies for our customers and undertake adaptive Long-term planning for each region in South Australia to ensure water supplies can meet future demands.

6.1 Other water supplies

In addition to our supply systems, the community also sources drinking and non-drinking water from:

- stormwater harvesting in private dams
- rainwater tanks
- wastewater reuse
- small-scale bores and single-supply desalination plants.

We do not administer the regulation or funding for these schemes, but we recognise their importance in reducing demand on our systems and heightening awareness of the need for water conservation in the community. These schemes are generally run by local government, the community or individual land holders.

In addition, a number of residents and businesses rely on indirect use of our systems via privately operated water carting services, particularly through dry summers when private water holdings can be low. Water is drawn from a number of standpipes along our water mains and transported across the island.

6.2 Previous Long-term plan for Kangaroo Island (2009)

Our previous Long-term plan for Kangaroo Island was finalised in 2009. At the time, demand projections indicated that a new resource would be required within five years for the Middle River system and after 2030 for the Penneshaw system. The plan recommended the option of a treated water storage near Kingscote as the most worthy of further investigation, followed by a raw water storage near the Middle River Water Treatment Plant.

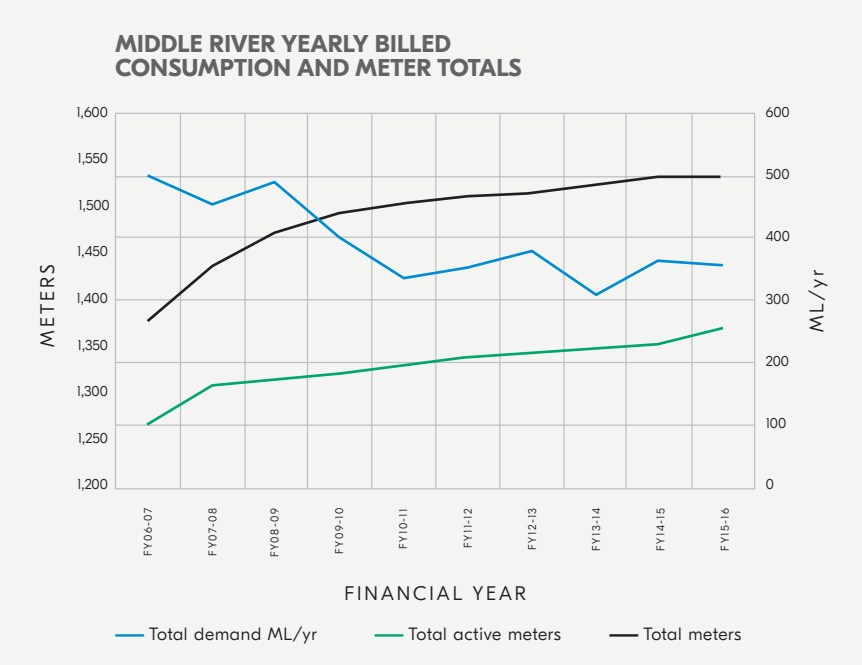
A capital delivery project started in 2009 and we investigated a number of potential sites, but a significant drop in yearly water demand in 2010 indicated that additional storage was no longer required and the project came to an end with no new assets required. This sustained reduction in demand is in line with state-wide changes in customer water use behaviour following the millennium drought.

