

PROPOSED ADELAIDE DESALINATION PLANT



EIS – Chapter 2 Need for Proposed Desalination Plant



Government of
South Australia



SA Water

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Contents

2.1	Introduction	1
2.2	Project Objectives	2
2.2.1	Overall Project Objectives	2
2.2.2	Environmental Objectives and Performance Criteria	3
2.3	Expected Benefits and Costs of ADP	5
2.3.1	Projected Need and Demand for Water	5
2.3.2	Benefits of the Project	6
2.3.2.1	State	6
2.3.2.2	Regional	6
2.3.2.3	Local	7
2.3.3	Costs of the Project	7
2.3.3.1	Financial Costs	7
2.4	Environmental, Economic and Social Considerations	8
2.4.1	Environmental Considerations	8
2.4.2	Economic Considerations	8
2.4.3	Social Considerations	9
2.4.4	Consideration of Options	9
2.4.4.1	Alternative Water Sources	9
2.4.4.2	Alternative Desalination Processes	10
2.4.4.3	Alternative Sites for the Desalination Plant	10
2.4.4.4	Alternative Disposal Option for Saline Concentrate	11
2.4.4.5	Expansion Capability	11
2.4.4.6	Consequences of Not Proceeding with the Proposal	12

2.1 Introduction

This Chapter provides an account of the factors leading to the decision to develop the proposed Desalination Plant. It discusses the key objectives of the ADP in the context of metropolitan Adelaide's water supply requirements and describes the anticipated local, regional and State benefits and costs anticipated to arise from the Desalination Plant. A summary of the environmental, social and economic issues associated with the proposed Desalination Plant is presented along with a consideration of the consequences of not proceeding with the proposal.

In providing the key rationale supporting the Desalination Plant, this Chapter addresses:

- The capacity of South Australia's water resources to cater for the projected increase in demand for water into the future alongside the rationale for desalination as a climate-independent source of water for metropolitan Adelaide;
- Alternative desalination processes and the decision to deploy reverse osmosis technology as opposed to thermal processes for the proposed Desalination Plant; and
- The reasons for the selection of Port Stanvac as the proposed site for the Desalination Plant.

In addition to attracting and retaining economic investment, the proposed Desalination Plant will create a positive impact on the State's economy through a range direct and indirect employment and investment opportunities. These effects are also considered in this Chapter.

2.2 Project Objectives

The security of Adelaide’s water supply is a matter of critical importance for the South Australian Government, the broader metropolitan community and SA Water. A number of significant initiatives are in place to manage existing water resources, deliver alternative water supply options and reduce demand on Adelaide’s water supply.

South Australia’s *Water Proofing Adelaide Strategy* aims to increase the reliability of Adelaide’s water supply and reduce our reliance on traditional water resources, while allowing the State to grow and develop.

The *Four-Way Strategy*, developed by the South Australian Government, aims to secure metropolitan Adelaide’s water supply for the future. This strategy involves the following measures:

1. **Managing water use:** Reducing the overall demand for water through initiatives such as the \$24 million rebates package, water efficiency plans for industry, irrigation of public open space and permanent water conservation measures;
2. **Recycling:** Investing in a range of projects to increase the amount of treated wastewater and stormwater used for purposes such as irrigation, watering of parks and gardens and flushing of toilets;
3. **Catchments:** Improving the health and efficiency of rivers and water catchments, including the River Murray. Work is also under way to investigate additional storage capacity in the Mount Lofty Ranges to better manage water in the face of variable inflows due to drought and climate change; and
4. **Desalination:** Ensuring there is a climate-independent water source included in the suite of projects to manage the State’s water supply into the future. This includes incorporating desalination of seawater as part of metropolitan Adelaide’s water supply.

Accordingly, the primary objective of the proposed Desalination Plant is to secure and diversify the sources of Adelaide’s water supply by delivering a climate-independent supply of water.

2.2.1 Overall Project Objectives

The overall objectives of the proposed Desalination Plant are as follows:

Adelaide Desalination Project Objectives	
South Australia’s Strategic Plan and SA Water’s Strategic Plan	To achieve South Australia’s Strategic Plan targets which are included within SA Water’s strategic objectives particularly in respect to sustainability, obligations to the owner (the State), customers, water quality and security. SA Water will also require the achievement of the highest standards of safety compliance with the aim of zero harm.
Water Availability Date and Quality	To produce safe desalinated drinking water by December 2010 within specified quality and quantity specifications.

