Towards a Healthy Coorong

A guide to help the community discuss infrastructure options for securing the future of the Coorong



Australian Government



of South Australia Department for

Acknowledgement of Country

Aboriginal people are the First Peoples and Nations of South Australia. The Coorong, connected waters and surrounding lands have sustained unique First Nations cultures since time immemorial. The Healthy Coorong, Healthy Basin program acknowledges the range of First Nations' rights, interests and obligations for the Coorong and connected waterways and the cultural connections that exist between Ngarrindjeri Nations and First Nations of the South East peoples across the region and seeks to support their equitable engagement. Aboriginal peoples' spiritual, social, cultural and economic practices come from their lands and waters, and they continue to maintain their cultural heritage, economies, languages and laws which are of ongoing importance. The Department for Environment and Water (DEW) works across the State with Aboriginal South Australians to conserve and sustain Country. Through this work we seek to improve the relationship between Aboriginal and non-Aboriginal Australians and build respect based on mutual understanding and acceptance of each other.

A guide to facilitate community input on potential infrastructure options for securing the future of the Coorong

As part of the broader <u>Project Coorong</u> initiative, the <u>Healthy Coorong, Healthy Basin</u> program is supporting the long-term health of the Coorong, with a focus on the Coorong South Lagoon.

Maintaining the long-term ecological health and resilience of the Coorong may not be achievable through improved knowledge and water resource optimisation alone. There is growing acceptance that additional management options may be required, particularly in the face of climate change.

Healthy Coorong, Healthy Basin's Coorong Infrastructure Investigations Project will investigate the technical feasibility, the environmental, social and cultural benefits as well as the impacts of long-term management solutions to support the long-term health of the Coorong.

A number of infrastructure and management options have been identified over the years to potentially improve management of the Coorong and enhance its ecological health.

Key to narrowing these options down, is an understanding of the social, economic and cultural needs and values of First Nations peoples, locals and the broader South Australian community. We need to explore the options together – First Nations, South Australian communities, governments and scientists - to ensure we get it right for the long term.



What's in this guide?

This guide has been written to support the community in taking an active role in exploring future infrastructure and management options for the Coorong.

It represents the first step of what will be a 1-2 year in-depth consideration across 3 distinct stages -

- 1. Identifying and shortlisting options (to mid-late 2020)
- 2. Detailed feasibility of shortlisted options (to mid-late 2021)
- 3. Development of the business case/s (to late 2021 / early 2022)

To help initiate the process, the Department for Environment and Water (DEW) commissioned Tonkin (an engineering environmental consultancy) to undertake a technical review of previously investigated management ideas generated from community and experts. These previously investigated options are introduced and summarised in this guide. The full technical review is available on the <u>Project Coorong website</u>.

Recently we started on the journey of engaging the community by asking them to put forward any new options/ideas they have for securing the long-term health of the Coorong. New options put forward have also been included in this guide.



How can I get involved?

This guide has been prepared to inform a broader, ongoing consultation process (depicted below). We are involving First Nations, local communities and the broader South Australian community at each assessment phase.

Below is a time-line of opportunities for you to get involved.



Right now you can learn more about the options by reading this guide and taking part in our online webinars. <u>Register Here</u>.

Once you feel you are ready you can then tell us what you think about the options here.

All current and future community engagement opportunities can be found on our Project Coorong website in the "Get Involved" section.

To receive Healthy Coorong, Healthy Basin updates and opportunities, including citizen science activities and community consultations, please email project.coorong@sa.gov.au.

Recognising the role of the Community to date

We recognise the countless hours of conversations, meetings, discussions and research which have been held in the region (and beyond) for decades to discuss solutions to help the Coorong.

We recognise the community's genuine interest in the Coorong and their unfailing commitment to work with government to find a long term solution to secure the environmental, economic and social health of this highly valued ecosystem.

The options outlined in this document will feel very familiar to many people reading this guide and we want to acknowledge and recognise the community's role in shaping them so far. The passion, goodwill and knowledge which reside in the Coorong community are reflected in where we are now, looking forward and working together for a healthy future. "The unique ecology of the Coorong, with its international Ramsar reputation, is at serious risk of collapse.

Its restoration, based on sound science and with community support, must now be our priority."

Hon Dean Brown AO Coorong Partnership Chair



What is important to the community

Analysing and making decisions about the options

In making a decision about the options, it is useful to reflect on what is important to us about the Coorong.

It is useful to understand, as a community, the outcomes we want (and the outcomes we don't want) from the construction and operation of any new infrastructure.

Thinking about these things helps us to analyse the options and determine which one is best.

As a first stage in the engagement process for this project, a group of 20 interested community members came together on behalf of the broader South Australian community, to develop a list of things that they felt were important in determining the best option.