7 INSIGHTS, CHALLENGES AND OPPORTUNITIES

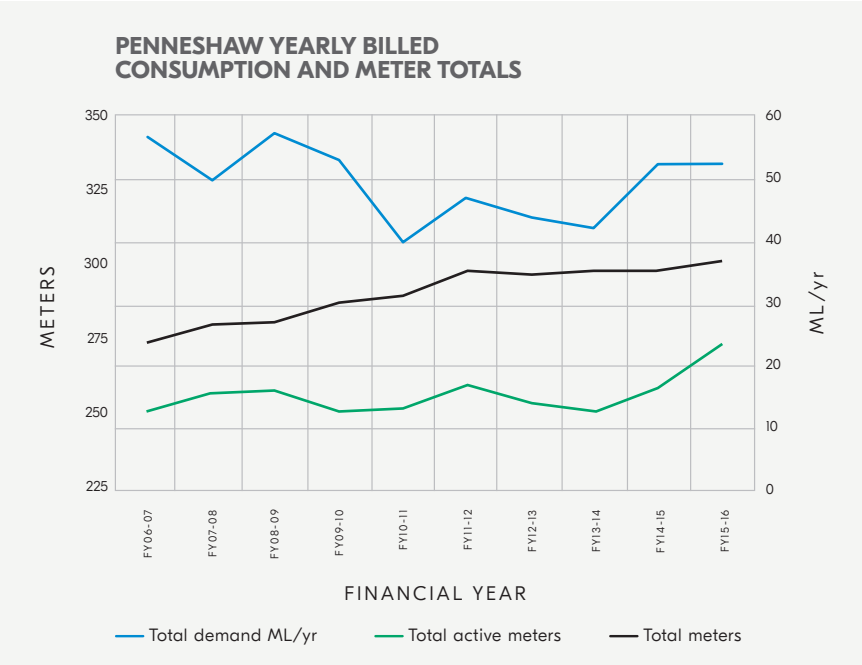
7.1 Historical water demand

Yearly data collected from 2006-07 to 2015-16 has been reviewed for trends in customer connections and total demand.

This analysis shows that, while the number of connections (meters) has been slowly and steadily increasing, overall demand has trended downwards in the Middle River system.



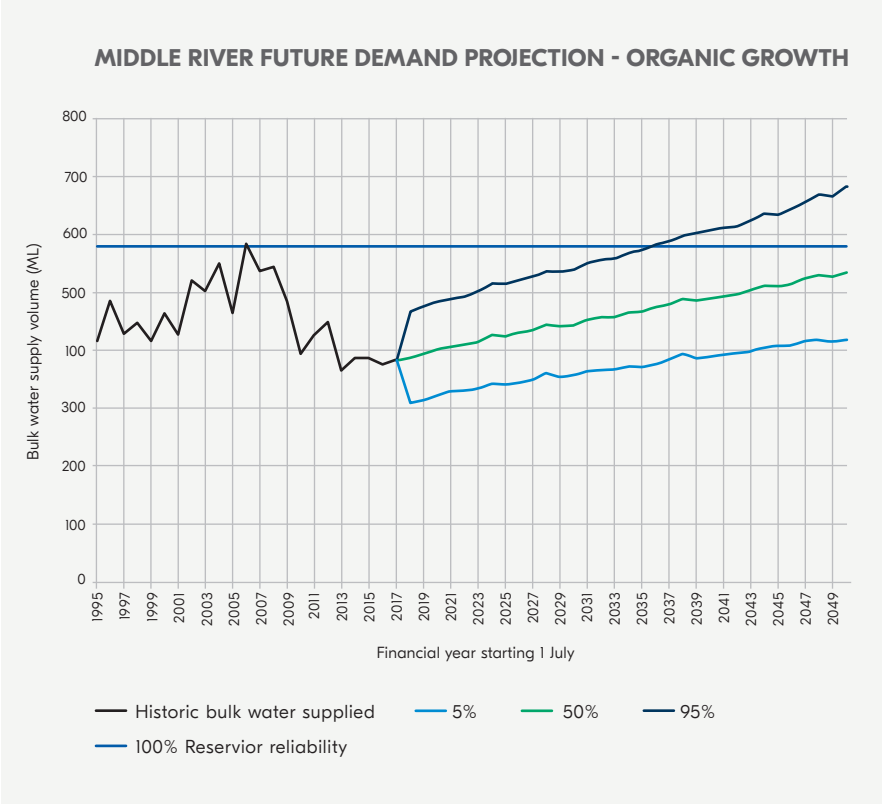
The system in Penneshaw incorporates a large balancing storage to allow the desalination plant to operate at its optimum capacity and to allow periodic maintenance shutdowns. As there is more than three months' storage available, the peaking of flows is not an issue for the Penneshaw source supply.