Adelaide Desalination Project Objectives	
Customer Confidence	To improve water security in the medium and long term. To enhance SA Water's ability to meet and secure its customers' needs and expectations.
Environmental Performance	To ensure that any potential adverse environmental impacts of the proposed Desalination Plant are avoided, mitigated and / or minimised.
Optimum Risk Transfer	To enable an optimum allocation of risks between SA Water and the private sector, providing SA Water with an optimised value for money outcome.
Expandability of the Plant	To accommodate possible capacity upgrades of the Desalination Plant in a cost effective manner.
Technological improvements	To provide an asset that has the flexibility to accommodate innovation and technological improvements in the future, sharing the benefits with SA Water's customers.
Knowledge Transfer	To ensure a high level of effective knowledge transfer to SA Water in all aspects of the ADP, including the operations phase.
Cost Optimisation	To deliver a cost efficient outcome for SA Water over the life of the ADP.
Operating Performance	To maximise operational efficiencies of the new asset through the achievement of key performance indicators.

2.2.2 Environmental Objectives and Performance Criteria

SA Water has adopted a number of key environmental objectives and performance criteria in the preparation of the Concept Design for the proposed Desalination Plant. As indicated in Chapter 1, these objectives and performance criteria have been used to examine the technical feasibility of the Desalination Plant and, most importantly, to support the environmental integrity of the Desalination Plant to ensure that any impacts are avoided, minimised or managed to reduce environment harm.

The environmental objectives specifically developed for this Desalination Plant address a wide range of issues aimed at protecting the terrestrial and marine environments in and around the proposed site of the development at Port Stanvac. These include:

- **Terrestrial Environment:**

The Terrestrial Environment Objectives seek to:

- Protect biodiversity values at the site and avoid (or minimise) impacts to native vegetation and fauna;
- Minimise energy use and greenhouse gas emissions throughout the design, construction and operation;
- Protect the coastal cliff zone;
- Protect sites of Aboriginal heritage significance, avoid impacts and manage interactions with known and unknown heritage sites;

- Protect historic places and sites from disturbance where impacts can be avoided and manage interactions with known and unknown heritage sites;
- Protect the quantity and quality of groundwater consistent with relevant State water policies;
- Minimise erosion and sediment movement;
- Ensure stormwater management is incorporated into the construction and operation of the Desalination Plant;
- Minimise waste production and manage wastes consistent with relevant State waste policies and guidelines;
- Protect local amenity and minimise noise during construction and operation, including noise impacts to the marine environment;
- Maximise efficient use of resources, including minimising resource use and maximising recovery and recycling;
- Protect visual amenity, including landscape and amenity values of the coastline;
- Protect air quality during construction and operation;
- Manage effects of increased traffic and transportation during construction and operation to minimise impacts to the community and protect public safety;
- Protect human health and the environment through management of any contamination;
- Protect waterways and surface water quality;
- Manage the site to enhance site environmental values;
- Manage and maintain communication with the local community; and
- Restore and rehabilitate disturbed areas including incorporating opportunities for enhancing site environmental values.

- **Marine Environment:**

The Marine Environmental Objectives seek to:

- Avoid introduction and spread of marine pests;
- Minimise impacts to marine recreational activities;
- Protect the ecological integrity and values of the marine environment;
- Protect existing coastal processes;
- Protect marine mammals; and
- Protect marine flora and fauna and associated habitats.

A detailed and comprehensive list of the environmental objectives as well as the performance criteria guiding the development of the design of the Desalination Plant are presented in Chapter 3.

The selected Contractor will be required to achieve these performance objectives in developing the final design of the proposed Desalination Plant.

2.3 Expected Benefits and Costs of ADP

2.3.1 Projected Need and Demand for Water

Historically, metropolitan Adelaide's water supply has been considered as one of the most secure in Australia by drawing on two major water sources; the Mount Lofty Ranges and the River Murray. Both sources depend on rainfall.