The community members determined that the most important, indeed essential outcome, is finding *the option/s that best contribute to improving the ecology of the South Lagoon as determined by scientific evidence, given water availability and constraints.*

In addition, the community members identified the following as being very important.

That the selected option/s:

- protect sites and areas of all cultural, Indigenous and broader community significance,
- provide a long-term solution that can be sustainably managed,
- reflect the needs of the community,
- grow / support local economic opportunities and education now and into the future,
- enable the continuation and enhancement of use of the wetland in a sustainable manner,
- are able to be adaptable, flexible and are aesthetically sensitive.

Analysing all the proposed infrastructure options against these outcomes in a robust and systematic way, will help to ensure that the final selected option will best meet our needs into the future.

It is important to note that initially we won't have all the information we would like to analyse whether the options can deliver on these outcomes. This guide summarises the information we have now and references more detailed reports. The process we are going through together over the next two years will help us get that information. To begin with we will have to use our best judgement and the information in this guide to help us work out the options that on balance are **most likely** to deliver these results and recommend that these options are analysed further as part of the Feasibility stage.

Once the Feasibility stage is completed, we will all be better placed to revisit these outcomes and analyse them again with more information.

State of the Coorong

The Coorong is a unique and complex ecological system that is widely regarded to be one of the most important waterbird wetlands in the Murray-Darling Basin. The wetland's significance is internationally recognised as part of the Coorong and Lakes Alexandrina and Albert Ramsar listed wetland, supporting endangered migratory birds from across the world, threatened wildlife and rare plants.

During the Millennium Drought the Coorong, Lower Lakes and Murray Mouth region was teetering on the verge of complete environmental collapse. While the majority of the site is slowly recovering well, the ecology of the Coorong South Lagoon in particular has remained in a degraded state.

In 2018, the Goyder Institute for Water Research Expert Panel reviewed the current condition of the Coorong South Lagoon and determined that the key ecological features that make this system unique and valuable are still in place, including the north-south salinity gradient, the large areas of mudflat habitat, and the species of plants, invertebrates, fish and birds. However, the concentration, abundance and distribution of many parameters and species have been dramatically altered.

The expert panel determined that the system is now in a vulnerable state, with little capacity to absorb continued and cumulative environmental stress.

The panel recommended that to restore the South Lagoon of the Coorong, management is required to sequentially:

- 1. Avoid the permanent loss of ecological values of the Coorong South Lagoon
- 2. **Restore** the ecological values of the Coorong South Lagoon
- 3. **Create** an ecosystem that maintains the ecological values under climate change.

In early 2020, DEW initiated a series of expert technical workshops to develop a **Desired State of the Southern Coorong discussion paper** to describe:

- the current state of the Coorong;
- the potential "do nothing" future state of the Coorong;
- the desired ecological state of the Coorong; and
- how we might reach the desired state.

The discussion paper provides a useful introduction and rationale for what long-term management options, like those introduced in this guide, might need to achieve.

It further reinforces that:

- 1. The Southern Coorong is a unique and complex ecological system, and requires complex management solutions.
- 2. The current state of the Southern Coorong is degraded, and if we do nothing, is at risk of no longer supporting some of the elements that make it a wetland of local, national, and international importance (its ecological character).

- 3. Waterbirds, fish, plants and invertebrates of the Southern Coorong have been affected by prolonged hyper-saline and hyper-eutrophic conditions.
- 4. The desired state for the Southern Coorong is a resilient and variable system, which provides habitat to support waterbird, fish, plants and invertebrate populations.
- 5. To reach the desired state, we need short-term and long-term strategies to manage salinity and nutrients to improve ecological function.



Options we are not able to consider

This process can only consider options that can demonstrate a potential benefit to the longterm health of the Coorong, with a focus on the South Lagoon.

The following options are therefore excluded:

- Opening barrages to allow sea water into the Lower Lakes In 1931, the then River Murray Commission [CWLTH, NSW, VIC, SA] decided, after extensive investigation, and in lieu of reducing upstream extractions, to construct 5 barrages to help manage lake levels and improve water quality in the lower Murray and Lower Lakes system. Under current arrangements there isn't enough freshwater coming down from the upper Basin to stop seawater naturally entering the lakes. South Australia and the Australian Government have a legal obligation to protect the freshwater environments of the site. The <u>MDBA's 2020 Lower Lakes Independent Science Review</u> concluded:
 - The main body of the Lower Lakes was largely fresh prior to European settlement. This is informed by palaeoecological records, water balance estimates, hydrological and hydrodynamic modelling, and traditional knowledge of the Ngarrindjeri People and anecdotal evidence of early explorers and colonists.
 - Without the barrages, the freshwater values in the Lower Lakes cannot be maintained.
 - A change in freshwater values will significantly change the ecological character of the Ramsarlisted site, which is a wetland of international importance and which we have an international obligation to maintain.
 - This will also impact traditional owner values and other socio-economic values that are reliant on a healthy Coorong, Lower Lakes and Murray Mouth system.
- 2. Lock Zero A weir at Pomanda Island was investigated during the Millennium Drought as an option for maintaining water levels between Wellington and Lock 1. The proposal was for a temporary structure and was designed for a nominal three year life span. An environmental impact assessment process was undertaken in the event that it was needed, but the weir was not pursued as water levels were reinstated before the criteria for its construction were met.