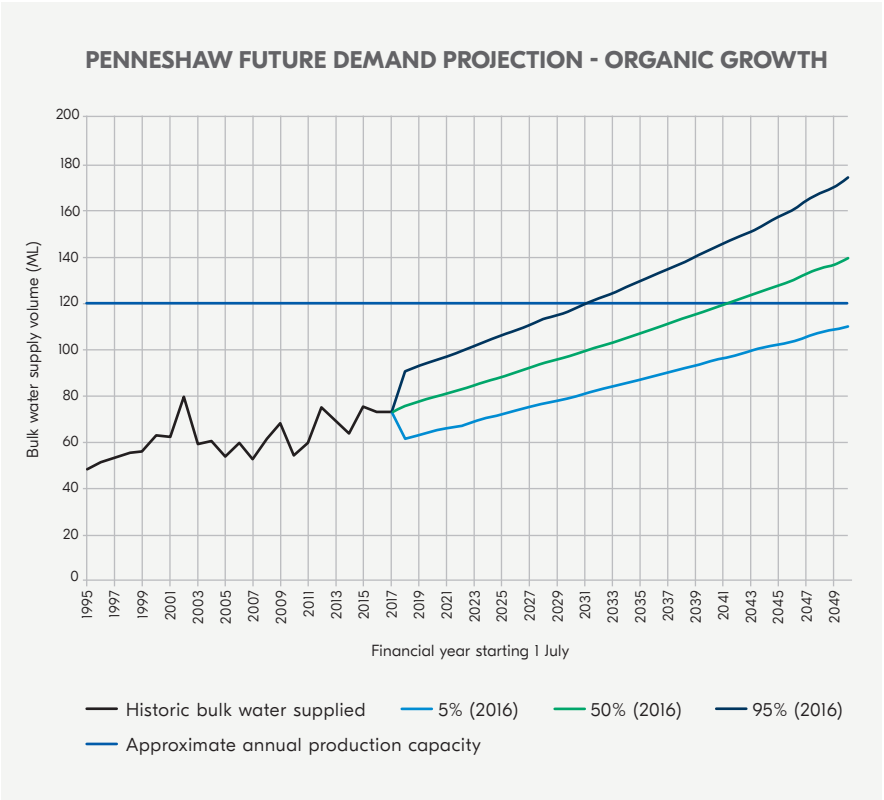


7.2 Future water demand

During the process of updating the Plan we remained adaptive to two scenarios ensuring recommendations would be able to satisfy both potential futures:

1. Increases in demand in line with organic growth only, about 11 additional new connections per year across the island with no increase in water consumption per connection as for the past three to five year maximum.
2. Step-change in demand due to major developments, such as approximately 200 to 300 ML per year additional demand from proposed developments in the tourism industry.





The projected demand was based on the below assumption:

SYSTEM	CONSUMPTION PER ACTIVE CONNECTION PER YEAR	NEW ACTIVE CONNECTION PER YEAR	TOTAL CUSTOMER CONNECTIONS IN 2015-16	CONNECTION GROWTH RATE AS A % INCREASE ON 2015-16
Middle River	167 kL	About six residential; one non-residential; zero country lands	1,534	0.5%
Penneshaw	161 kL	About three residential; one non-residential; zero country lands	302	1.32%

Table 7: organic growth assumptions.

SCENARIO ONE: ORGANIC GROWTH

To analyse future growth, both a forecast method and simpler projection method were employed.

The forecast method used statistical analysis to assess the demand drivers such as climate conditions, population growth and economic conditions. This method provided an envelope of possible demand under different conditions.