On average, 40% (out of an approximate 200 GL per annum) of Adelaide's water supply is met from the River Murray. This supply is variable and climate dependent. In a drought year, for instance, up to 90% of Adelaide's water is sourced from the River Murray.

In recent years, climate change and severe drought have resulted in both reduced flows and greater variability of flows to the reservoirs of metropolitan Adelaide and have reduced the capacity of the water system to adequately supply metropolitan Adelaide's water needs. Over the past seven years, inflows into the Mount Lofty Ranges catchment and the Murray-Darling Basin have declined dramatically. Based on analysis of the best information currently available, inflows into the Mount Lofty Ranges catchment are expected to decrease by an average of 30 GL per annum. This decrease in water supply amounts to approximately 15% of metropolitan Adelaide's water consumption.

When this situation is considered alongside the expected effects of climate change over the next 25 to 50 years, it is highly likely that Adelaide will experience further reduced flows and greater variability of flows to reservoirs in the Mount Lofty Ranges, as well as into the Murray-Darling Basin.

Given this context, the Desalination Working Group (DWG) was established in March 2007 by the State Government to investigate the feasibility of a Desalination Plant for Adelaide. At the end of this investigation in November 2007, the DWG recommended that a Desalination Plant be built in Adelaide to increase the security of metropolitan Adelaide's water supply system.

In December 2007, the South Australian Government announced a package of water security commitments which included the proposed Desalination Plant, as well as:

- Continued support for the *Water Proofing Adelaide Strategy* to meet increases in demand;
- Exploring the doubling in size of storage in the Mount Lofty Ranges to better manage water given the effects of climate variability; and
- Construction of an inter-connection pipeline from Adelaide's northern to southern water supply networks to balance water security across the metropolitan area.

These projects represent a comprehensive water security package that will ensure all residents of metropolitan Adelaide continue to have good quality water services and water security into the future. A range of measures is also being proposed for supplies outside of the metropolitan area.

The proposed Desalination Plant will diversify metropolitan Adelaide's water resources by creating an additional source of water that is climate independent, thereby reducing the metropolitan area's reliance on rainfall. It is anticipated that the proposed Desalination Plant would be operational by December 2010 and increase to full capacity by June 2011.

The additional security offered by the proposed Desalination Plant in enhancing the supply of drinking water to metropolitan Adelaide is of major significance, particularly with regard to the key population objective articulated in South Australia's Strategic Plan (see Chapter 5) to increase the State's population to 2 million people by 2050. According to the latest data provided by Planning SA, and verified by the work of Professor Graeme Hugo (2007), the 2 million population objective is likely to be reached by the early 2030s (or possibly earlier if current high population growth continues).

2.3.2 Benefits of the Project

The primary benefit of the proposed Desalination Plant is that it will assist in securing the supply of drinking water to the metropolitan population well into the future. As indicated above, Adelaide's water supply system is currently under stress owing to the combined effects of climate change and ongoing drought. Since desalination represents the *only* climate independent water supply option, the proposed Desalination Plant offers considerable benefits in facilitating the ongoing development of metropolitan Adelaide and the State in line with South Australia's Strategic Plan objectives (see Chapter 5).

In addition, the proposed development presents a number of State, regional and local benefits as follows:

2.3.2.1 State

At the level of the State, the likely benefits of the proposed Desalination Plant include:

- Provision of a climate-independent water source that will supplement Adelaide's water supply and reduce the reliance on rainfall;
- Reduction in the State's reliance on the River Murray and other traditional water resources, particularly during periods of severe drought;
- Enabling greater flexibility in water management through diversification of metropolitan Adelaide's water sources;
- Enhancing confidence within the South Australian community to both retain and increase investment in housing and business development; and
- Encouraging investors outside the State to invest in the South Australian economy.

2.3.2.2 Regional

Within the regional context, the major benefits of the proposed Desalination Plant include:

- The provision of a secure water supply for residents and industry within the Adelaide metropolitan area which will assist in maintaining living standards and the amenity of the urban area;
- Primary and secondary employment opportunities during the construction and operation of the proposed Desalination Plant;
- Further impetus to industrial investment and growth across the southern suburbs and metropolitan Adelaide more generally; and
- Less reliance on the Mount Lofty Ranges catchment as a source of water.