It is not possible to construct a permanent weir. The sediments are so soft and bedrock so deep that even a temporary weir at the site would continuously sink and would require regular reinstatement at significant cost. With a weir in place, a minimum through flow would be required to avoid major water quality issues upstream of the weir. It was found that the volume required would actually be sufficient to maintain suitable water levels in the Lower Lakes, removing any necessity for a weir (or for the introduction of seawater).

For more information on the response to the Millennium Drought, please visit the <u>DEW Website</u>. This investigation also cannot seek to access more water from the River Murray, however it can investigate options that improve the efficiency and effectiveness of existing water resources into, and within, the Coorong.

Options under consideration

The remainder of this guide introduces a range of management options to support the long-term health of the Coorong that have been previously investigated or proposed by the community more recently.

Each option includes information about the:

- general concept and rationale of the option
- potential environmental, social, cultural and economic benefits and impacts
- main knowledge gaps that require further investigation (if the option is progressed to the next stage of analysis)
- estimated cost these are very broad estimates that the feasibility/business case process will aim to
 provide more clarity on. They are included to give a sense of the scale of the investment associated
 with each option.

While many of these options have been previously considered on their own, some of them may be more effective if implemented in conjunction with one or more of the other options.

We have also included new options identified by the community through the early stages of consultation for this project. Where new options have been proposed, as much information as possible has been provided. However, due to the lack of detailed investigations, these options have significant knowledge gaps which should be considered in their evaluation.





Option 1A Increased dredged Murray Mouth dimensions

The Increased dredged Murray Mouth dimensions option involves using additional dredges to create a larger channel than the current dredged channel dimensions at the Murray Mouth. This will improve tidal movement into the Coorong, increasing the exchange of water between the Southern Ocean and Coorong, particularly the North Lagoon. It is thought that improving the exchange of flows (both in and out of the Coorong) via the Murray Mouth will improve the flushing of the Coorong and the management of water quality (particularly salinity) within the Coorong.

This option would further increase the dredging effort, possibly by using additional dredging equipment or a larger dredge than the two currently in operation.

Estimated cost

An investigation into this option undertaken in 2009 estimated that over a 30 year operational period, the estimated cost would be **\$36.9-\$73.6 million**.

0	Benefit	 This option may increase the connectivity and tidal exchange between the Coorong and Southern Ocean. This has been shown to have benefits for the ecology e.g. fish and macroinvertebrate populations) and ecological processes of the Coorong The above outcome will improve the numbers of commercially and recreationally fished species within the Coorong, particularly in the Coorong North Lagoon Greater connectivity of the Coorong and Southern Ocean ensures the connectivity of culturally significant waterbodies (the Coorong, Lower Lakes and Southern Ocean)
	Impacts	 Dredging can have negative impacts such as the removal of seagrass and to the water quality particularly in localised areas Likely increase in the build-up of sand in the Coorong which will require additional dredging to manage Increased greenhouse gas emissions from fossil fuels used in dredging operations Improved ecological health of the Coorong North Lagoon is likely, however the benefits are expected to diminish further south (towards the Coorong South Lagoon) Some increased local noise pollution from dredging
8	Knowledge gaps	 The impact of climate change and sea-level rise on Murray Mouth openness is not well understood and further investigation would be required to determine how this would impact the effectiveness of increased Murray Mouth dimensions (i.e. width and depth) Further investigation is required to determine whether this option will improve nutrient concentrations in the Coorong More targeted investigations are required to determine the level of benefit/impact of this option to the Coorong South Lagoon

Option 1B Training walls for an open Murray Mouth

The option to construct training walls at the Murray Mouth would involve the construction of groynes and/or sea walls each side of the Murray Mouth to intercept the coastal transport of sand and prevent it from blocking the mouth. Training walls are commonly used to prevent sand being transported into, and therefore constricting the entrances of, river mouths.

Previous evaluations of this option have indicated that the training walls are feasible to construct at the Murray Mouth and would be likely to successfully reduce the need for constant dredging. However, they would require a sand bypass system and potentially require some dredging when River Murray flows are insufficient.