The projected organic growth scenario assumes:

- Consumption per active connection will remain in line with the past three years. The modelling assumes the maximum unit demand rather than the average.
- New active connections will continue to grow in line with the past few years. The modelling assumes growth in line with the past five year average for Middle River and growth in line with the past three years for Penneshaw which is higher than the five year average.
- Under the organic growth scenario, the Middle River system has adequate capacity until 2036, and the Penneshaw system has adequate capacity until 2031.

SCENARIO TWO: MAJOR DEVELOPMENT GROWTH

In updating the Plan we worked with proponents proposing major developments on Kangaroo Island to understand their water supply needs and potential options. Combined, these developments could represent a significant direct increase in demand of approximately 200—300 ML per year, primarily during summer.

This increase in future water demand would represent a step-change in demand for supply from either the Middle River or Penneshaw systems. In the case of the Middle River system this represents an increase of approximately 60 per cent above the current supply. In either case, it would require investment in an additional water supply resource for Kangaroo Island. The timing of this investment is subject to if and when any additional demand is required.

Water supply to these proposed developments may also benefit neighbouring communities and future customers. Coupled with sufficient demand from established communities, like American River, this may result in a viable supply of safe, clean drinking water to these areas.

7.3 Existing water sources

MIDDLE RIVER RESERVOIR

The Middle River Reservoir provides the water supply to the Middle River Water Treatment Plant. The reservoir is located approximately 50 kilometres west of Kingscote and has a design capacity of 540 ML and a water catchment area of approximately 101 square kilometres.

The dam that forms the reservoir was constructed in 1968 and has spilled every year since it was completed. In June 2007, a fuse was installed on the spillway to raise the level and increase the reservoir capacity by 15 per cent to the current 540 ML.

Inflows to the reservoir are likely to decrease in the future due to the effects of climate change reducing rainfall in the catchment and from any increase in areas developed for forestry. Based on future climate projection a reliable yield from the reservoir has been calculated at 580 ML per year.

PENNESHAW DESALINATION PLANT

Operational since March 1999, the Penneshaw Desalination Plant treats seawater from Backstairs Passage and has a capacity of 120 ML/year. The plant consists of pre-treatment, Reverse Osmosis (RO) membranes and a post-treatment stage to increase the alkalinity of the treated water to reduce the potential for corrosion in the distribution network and customers' plumbing.

The plant, which has a nominal capacity of 400 kL/day, is operated in conjunction with a bulk storage located approximately two kilometres from the plant to cover the peak day demand of 450 kL/day. When the Penneshaw Water Treatment Plant is offline, the town is supplied from storage and the water is re-chlorinated before entering the distribution system.

NON-RETICULATED SUPPLIES

A large part of Kangaroo Island is not supplied from our network. The following water sources form a part of Kangaroo Island's water supply:

- Rainwater tanks are used extensively on Kangaroo Island in areas without a reticulated water supply. During dry periods it is common for rainwater tank supplies to be replenished with water carted from standpipes fed from the reticulated systems. During the drought in 2006 approximately 40 ML of water was carted from standpipes which equates to 7 per cent of the Middle River system demand.
- Wastewater reuse from the Community Wastewater Management Schemes operated by the Kangaroo Island Council in Kingscote, Parndana and American River. Development of an additional scheme at Penneshaw is currently pending.

7.4 Water quality

We are committed to efficiently managing our water supplies on behalf of our customers to comply with the *Safe Drinking Water Act 2011* and associated Regulations (2012), and deliver on our customers' expectations. The Act and Regulations require us to observe the principles of the Framework for Management of Drinking Water Quality that are outlined in the *Australian Drinking Water Guidelines (2011)* (ADWG) prepared by the National Health and Medical Research Council.

The Act and Regulations are administered by SA Health through a cooperative relationship with us. The terms of this relationship and responsibilities are clearly outlined in a Memorandum of Administrative Arrangement.