2.3.2.3 Local

At the local level, the construction and operation of the proposed Desalination Plant will provide:

- Employment opportunities for the local community, including within the construction, retail and hospitality trades;
- Opportunities to rehabilitate degraded areas to provide a more natural environment for flora and fauna while enhancing the environmental values of the local area;
- Opportunities to provide educational and interpretive facilities highlighting the local area's recreational and cultural assets while providing additional employment opportunities;
- Further impetus to industrial investment and development within the City of Onkaparinga; and
- Ongoing opportunities for local community involvement in the operation of the proposed development.

2.3.3 Costs of the Project

2.3.3.1 Financial Costs

In relation to the financial costs of the Desalination Plant, SA Water has determined the financial and commercial impacts of the proposed development, as well as its broader economic impacts on the South Australian Government and the State (see Chapter 10). These costs have been calculated based on:

- The Concept Design, including technical drawings and reports;
- Quantity survey of the Concept Design to prepare a cost estimate for the proposed Desalination Plant;
- Allocation of costs over a construction curve; and
- Estimation of energy costs for construction and operation, project development costs, ETSA Utilities electricity infrastructure costs, and land acquisition costs.

The capital investment for the Adelaide Desalination Project is estimated to be \$1,374 million (in Nominal dollars or dollars at completion and subject to final costing) for a 50 GL per annum plant with capability to expand up to 100 GL per annum capacity in the future. The Cost Estimate of \$1,374 million (in Nominal dollars and subject to final costing) is for First Water delivery by December 2010. The final cost of the ADP is subject to a competitive tender process and will not be known until the contracts are signed in 2009.

The cost of the proposed development will result in increases in water prices to customers. In December 2007, the Government announced that a new water pricing structure would be introduced. In addition, the new structure includes a new, third tier targeting residential customers who use in excess of 520 kilolitres per annum. The new pricing structure is designed both to raise sufficient revenue to meet the costs of the water security initiatives discussed above and also to provide an incentive for residential customers to minimise their discretionary use of water.

2.4 Environmental, Economic and Social Considerations

As discussed above, the ongoing impact of the severe drought, possible implications associated with climate change and Adelaide's limited water storage capacity has led the South Australian Government and SA Water to seek additional supplies of water for the metropolitan community. It is essential that a reliable source of drinking water supply be secured to ensure the environmental, economic and social sustainability of South Australia. Growing urbanisation and the projected increase in population will place further pressure on South Australia's water resources.

2.4.1 Environmental Considerations

The desalination of water has been practised since ancient times (Tsiourtis 2001), and is being used increasingly across the world to secure additional fresh water. Investment in desalination plants as a solution to water supply problems has been used in more than 120 countries to produce drinking water (IDA Report No. 16, cited in Tsiourtis 2001). In Australia, large-scale plants have been constructed, are under construction, or are proposed in Queensland, New South Wales, Victoria and Western Australia.

There are a number of important environmental considerations for a desalination plant, including the need to manage saline concentrate to minimise impacts on marine ecosystems and greenhouse gas emissions related to the energy consumption. These issues are discussed in detail in Chapters 6 and 7.

The proposed Desalination Plant will contribute to the environmental sustainability of the South Australia, and reduce reliance on the River Murray. Desalination of seawater is used extensively throughout the world and, on the basis of the extensive investigations undertaken as part of this EIS, it is anticipated that the proposed Desalination Plant can be constructed and operated without any unacceptable environmental impacts.

The environmental management measures proposed as part of the development of the Desalination Plant are discussed in Chapters 3, 4 and 8.

2.4.2 Economic Considerations

Most of South Australia's industries are reliant on a secure water supply. Hence, it is vital that South Australia has reliable supply of fresh water resources to attract and retain investment. Desalination provides a climate-independent secure water source that will help protect the South Australia's productive capacity.

In addition to attracting and retaining economic investment, the proposed Desalination Plant will create a positive impact on South Australia's economy through employment opportunities. The proposal will create direct and indirect employment opportunities associated with the design, construction, operation and maintenance of the Desalination Plant. A wide range of skills will be required during the construction and operation of the Desalination Plant, including manual, administrative, technical and specialist skills. Indirect employment opportunities will also be created in the local economy in retail and hospitality industries. Chapter 10 details the employment and investment impacts of the proposed development.

