

REPORT TO THE SITE SELECTION COMMITTEE FOR THE EP DESALINATION PLANT

INDEPENDENT MARINE SCIENCE REVIEW PANEL

The Independent Marine Science Review Panel (Panel) met for the fourth time on Thursday 29 September 2022. The main agenda items for the meeting were:

- Review of the Ecotoxicity Report
- Review of the Habitat Mapping Report
- Consideration of industry feedback to the Site Selection Committee

Role and Membership of the Panel

The role of each panel member is to provide independent technical feedback and advice to ensure the objectives of the environmental assessment process are achieved.

The membership of the Panel is as follows:

- Dr Don Plowman – former Deputy Chief Executive of Primary Industries and Regions and Director of Research, SA Research and Development Institute.
- Dr Ian Wallis – Environmental engineer with extensive experience with desalination plant site selection and operations.
- Dr John Luick – Oceanography and Modelling, formerly with SARDI and currently a consultant
- Professor Sean Connell – Environmental Scientist and Marine Ecologist, University of Adelaide
- Dr Anu Kumar – Environmental toxicologist and environmental risk assessment, CSIRO
- Dr Alistair Hobday – Spatial management and migration of pelagic species and marine environmental impacts, Research Director, CSIRO
- Dr Hazel Vandeleur – Senior Environmental Impact Assessment Officer, SA Water
- Ms Nancy Nguyen – Executive Officer TSA

All Panel members were present at the fourth meeting.

It should be noted that the Panel represents a broad base of experience and technical expertise in areas of direct relevance to advising on the location and operation of a desalination plant. The advice provided to the Site Selection Committee is based on both reviewing documents available to the Panel and the experience and capability of each Panel member.

Boston Bay Marine Habitat Video Analysis

This report was prepared by J Diversity Pty. Ltd (“JDP”). An earlier draft had been reviewed by the Panel and the preliminary results incorporated into the presentation to the Site Selection Committee meeting held on the 2nd of August 2022. Version 2 of report has been updated to include the video analysis for Point Boston.

The report contains summary information from previous works undertaken by various parties (including the EPA, University of Adelaide) over several decades within the Boston, Proper and Louth Bays areas. The report also details new habitat mapping based on drop-camera video taken by SA Water and analysed by JDP. The Panel also received review comments on the document and advice from the EPA in terms of how the results compared to survey work they had undertaken.

While the MSRP agreed that the report provided excellent scientific data and baseline on the current habitats found within the survey area, feedback to JDP was provided by the MSRP in relation to the report structure in order that the document be easier understood by a wider audience.

The advice from the Panel has not changed appreciably from that provided in August. The SAW Environmental Performance Criteria require minimisation of impacts upon marine flora, fauna, and habitats during all stages of development. The Habitat Mapping Report should be included within decision making around the location of the intake and outfall pipelines if a site is selected at Billy Lights Point or Point Boston.

Until SAW have a project site and a construction methodology, the Panel have no oversight for how much of a footprint and consequent impact on the marine environment is likely.

Any removal (or impact on) of seagrass will have require calculation and inclusion within a Native Vegetation Clearance Application (under the Native Vegetation Act 1991) submitted separately from and discussed within the Development Application. Key to the Native Vegetation Clearance application will be the requirement to demonstrate the mitigation hierarchy.

The Panel was of the view that once the document has been updated in accordance to the comments provided, the report will provide a good baseline against which a monitoring program can be developed. Further to this, the Panel consider that substantial benefits would accrue from a closer collaboration between all interested parties within the Bays in working together in scoping the monitoring program once the site is selected and plant is operational.

Desalination Ecotoxicity Data Review

The draft report was provided by Hydrobiology Services Pty Ltd (HSP) and summarised available data on the potential impact of the return of brine to the marine environment, with discussion also detailing the potential impact of chemicals used in descaling, membrane management and related plant operations. The authors drew heavily on monitoring of operations of pilot and full-scale desalination plants at Adelaide, Olympic

Dam, Sydney, Melbourne, Gold Coast and Perth. Panel members also have substantial experience in the operation of desalination plants referred to in the review.

The Ecotoxicity Review concluded that most potential impacts from desalination plants relate to the salinity of the brine discharge itself (rather than chemicals that may be present). The report presented analysis in some detail of the potential impacts of brine discharge from the outfall and concluded the proposed dilution of 40:1 sufficient to ensure no negligible impact on marine species but that additional testing of the impacts of salinity on additional key species is recommended.

In relation to the potential impacts from the chemicals used for antiscaling and membrane cleaning, the finding of the Ecotoxicity Review was that there would be no appreciable negative impact on the marine environment from these substances provided that dilution ratios calculated for each chemical tested previously are met and that appropriate management procedures are followed. This was based on the small amounts of chemical used and the low toxicity of the chemicals once they had been neutralised before discharge. This advice was supported by Panel members with experience in management of plants similar to the proposed plant and the body of information in the published literature.