Estimated cost

An investigation into this option undertaken in 2009 estimated that over a 30 year operational period, the estimated cost would be **\$61.5 million**.

0	Benefit	 Ensure tidal exchange/connectivity between the Coorong and the Southern Ocean - providing positive ecological benefits and assisting in the dilution of salt in the Coorong Increase the connectivity and tidal exchange between the Coorong and Southern Ocean Reduce the volume of dredging that is required to maintain an open Murray Mouth Improve numbers of commercially and recreationally fished species within the Coorong, particularly the Coorong North Lagoon Ensure the connectivity of culturally significant waterbodies (the Coorong, Lower Lakes and Southern Ocean)
•	Impacts	 Training walls will disrupt the transport of sand along the coast. This will require a bypass system to ensure sand does not build up on one side of the Mouth, with erosion on the other side Improved ecological health of the Coorong North Lagoon is likely, however the benefits are expected to diminish further south (towards the Coorong South Lagoon) Construction of a permanent structure at the Murray Mouth may impact the local amenity / visual appeal of the mouth
0	Knowledge gaps	 The impact of climate change and sea-level rise on Murray Mouth openness is not well understood and further investigation would be required to determine how this would impact the effectiveness of increased Murray Mouth dimensions Further investigation is required to determine whether increased permanent training walls on the Murray Mouth will improve nutrient concentrations in the Coorong Further investigation is required to determine the social impacts of a permanent structure at the Murray Mouth Potential cultural impacts of this option haven't been previously investigated



Conceptual drawing of dredging channel and Murray Mouth Training Walls (Tonkin, 2020)



Option 2 Coorong - Lake Albert Connector

This option includes installing a permanent channel and barrage or pipeline between Lake Albert and the Coorong.

The concept of a connecting pipe or channel between Lake Albert and the Coorong has been investigated a number of times since the 1980s to varying degrees. The reason for exploring this option is that it may provide improvements to water quality and water level management within the Coorong through a more direct flow path from the Lower Lakes/River Murray to the Coorong.

Options investigated over the past 15 years have included both channels and pipes to connect the Coorong to Lake Albert.

The Lake Albert Scoping Study undertaken in 2013 focussed on a long-term option for the exchange of water between Lake Albert and the Coorong, intended to increase flushing of Lake Albert rather than providing any benefit of more direct flows to the Coorong. The study determined that a 1.7km channel with a barrage to control the water was preferred over a pipeline due to construction cost, maintenance, and overall footprint.

Estimated cost

An investigation into this option undertaken in 2008 estimated the construction cost of a pumped solution to be \$21 million. In 2013 the estimate of constructing an open channel with a barrage for flow control was \$19 million.

0	Benefits	• Preliminary modelling suggests a Coorong – Lake Albert Connector may provide water quality benefits to the Coorong including the Coorong South Lagoon
	Impacts	 Localised impacts on ecological communities within the construction footprint, whether this is a pipe or channel, will occur There will be dredging/water quality impacts from construction. Some excavation/dredging of sediment in Lake Albert and the Coorong would be required Noise pollution from pumping (piped option) CO₂ emissions from diesel generators (piped option) Preferred channel alignment identified in the 2013 study passes through three properties with different land titles including Aboriginal Trust land Social/economic assessments, including aesthetics impacts, have not been undertaken for this option to date
0	Knowledge gaps	 The sensitivity of this option to a prolonged dry period (e.g. droughts) is unknown Further investigations are required into water quality impacts/benefits of this option to the Coorong South Lagoon Further investigation is required to determine the social impacts of this option Further Investigations are required to determine potential cultural impacts of this option



Coorong Conceptual drawing of Lake Albert – Coorong Connector locations (Tonkin, 2020)

Option 3 Coorong Lagoon dredging to improve connectivity

This option proposes dredging within the Coorong at various sites to improve the connectivity between the North and South Lagoons.

The Coorong Lagoons have multiple restricted areas that limit the movement of water between the two lagoons. Previous investigations for options to improve the connection between the North and South Lagoon have looked into the possibility of increasing water flow through channel excavation or dredging. Several locations have been identified as possible sites.

In 2010 a study was undertaken to determine how effective it would be to dredge 'Hell's Gate' between the Needles and Parnka Point. This option was only looked at in combination with temporary pumping to the Southern Ocean, which is discussed later in this guide (Option 6 Temporary pumping from the Coorong South Lagoon to the Southern Ocean) for the purposes of reducing salinity to acceptable levels.

Analysis undertaken for this option identified potential improvements to Coorong South Lagoon salinity concentrations and water levels. It also suggested a greater rate of refilling of the South Lagoon, if undertaken in combination with the temporary pumping option (Option 6). This option was not assessed on its own and further investigations would be required to determine whether this option alone would result in benefits for the Coorong, or if it is only beneficial in combination with other options (such as Option 6).