The impact of the capital expenditure and direct job creation will have a positive effect on the economy, and results in a net benefit to the South Australian GSP. SA Water's Advisers, KPMG, undertook economic modelling (including Structured Time Series and Computable General Equilibrium models) and identified that the South Australian GSP is expected to increase by more than \$2.8 billion (or 0.4% of GSP) to 2017 as a result of the ADP.

2.4.3 Social Considerations

The proposed Desalination Plant will relieve pressure on South Australia's water resources, in particular the River Murray and the Mount Lofty Ranges catchment. Both of these resources provide the South Australian community with social opportunities through a range of recreational and tourism pursuits. There are also a significant number of regional and rural townships and communities within these catchment areas that have developed and continue to rely on the health of the River Murray or the Mount Lofty Ranges.

Chapter 10 presents the results of the social impact assessment undertaken as part of this EIS.

2.4.4 Consideration of Options

2.4.4.1 Alternative Water Sources

Through the Government's water security strategy a range of initiatives to ensure reliable water supplies for the future are being progressed. The *Water Proofing Adelaide Strategy* identified the key sources of additional supply as recycled wastewater, stormwater, the purchase of water licences from the River Murray and desalination.

South Australia is already a national leader in the recycling of treated wastewater, expansion of existing schemes and the introduction of new schemes will further increase the amount of water recycling.

A number of stormwater initiatives are currently being implemented across metropolitan Adelaide, many of which are supported or driven by State and local governments that will further enhance the utilisation of stormwater. SA Water will continue to actively support and implement these measures.

However, unlike seawater that is always present, stormwater is a highly variable source of water in terms of both volume and quality as it remains reliant on rainfall and is therefore a climate dependent water source. The proposed Desalination Plant is therefore essential to secure Adelaide's water supply over the long-term, primarily due to it being the only climate independent water source.

The purchase of additional water extraction licences for the River Murray would increase SA Water's share of the total water available in South Australia (and water could also be held in interstate allocations). However, this approach does not provide the same degree of security as climate-independent desalination plants.

Natural intakes into the Mount Lofty Ranges represent a lower cost water supply option. A project to increase storage capacity in the Mount Lofty Ranges is in its planning stages to assist in managing flow variability as a further insurance policy for dry years. However, this project is also reliant on sufficient available flow in the River Murray.

The DWG recommended a balance between the proposed Desalination Plant capacity and additional storage, noting a more immediate benefit to the South Australian community of a 50 GL per annum Desalination Plant, with infrastructure for future capacity of up to 100 GL of drinking water per annum.

2.4.4.2 Alternative Desalination Processes

The DWG engaged a consultant to determine the most feasible and optimal technology for a large-scale seawater desalination plant in South Australia.

While a large number of the plants constructed in the Middle East use thermal processes, all major seawater desalination plants in Australia, either currently under construction or proposed, use reverse osmosis (RO) technology. According to the DWG's report, thermal plants use a significantly greater amount of energy per unit of water produced than RO, which is the most energy and cost efficient technology currently available.

In summary, RO was considered to be the preferred technology for the proposed development mainly because of the lower energy requirements than thermal processes, and therefore lower greenhouse gas emissions.

A detailed description of the RO process is provided in Chapter 3.

2.4.4.3 Alternative Sites for the Desalination Plant

A number of possible locations for the proposed Desalination Plant were considered. These sites stretched along the Adelaide coast of the Gulf St Vincent as well as a location on the South Coast.

The investigations assessed locations based on broad environmental and evaluation criteria including:

- Proximity to coastline, site size and elevation;
- Current land use and zoning;
- Offshore marine environment and dispersion properties and the potential impact of constructing the intake and outfall pipelines and structures;
- Environmental issues at the plant site such as site vegetation, known presence of threatened plant and animal species;
- Social considerations, such as proximity to residential areas, potential amenity impacts and cultural heritage issues (both Aboriginal and European);
- Availability of electricity supply infrastructure; and
- Ease of integration with existing water infrastructure.