One of the key principles stated in the ADWG is the need to prioritise disinfection thereby ensuring microbiological control is maintained at all times. We achieve this through a robust risk management process that assesses potential hazards and considers their impact on customers.

7.4.1 Middle River

Middle River's source water contains high concentrations of dissolved organic carbon (DOC) which originates from vegetation in the catchment area, creating its natural tea-like colour. The water also contains suspended dirt, salts and microorganisms.

The water goes through a number of treatment processes to remove these contaminants including a patented ion exchange process called MIEX®, conventional settling and filtration followed by ultraviolet disinfection and chlorination. Remaining DOC, along with naturally occurring bromide, will react with chlorine over time to generate low concentrations of compounds in the water, commonly referred to as disinfection by-products (DBPs). Some DBPs are listed in the ADWG with recommended health limits.

We work closely with the Department for Health and Wellbeing to manage compliance with theses limits and implement improvements where practical.

Recent actions taken to reduce DBP concentrations in the water supply include:

- incorporation of an aeration system at Middle River
- optimisation study at Middle River to enhance the removal of organics from the source water at Middle River using MIEX®
- network modifications to help manage DBP concentrations including in-tank aeration, optimisation of water age and flushing
- management of disinfectant concentrations throughout the water supply network.

The Department of Health and Wellbeing encourages efforts to reduce disinfection by-products but recognises the importance of not compromising disinfection. Poor microbiological quality represents a greater and more immediate risk to human health (National Health and Medical Research Council).

7.4.2 Penneshaw

The Penneshaw desalination plant initially provided a capacity to supply 300 kL/day of high quality drinking water to the township. The plant has experienced a number of subsequent upgrades to continue to improve the quality of the treated water to minimise corrosion. This followed an investigation that recommended we maintain certain water quality parameters within defined limits.

An upgrade in 2017 was undertaken at the plant to improve safety and reliability, and increased the capacity from 300 kL/day to 400 kL/day.

8 SUMMARY

Based on the analysis, the below summarises our plan to serve Kangaroo Island into the future.

- Based on the findings of the multi criteria analysis, the preferred option to be further explored is to expand the desalination capacity at Penneshaw with a new desalination plant.
- Locating a new desalination plant at Penneshaw could provide additional benefits including a significant increase in security of supply for the Middle River system, and the option for residents along Hog Bay Road to connect to the system.
- Under an organic growth scenario, the additional source would not be required until 2036. To optimise whole-of-life costs, the augmentation would likely be brought forward to 2030 to avoid significant renewal investment of the current Middle River Water Treatment Plant and reservoir.
- We are working with a number of major developers to understand their water supply needs and potential options. This increase in future water demand would represent a step-change in demand for supply from either the Middle River or Penneshaw systems. In either case, it would require investment in an additional water supply resource for Kangaroo Island.

8.1 Recommendations

These recommendations will be used to guide the scheduling of investment for Kangaroo Island over the 25 years to 2043.

PRIMARY DRIVER	ACTIVITY/DELIVERABLE	TIMING
Adaptive planning	Review major assumptions contained in the Plan	Yearly
Water security	Current resources are sufficient for organic growth with proactive monitoring of reservoir levels throughout the year. Planning for transition from Middle River reservoir over the next decade and current planning to provide additional water source pending an agreement with large developments	Ongoing
Operational flexibility	Refurbishment of two treated water storage tanks at Kingscote. This will increase storage at Kingscote to 18 ML (from 4.5 ML)	Commenced, expected completion 2019
Future opportunity, operational flexibility	Additional modelling of the Middle River catchment	Completed in-house
Customer experience, operational flexibility	Work with Kangaroo Island Council and the existing users of the standpipes on a better whole-of-island approach to stand-pipe management and indirect water use	Commenced, expected completion before summer 2018-19
Future opportunity, customer experience	Work with the American River community to explore opportunity to expand water supply system to American River township	Commenced expression of interest process mid-2018, expected completion within 6-9 months
Cost, environmental impact	Continue to explore renewable energy opportunities as part of existing and future infrastructure	Commenced in-house
Cost, customer experience	Install smart meters on all connections in Penneshaw due to the high volume of water loss and the high cost of producing water in the system. Trial to provide insight into how we might shape a larger-scale smart meter rollout in South Australia	Commenced late 2018, expected completion mid-2019 Expansion of smart meters in line with yearly review process
Safety	Renew Middle River reservoir to maintain reliability	Commence around 2028