In addition to the Hell's Gate dredging option, locations within the North Lagoon and Coorong estuary have also been identified as possible dredging locations to improve tidal and wind-driven flows into the Coorong, and therefore improve the movement of seawater throughout the Coorong. These locations include around Bird Island and near Mark Point, Long Point, Dodd's Point and Rob's Point. Dredging these locations has not yet been assessed and further investigation will be required to determine the best dredging locations.

Estimated cost

An investigation into this option undertaken in 2010 estimated the cost of dredging between the Needles and Parnka Point to be \$7.12 million. Dredging additional locations within the North Lagoon has not yet been costed.

0	Benefit	• Removing constrictions within the Coorong may increase the exchange of flows between the Coorong Lagoon and assist in the management of salinity and water levels, particularly during Summer
0	Impacts	 Dredging can have negative impacts such as the removal of seagrass and water quality particularly in localised areas Increased turbidity can impact the health of aquatic species, reduce light penetration and smother aquatic plants Dredging within the Coorong will generate a significant amount of dredged material that will need to be disposed and potentially treated for Acid Sulphate Soils
0	Knowledge gaps	 Cultural assessments have not been undertaken for this option to date Additional modelling is required to determine the likely impacts to Coorong hydrology and environmental impacts from dredging within the Coorong lagoons

- Additional modelling is required to determine the long-term effectiveness of dredging in the Coorong
- Disposal options need to be developed to manage dredging spoil and potential acid sulfate soils
- Social/economic assessments have not been undertaken for this option to date
- Further Investigations are required to determine potential cultural impacts of this option



Conceptual drawing of dredging location for improved lagoon connectivity (Tonkin, 2020)



Option 4 Further augmentation of South East Flows to the Coorong (SEFA)

This option would seek to extend the catchment of the South East Flows Restoration Project (SEFRP) further south, to divert 'surplus' water currently flowing out to sea through Drain L in the South East into the Coorong South Lagoon.

By providing additional freshwater, South East Flows Augmentation (SEFA) would reduce salinity and nutrient levels in the Coorong South Lagoon.

The South East Flows Restoration Project (SEFRP), completed in 2019, involved the construction and upgrading of the South East Drainage Network to connect existing elements of the network (Blackford Drain) to the Coorong via the Morella Basin. This has increased the amount of water from the South East Drainage Network that can be delivered directly into the Coorong South Lagoon up to an average of 26.5 gigalitres per year (GL/year). Monitoring and modelling of current South East Flows to the Coorong have suggested that these flows can reduce salinity and nutrient levels in the South Lagoon, particularly around Salt Creek.

Investigations into this option undertaken in 2017 identified that connecting the Drain L catchment into the Blackford Drain could support the Robe Lakes, Lake Hawdon North, *en route* wetlands, and still increase the water to the Coorong South Lagoon by an additional 15.6 GL/year in a median year,

This concept does not affect the Drain M or Lake George catchment.

Previous investigations into augmenting the South East Flows Restoration Project with additional water from Drain L identified a number of matters as important to secure social licence and community support for the concept. This feedback, which would form the guiding principles and pre-conditions for any further investigations, included:

- Ensuring the Robe Lakes system and Lake Hawdon North received their environmental water requirements before any water was diverted.
- Ensuring water could be returned to *en-route* wetlands, such as the West Avenue Watercourse.
- Ensuring water is only diverted when it is of a suitable quality.
- Ensuring that any deepening of drains be assessed as part of the design process and mitigation strategies developed.
- Ensuring appropriate structures are in place to manage pest fish (Gambusia).

The South East Aboriginal Focus Group (SAEFG) and the Ngarrindjeri Regional Authority (NRA) have both provided in-principle endorsement of the SEFA concept in the past, as it aims to restore natural flow paths and support the ecological health of the Coorong South Lagoon.

Extensive community, landholder and First Nations consultation would be required if this concept were to be identified for further investigation.

In addition, further investigation into South East Flows Augmentation would need to ensure that this concept was consistent with the <u>South East Drainage and Wetland Strategy 2019</u>.

Estimated cost

An investigation into this option undertaken in 2017 estimated the cost of undertaking the additional augmentation of the South East Drainage Network to be **\$40.1 million**.