The MSRP Panel is aware of other work that relates to this topic, including the validation data and preliminary results of the SARDI hydrodynamic model, the seasonal water quality data collected by SAW and the SAW design criteria for the diffusers and near-field salinity impacts. The Panel is of the view that this information as well as a summary of the substantial scientific information on the levels of brine that can cause adverse effects on marine species should be included within the report.

Feedback from the panel has been provided to HSP with the following guidance:

Report needs to include multiple lines of evidence including:

- Salinity tolerance of species including links to habitats recorded within the project area
- Post-construction monitoring results from previous plants
- Background salinity context from ADCP and water column profiling salinity data

Recommendations should include:

- Suggested extension of the mussel larval test from 48hr to 2-week chronic test
- Discussion needs to circle back to the lines of evidence and explain better why the 40:1 dilution is appropriate

The MSRP agreed that once the document has been updated to include and the recommendations and comments from the Panel, the document provides good information and rationale to the adequacy of the 40:1 dilution specified as a key design criterion for the EP desalination plant.

Preliminary results provided within the SARDI oceanographic modelling report (provided at the August 2022 Site Selection Committee meeting) show the far-field salinity levels within

the ANZECC limits. It is important to note that the preliminary assessment assumed all brine was expelled from one port (i.e. a single grid cell) in the bottom layer of the model. It is therefore a worst-case scenario as it is expected that a multi-port diffuser will be used in practice to discharge brine.

A further observation from the SARDI modelling was that the natural seasonal variation in salinity within the bays was greater than the variation in salinity due to brine release and dispersion from the plant.

Feedback on reports provided by Industry

The following tables contains a list of submissions the Panel has received from industry and reports provided by SA Water on reviews commissioned.

Reports from industry	Date
<i>An Independent Expert Assessment of the Viability of the Planned Port Lincoln Desalination Plant</i> by Prof. Jochen Kaempf	01-Aug-21
<i>Biological and Physical Effects of Brine Discharge from the Carlsbad Desalination Plant and Implications for Future Desalination Plant Constructions</i> by Petersen et al	25-Jan-19
<i>Desal plant at Billy Lights Point doesn't stack up:</i> letter from globally respected marine biologist.	Undated
<i>Hyper-Saline Conditions Affect Growth, Osmoregulation and Survival of Fingerling and Juvenile Yellowtail Kingfish, <i>Seriola lalandi</i></i> by Stone et al	20-Nov-14
<i>Impact of the brine from a desalination plant on a shallow seagrass (<i>Posidonia oceanica</i>) meadow</i> by Gacia et al	16-Jan-07
<i>Physical Modelling of Desalination Discharges Impacting an Inclined Boundary</i> By Elizabeth North	15-Feb-22
<i>Potential impacts of a desalination plant at Port Lincoln with particular reference to mussel farming</i> by Dr Paul McShane	01-Sep-21
<i>Risks to blue mussel aquaculture and supporting ecosystems from the proposed desalinisation facility at Billy Lights Point in Boston Bay</i> by Paul Rogers	30-Jul-21

Study Undertaken by SAW	Status	Date
<i>Oceanographic monitoring and modelling to inform desalination plant development in Boston Bay</i> by Mark Doubell and Charles James	Milestone report 1-3 received. Final report is pending	Oct-22
<i>Boston Bay Habitats Video Analysis (Rev 2)</i> by J Diversity	Draft	Sep-22
<i>Desalination Ecotoxicity Data Review</i> by Hydrobiology Ltd	Draft	Aug-22

Study Undertaken by SAW	Status	Date
<i>Memo Response re nutrients and salinity modelling by Hazel Vandeleur</i>	Final	Jul-22
<i>A review of the salinity and temperature tolerances of various life history stages of key taxa of aquaculture and recreational significance in Boston Bay and Proper Bay, South Australia</i> by Maylene G K Loo and Sasi Nayar	Superseded, to be incorporated in the final Ecotoxicology report	Jun 22
<i>Preliminary Results: Far-field Modelling of Brine Discharges</i> by Mark Doubell and Charles James	Final	Jun-22
<i>Baseline Assessment of Fish Diversity and Abundance at the Proposed Boston Bay Desalination Site (May 2022)</i> by Thomas Clarke & Charlie Huveneers	Final	May-22
<i>Results addendum to: Mapping change in seagrass cover overtime (1991, 2008 and 2015): Boston and Louth Bays, South Australia Addition of 2021 mapping and comparison to previous years</i> by Molly Ellis Hennekam, and Kenneth Clarke	Final	Nov-21
<i>Sleaford Desalination Plant Underwater Noise Assessment</i> by Adam Cook	Final	Nov-20

The key industry concerns have been extracted from submissions and summarised below. For each of the issues raised the Panel has provided commentary. In several cases, a final response requires the SARDI hydrodynamic model report and the near-field diffuser modelling information. Both of which are pending.