8.2 Connecting additional communities

There are a number of communities on Kangaroo Island that are not currently supplied directly by our network as the infrastructure does not extend to that area. In the past a number of these communities have approached us for the provision of a reticulated water supply. Schemes have been designed and costed to extend supply to these townships, but due to the cost of construction these have not been considered economical.

We have standard procedures for working with communities who register interest in having an SA Water supplied reticulated water supply. Broadly this involves:

- a community body or member of the community approaching us to express an interest in having a water supply
- an initial expression of interest process where we write to all property owners in the area asking if they are interested in a potential supply from us
- if high enough levels of interest are received then we determine the augmentation costs per connection and seek commitments from all property owners to connect at that cost
- if there is enough commitment to cover the cost of the augmentation, and we have funds available to do the work, we then build the required infrastructure.

The Reference Group included representatives from the Emu Bay, American River, Stokes Bay and Vivonne Bay (Harrier River) communities. We also invited representatives from the Sapphiretown, Island Beach and Baudin Beach communities to contribute to the process although no nomination was received for either group.

The American River Progress Association have approached us to re-commence the process outlined above for the American River community which will occur in late 2018/early 2019. No other communities have expressed an interest in a new water supply at the time of the release of this plan.

8.3 Other opportunities

While the Plan focuses on our current and future drinking water supply systems, an integrated whole-of-island water planning approach has been taken that considers the wider water supply needs of the community including non-connected communities, industries and non-drinking supplies. Consequently, a number of opportunities identified in this planning process may be considered as part of adaptive planning either in yearly reviews or if triggered at any time:

- connection of new communities
- introduction of non-drinking/irrigation water customers
- recreational access to Middle River reservoir
- alternative uses of water by the community in the Middle River catchment
- alternative renewable energy supplies
- partnership and/or collaboration with the Kangaroo Island Council on an integrated energy and distilled water opportunity.

To ensure we keep prices as low and stable as possible for our customers, augmentation or extension of our systems to accommodate any of the above opportunities will be undertaken on a commercial basis, taking into account our Community Service Obligations.

9 ADAPTIVE PLANNING

Our adaptive approach to planning ensures the decisions we make, and how we make them, are informed by a rigorous continual learning process. This recognises the complex and changing environment in which we operate and provide services to our customers and the community.

Adaptive management ensures we collectively and continually monitor and respond to change. System thinking ensures we take a holistic approach to understanding how water systems work over time within the context of larger technical, economic, social and environmental systems.