0	Benefit	 An increase in flows into the Coorong South Lagoon would cause a drop in the salinity of the Coorong, particularly in the South Lagoon Increased flows of fresher water are possible through a number of en-route wetlands (outside the South Lagoon), in particular the Taratap Watercourse and Tilley Swamp Watercourse Ability to better manage water within Lake Hawdon and the Robe Lakes which will have environmental benefits (e.g. for aquatic plants) With the inclusion of the West Avenue connector, significant environmental benefits could be achieved through additional water delivery to the West Avenue watercourse Positive social and cultural impacts include the restoration of some environmental flows which the Coorong historically enjoyed potentially providing a positive result for the South East aboriginal community
•	Impacts	 Low risk of pest fish migration into parts of the South East drainage network Diversion of flows from Wilmot Drain and Avenue Flat K Drain into and the Blackford Drain would require regulating structures and small sections of new drain Impacts on native vegetation through construction of new floodways and infrastructure Impacts associated with construction through private and public land Ongoing annual operational costs
0	Knowledge gaps	 Extensive community and landholder consultation would be required Further investigations into potential cultural heritage considerations is required. Further understanding of the positive and negative ecological responses of the Coorong to additional freshwater flows, including effects on water quality are required Further investigations into the impact to South East water availability under a range of climate change scenarios is required



Conceptual drawing of dredging location for improved lagoon connectivity (Tonkin, 2020)

Option 5 Coorong South Lagoon regulator

The construction of a potential water regulating structure within the southern lagoon of the Coorong aims to maintain water levels in the South Lagoon throughout spring and summer at a level sufficient to enable Ruppia to reproduce by flowering and setting seed.

The abundance of *Ruppia tuberosa*, a key aquatic plant species within the Coorong, has been in decline since the 1980s, likely a result of changes in salinity and water level. Ruppia is a key-stone species for the Coorong, providing habitat and a food source for multiple aquatic animals, including some migratory waterbird species.



This option was investigated in detail in 2017 with multiple temporary, semi- permanent and permanent solutions explored. A gated regulating structure was the preferred option as it was likely to be the most successful at maintaining spring water levels without impacting water levels during autumn. Modelling for this option concluded this option would likely result in water maintained at a higher level than without a structure through spring and summer, with some increase in salinity. Modelling of ecological responses to this option were mixed and would require additional investigation.

Estimated cost

An investigation into this option undertaken in 2017 estimated the cost of undertaking construction of a regulating structure to be **\$15.7** - **\$34 million** depending on the construction method used (e.g. concrete or plastipile structure

0	Benefit	• Modelling indicated that this option would assist in maintaining water levels in the South Lagoon over spring/summer, which is a critical period for Ruppia reproduction
•	Impacts	 Some increases in salinity are expected, which could have other negative ecological effects
Ó	Knowledge	Previous modelling of ecological responses to this option produced
¢,	gaps	inconclusive results. Further investigation is required to determine ecological benefits/impacts from this option
		 No specific social or cultural benefits have been identified in the work completed to date
		• Social/economic assessments have not been undertaken for this option to date
		Cultural assessments have not been undertaken for this option to date



Conceptual drawing of possible locations for South Lagoon regulating structures (Tonkin, 2020)

Option 6 Temporary pumping from the Coorong South Lagoon to the Southern Ocean (salinity reset)

This option proposes to temporarily pump poor quality water from the Southern Lagoon directly to the Southern Ocean, to help reset the condition of the Coorong.

In 2010, the Coorong South Lagoon Pumping Project looked at the possibility of reducing salinity in the Coorong South Lagoon by pumping the hyper-marine (i.e. saltier than sea water) water in the South Lagoon direct to the Southern Ocean via a temporary pipe through the coastal dunes. The scheme was intended to 'reset' salinity in the South Lagoon through export of salt and drawing in lower salinity water from the south east drainage schemes, through the Murray Mouth and from the River Murray (through the barrages).

At the time, a solution was proposed that would temporarily pump 250ML/day of Coorong South Lagoon water to the Southern Ocean for 2 - 4 years, which was the maximum expected timeframe in order to reduce salinity levels in the Coorong to acceptable levels.

The recommended dune crossing location in this study was located approximately 3 km west of Policeman Point, just south of Princes Soak. This locality provides a short dune crossing and close access to suitable water depth within the Coorong, thus providing a relatively short pipeline length of 1.3 km.

The pumping would also require a pumping station and at the time of investigation a diesel pump was recommended. However, new options including a siphon system or wave pump/wave energy system have also been suggested and would require further investigation.

As discussed previously, this option was also considered in combination with Option 3 Coorong Lagoon dredging to improve connectivity. At the time of its investigation, this option was in response to the Millennium Drought, which ended in late 2010. With the return of River Murray flows, this option was not progressed.

Estimated cost

An investigation into this option undertaken in 2009 estimated the cost of undertaking temporary pumping from the Coorong to the Southern Ocean over 4 years to be **\$20 - \$33 million.** This estimate included the initial construction costs (**\$15 - \$18 million**) as well as ongoing operation and maintenance including fuel costs for pump operation (**\$5 - \$15 million**).