A multi-criteria analysis (MCA) process identified three locations for further assessment. These included:

- Port Stanvac;
- West Beach (near Adelaide Airport); and
- Pelican Point (near the existing power station).

United Water was subsequently engaged to estimate the cost of constructing a seawater desalination plant at the three preferred sites. The preferred locations required further analysis to determine the issues associated with each site. Based on information supplied by ETSA, it was established that there was sufficient capacity within the network to support a desalination plant at any of the three locations, although some network upgrades would be required.

The siting investigations also identified that seawater depth significantly decreases north of Port Stanvac along the Gulf St Vincent, which has ramifications for marine dispersion characteristics. A nominal water depth of at least 10 metres was identified as preferred for the dispersion of seawater concentrate. This depth is only achieved further off-shore at sites north of Port Stanvac requiring significantly longer seawater intake and outfall conduits. The sensitivity of marine habitats and water quality considerations were also identified as an additional constraint for the sites further north of Port Stanvac, due to their proximity to seagrass meadows and sensitive marine nursery areas.

Following further assessment of the three locations, Port Stanvac was selected as the preferred site for the proposed Desalination Plant based on the relatively deep seawater, superior marine dispersion characteristics, ease of integration to the water supply network, suitable land use zoning and lower life-cycle costs than the other sites investigated. The Port Stanvac site has other desirable features including secure coastal location, its ease of access by sea and by road and the likelihood of minimal disturbance to beach and marine users.

[2.4.4.4 Alternative Disposal Option for Saline Concentrate](#)

The Desalination Working Group considered alternative options of disposing the saline concentrate from the proposed Desalination Plant as an input for a salt processing facility. This option would require the transfer of the saline concentrate to evaporation basins. The area required for the evaporation basins, for a typically 50 GL per annum capacity plant was estimated to be approximately 6,400 hectares assuming a net evaporation rate of 950 millimetres per annum. This area is around eight times larger than the salt pans at Dry Creek. Accordingly, a significant area of land would be required for this purpose. For this reason, this was not considered to be a feasible disposal option.

[2.4.4.5 Expansion Capability](#)

In order to cater for anticipated population growth and likely climate change impacts, the proposed Desalination Plant has been designed with infrastructure capable of producing up to 100 GL of drinking water per annum with minimal disruption. The future capacity of 100 GL of drinking water has also been considered as part of the performance specification requirements and in the preparation of this EIS.

The following infrastructure components will be designed and constructed for the 100 GL per annum capacity:

- Seawater intake and outfall systems (including seawater conduits and structures);
- Power supply infrastructure;
- Transfer pipeline system;
- Drainage and wastewater system; and

- Layout provision for additional buildings, seawater pumps and outfall conduit energy recovery device.

The scale and staging of the proposed Desalination Plant has been developed based on the assessed water supply needs for metropolitan Adelaide, allowing for greater water demands in the future.

2.4.4.6 Consequences of Not Proceeding with the Proposal

The environmental, economic and social sustainability of South Australia is heavily dependent on Adelaide's continued secure supply of water. Consequently, the increasingly unreliable nature of Adelaide's existing water resources potentially threatens the viability of the South Australian economy, its environment and the social health of the community.

If a Desalination Plant is not built, South Australia would be forced to continue to draw substantial volumes of water from the River Murray and pump that water to Adelaide's reservoirs for metropolitan supply.

Given the ongoing drought in the Murray Darling Basin, the severe effect this has had on storage levels and the likely length of time required for storages to recover, Adelaide cannot continue to rely solely on the River Murray to supplement Adelaide's water supply system in periods of drought.

A critical aspect of any urban water supply system is to have a contingency plan that guarantees that the system can never 'run out of water' even in the most extreme drought. Critical urban needs should always be maintained.

While the River Murray will continue to make an important contribution to Adelaide's water supply, it is essential that South Australia reduces its reliance on this source at least to the extent that it can manage during extreme drought when water available from the River may be limited.

In the future it is likely that changing climatic conditions will result in less reservoir inflows and increased climatic variability. In the long-term it is likely that the frequency and duration of water restrictions may increase if the proposed Desalination Plant was not built.

The proposed Desalination Plant is therefore considered an essential investment into the environmental, economic and social sustainability of South Australia.