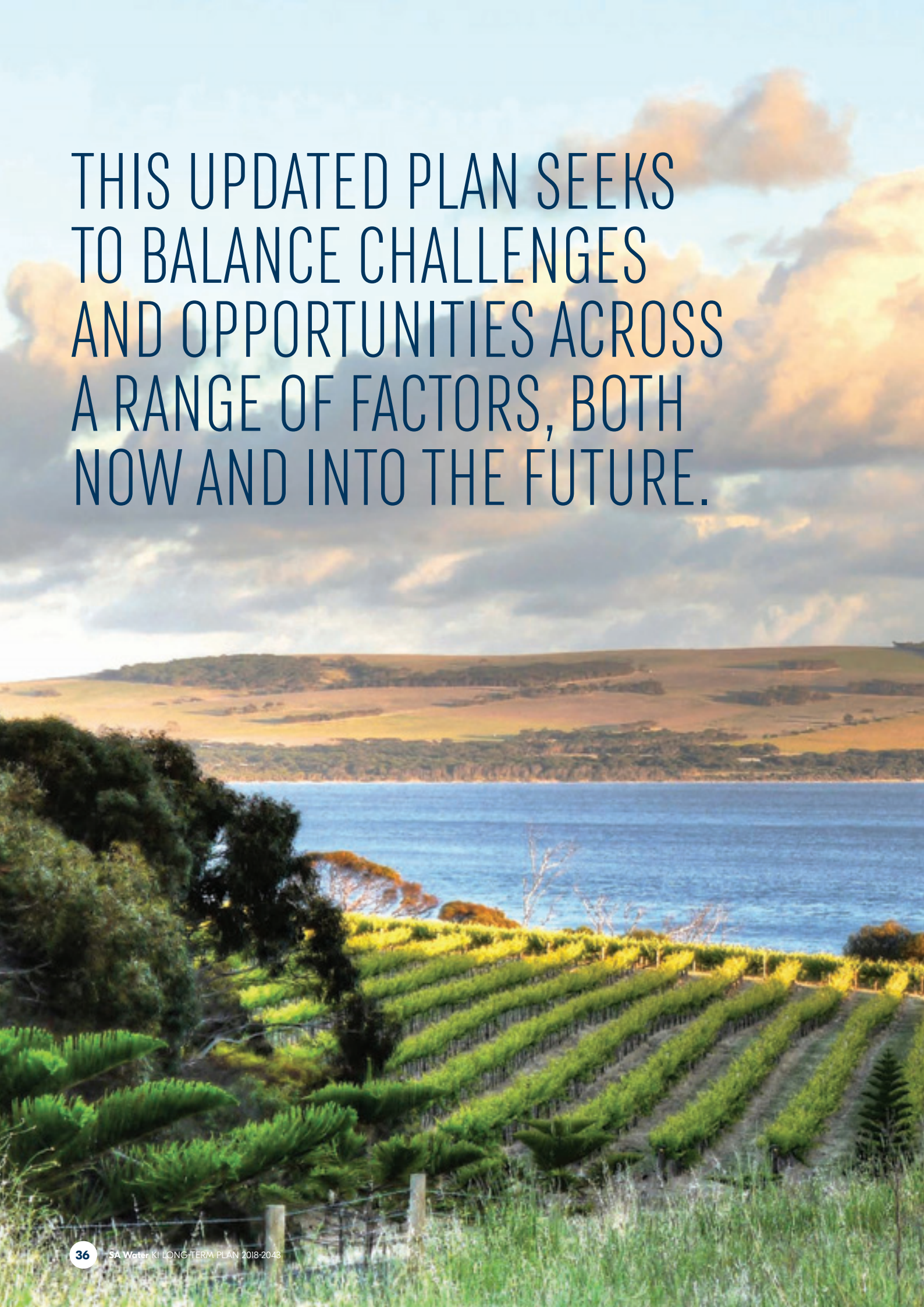
Our standard practice for developing and amending Long-term plans is:

- major assumptions contained in a Long-term plan are reviewed yearly
- a major departure from an assumption or key parameter can trigger a total review of the plan and the strategies it recommended at any time.

A departure from these assumptions or key parameters is known as a trigger point. Trigger points are monitored and checked at least yearly to ensure the Plan remains relevant and is adapted if required.

The assumptions and key parameters in this Plan are:

- the population of Kingscote and Penneshaw
- actual demand
- impact of climate change on available resources and demand
- agreed take-limits from the Middle River system
- government policy on carbon neutrality and energy generation
- government policy on recreational access to reservoirs
- our approach to rolling out smart meters across the state
- water aesthetics
- systems-based triggers.



THIS UPDATED PLAN SEEKS TO BALANCE CHALLENGES AND OPPORTUNITIES ACROSS A RANGE OF FACTORS, BOTH NOW AND INTO THE FUTURE.

Government of
South Australia

SA Water