0	Benefit	 Modelling has suggested that with this option the salinity levels in the South Lagoon may reach target levels within 2-4 years of operation Reducing salinity levels to within acceptable levels will significantly improve the ecological health of the Coorong
•	Impacts	 Potential noise pollution for nearby landowners CO₂ emissions (if diesel pumps used) Vegetation clearance will be required Temporary solution may not address long term drivers of the current state of the Coorong

6 0	Knowledge gaps	• The longevity of benefits/impacts from this option need to be investigated further
	5.	 Benefits/impacts to nutrient concentrations in the Coorong from this option need further investigation A small risk of acid sulfate soil exposure in some locations requires further assessment
		 Social/economic assessments have not been undertaken for this option to date Cultural assessments have not been undertaken for this option to date but there is the potential for disturbance of culturally sensitive sites. Further consultation is required to ensure preferred construction location removes or reduces the chances of disturbance Alternative options to power the pumping process (e.g. siphon system, wind, solar, wave pump) should be investigated to reduce noise and CO₂ emissions



Option 7 Permanent connection between the Coorong South Lagoon and Southern Ocean

This option involves a permanent connecting pipe or channel between the Coorong South Lagoon and the Southern Ocean to either import marine water into the Coorong or to export flows of hyper marine water out of the Coorong (similar to Option 6).

There are a lot of similarities between this option and Option 6 (above). This option is effectively permanent rather than temporary, with the possibility to also pump water into the Coorong.

Previous investigations have indicated both pumping seawater in and pumping Coorong water out, would result in a decrease in Coorong South Lagoon salinity. Pumping seawater in may result in higher salinity water in the Coorong South Lagoon being pushed into the North Lagoon. However this option was less intensely investigated than the pumping out option. Like Option 6, this option previously appeared to work best when combined with Option 3 (Coorong Lagoon dredging to improve connectivity).

Estimated cost

An investigation into this option undertaken in 2009 estimated the cost of constructing a permanent connection between the Coorong and the Southern Ocean at **\$10 - \$16 million** depending on the direction of flow (i.e. pumping into or out of the Coorong). Yearly operational costs were estimated to be **\$0.75 - \$3.6 million**.

It should be noted that the variance in estimated cost between Option 6 and Option 7 is due to Option 7 not progressing to the same level of design as Option 6.

0	Benefit	 Modelling has suggested that with this option, both pumping into and out of the South Lagoon, salinity levels in the South Lagoon will decrease Reducing salinity levels to within acceptable levels will significantly improve the ecological health of the Coorong
0	Impacts	 Potential noise pollution for nearby landowners CO₂ emissions (if diesel pumps used) Vegetation clearance may be required
0	Knowledge gaps	 A small risk of acid sulfate soil exposure in some locations was previously identified and would require further assessment Social/economic assessments have not been undertaken for this option to date Cultural assessments have not been undertaken for this option to date Potential for disturbance of culturally sensitive sites. Further consultation required to ensure preferred construction location removes or minimises chances of disturbance Alternative options to power the pumping process (e.g. siphon system, wind, solar, wave pump) should be investigated to reduce noise and CO₂ emissions



Conceptual drawing of possible location of a connecting pipeline between the Southern Ocean and Coorong (Tonkin, 2020)



Option 8 Additional automated barrage gates (Community submitted)

This option involves the automation of an additional 20 barrage gates on Tauwitchere Barrage as well as 3 automated gates on Goolwa Barrage.

The Lower Lakes barrages separate the freshwater lakes Alexandrina and Albert from the Coorong estuary. Water is released from the barrages into the Coorong estuary for multiple reasons including maintaining an open Murray Mouth, providing ecological cues for fish migration and for supporting the Coorong ecosystem (e.g. managing Coorong salinity). Significant investment has been made to improve the efficiency of the barrages since their construction in the early half of the twentieth century. This includes the automation of barrage gates to improve ease of operation and the ability to adapt barrage operations to changing weather and tidal conditions. Manually operated gates require on-site equipment and staff to operate. Automated gates can be opened and closed remotely and quickly, which allows for targeted releases of freshwater into the Coorong during favourable conditions (e.g. low tide and favourable wind directions) to help manage salinity concentrations. Further investment at the Lower Lakes barrages to increase the number of automated gates has the potential to improve water delivery into the Coorong. Presently automation consists of 1 gate at Goolwa, 6 at Mundoo, 12 at Ewe Island and 21 at Tauwitchere barrage.

Estimated cost

Cost estimations have not been undertaken for this option.

0	Benefit	 Automated barrages currently can be used to release flows into the Coorong during favourable conditions. Additional automated barrage gates will possibly increase the volumes that can be released during favourable conditions Advice has been provided by professional fishermen that fish populations and condition of the fish have improved by changing (improving) water quality along the North Lagoon Automation increases flexibility for SA Water operational staff and DEW Water Delivery staff to make decisions on how to make optimised releases into the Coorong for a range of benefits including water quality and scouring at the Murray Mouth. Without automation operations are largely constrained to 5 days per week between 08:00 and 16:00, which is a significant constraint to achieving environmental outcomes
0	Impacts	Impacts of this option on the Coorong South Lagoon have not been assessed.
8	Knowledge gaps	 Some preliminary investigations have shown that automated barrages have improved salinity management in the Coorong, however these improvements have been predominantly in the North Lagoon. Further investigation is required to determine the level of impact on the ecological health of the South Lagoon Additional investigations are required to determine the likely benefit/impact of this option to Coorong nutrient concentrations Additional modelling is required to determine the optimal amount of additional automated barrage gates on Tauwitchere



Option 9 Temporary wetting/drying cycling of South Lagoon (Community submitted)

This option submitted by a member of the community involves the temporary isolation of the Coorong South Lagoon and complete drying of the lagoon prior to reintroducing flows to reset the ecology of the system.

This option is based on examples of other wetlands where cycling between wetting and drying such as Lake Cantara just South of the Coorong occurs.

The Proponent for this option believes that by cycling between a wetting and drying phase, it may be possible to mimic natural processes to remove excess nutrients and salts from the system, while allowing chemical interactions and aerobic conditions within the lagoon to improve submerged sediments. The proponent believes this may have been a natural process that occurred during dry periods before the modification of River Murray flows and dredging of the Murray Mouth.

This option has not been investigated previously for the Coorong and would require investigation to determine whether it is feasible to be undertaken, what the likely impact would be on the ecology of the Coorong, as well as the likely social, cultural and economic impacts.

No engineering concept has been developed for this option to date, however the proponent has suggested using a temporary bund/regulating structure to separate the South Lagoon. They have also suggested that this option may work best in combination with another option, or a value-add, such as with Option 6 - pumping Coorong water out of the South Lagoon and also suggest restricting flows from the South East Drainage Network to the Coorong to speed up the rate of drying.

Estimated cost

Cost estimations have not been undertaken for this option.

0	Benefit	•	Wetting and drying cycles in other wetlands has in some cases resulted in improved ecological health (e.g. improve aquatic plant and macroinvertebrate production)
0	Impacts	•	Impacts of this option on the Coorong South Lagoon have not been assessed.
00	Knowledge gaps	•	An assessment of the ecological response to this option would be required to determine any potential benefits/impacts

- Social/economic assessments have not been undertaken for this option
- Cultural assessments have not been undertaken for this option
- Conceptual designs for this option are required to determine whether this option is feasible to construct

Option 10 Water level induced flow from the Southern Ocean water into Coorong (Community submitted)

This option submitted by a member of the community involves the construction of an enclosure that will force seawater from the Southern Ocean through a pipe into the Coorong. The proponent for this option believes it will support the management of salinity within the Coorong as well as support maintaining an open Murray Mouth by increasing the amount of water flowing from the Coorong through the Murray Mouth.

The proponent has also proposed the use of hydroelectricity generation devices to power a desalination plant to further improve the quality of the seawater entering the Coorong. The proponent believes this water could also possibly be pumped to the Lower Lakes.

The preferred location for construction of this option is on the Young Husband Peninsula in the Coorong North Lagoon.

Previous investigations into this option have concluded that in principle, it may be feasible to use



Conceptual design submitted by proponent

wave energy to drive water from the Southern Ocean into the Coorong. However, further investigation is required to determine the scale required for this option to deliver sufficient water to the Coorong and in particular the South Lagoon

No construction feasibility, impact assessments (environmental, social, cultural or economic) or cost estimation has been undertaken to date.

Λ	Benefit	٠	Providing flows to the Coorong from the Southern Ocean may assist in the
U			management of salinity in the Coorong
	Impacts	٠	Impacts of this option on the Coorong South Lagoon have not been assessed.
	-		
-			
Ø	Knowledge	٠	An assessment of the ecological response to this option would be required to
¢.	gaps		determine any potential benefits/impacts
		٠	Social/economic assessments have not been undertaken for this option
		٠	Cultural assessments have not been undertaken for this option

- Conceptual designs for this option are required to determine whether this option is feasible to construct
- Constructability in an extreme marine environment needs to be considered

- Sand management/ sand bypass systems need to be considered
- No cost estimations have been undertaken for this option
- No assessment of the ongoing maintenance and operation requirements has been undertaken



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