Item	Topic of concerns from the industry	From Report (by authors)	Relevant SAW report	Notes
1	Salinity levels and flushing time	Kaempf, Rogers, McShane	1. Oceanographic monitoring and modelling to inform desalination plant development in Boston Bay by Mark Doubell and Charles James 2. A review of the salinity and temperature tolerances of various life history stages of key taxa of aquaculture and recreational significance in Boston Bay and Proper Bay, South Australia by Maylene G K Loo and Sasi Nayar	Final SARDI report required. However, ANZECC guidelines recommend salinity increase of less than 1 PSU be maintained in the environment around the discharge. Preliminary SARDI modelling indicates that the 1 PSU limit is met and seasonal variations due to natural processes are larger than the far-field effects of the brine discharge. Preliminary modelling indicates the salinity in the plume in the near field should be reduced to the 1 PSU level within 50 m of the diffuser. The Panel is of the view that the SARDI hydrodynamic model is equivalent to the models used in the papers referred to the Panel. Some matters in the papers involve environmental conditions different to those at Pt Lincoln or at other desalination plants operating in Australia.

Item	Topic of concerns from the industry	From Report (by authors)	Relevant SAW report	Notes
2	Mussel spat entrainment	Kaempf, Rogers, McShane	1. Oceanographic monitoring and modelling to inform desalination plant development in Boston Bay by Mark Doubell and Charles James (Particle tracking modelling section will be relevant) 2. Boston Bay Habitats Video Analysis (Rev 2) by J Diversity	There are opportunities to locate the intake away from reefs and avoid spat production areas. The volume of water taken in is small compared with the volume of water moving through the bay. The amount of spat entrained would be very small in comparison to the natural loss of spat. A key operational aspect is to minimise the entrapment and entrainment of biological material into the intake of the plant. This will include ensuring that the seawater intake velocity at the entry to the intake structure does not exceed 0.15 m/s at any time (which will allow small fish to swim away), raising the intake off the seabed and avoiding placing the intake on hard substrate or in seagrass areas.
3	Discharge contaminants	Rogers, McShane	1. Desalination Ecotoxicity Data Review by Dustin Hobbs	The Ecotoxicology review report concludes that discharge of antiscaling and membrane cleaning chemicals (as tested by SAW previously for their existing desalination plants) should not pose a risk to the marine environment provided that the chemicals are adequately neutralised and/or discharged in accordance to the dilution ratios established and agreed previously with the EPA.
4	Ecological impacts (near-field hydrodynamics, fish assemblages)	Rogers, McShane	1. Baseline Assessment of Fish Diversity and Abundance at the Proposed Boston Bay Desalination Site (May 2022) by	The specified design criteria of 40:1 dilution by the time it reaches the seabed is appropriate for protection of the marine habitats within the proposed site/s. The discharge diffusers should be located in an area of sandy seabed or low seagrass prevalence

Item	Topic of concerns from the industry	From Report (by authors)	Relevant SAW report	Notes
			Thomas Clarke & Charlie Huveneers 2. Near-field hydrodynamic modelling report by WSP 3. Desalination Ecotoxicity Data Review by Dustin Hobbs	
5	Classification status of mussel farming threatened	McShane	1. Oceanographic monitoring and modelling to inform desalination plant development in Boston Bay by Mark Doubell and Charles James (Particle tracking modelling section will be relevant)	Technical information does not support this.
6	Dissolved Oxygen	Rogers	1. Near field diffuser modelling (once design completed) 2. Oceanographic monitoring and modelling to inform desalination plant development in Boston Bay by Mark Doubell and Charles James Operational monitoring program (which will validate the predictions of both the near-field and far-field modelling)	Adequate dispersal of the saline discharge will ensure no change in dissolved oxygen levels either at the seabed or within the water column

Item	Topic of concerns from the industry	From Report (by authors)	Relevant SAW report	Notes
7	Climate change compounding effect	Rogers, McShane	1. Boston Bay Habitats Video Analysis (Rev 2) by J Diversity 2. Results addendum to: Mapping change in seagrass cover overtime (1991, 2008 and 2015): Boston and Louth Bays, South Australia Addition of 2021 mapping and comparison to previous years by Molly Ellis Hennekam, and Kenneth Clarke	The desalination plant will have a small impact relative to other activities impacting on the health of the marine environment. A collaborative approach to monitoring and responding to all externalities would be advised by the Panel.
8	Phytoplankton dynamics and its consequences	Rogers, McShane	1. Water quality report - SAW	The desalination plant does not add or remove nutrients as part of its processes.
9	Toxic phytoplankton	Rogers, McShane	1. Water quality report - SAW	SA Water is awaiting industry data on this matter (The MSRP understands that PIRSA in conjunction with the aquaculture industries collects harmful algal data). Harmful algal cysts are ubiquitous and relatively abundant in marine environments and when suitable conditions arise, an event may be triggered. Disturbance of sediments during the construction phase of the plant will not constitute a higher risk of cysts dispersing compared to natural processes. There is no evidence presented, or mechanism proposed, that the desalination plant will increase the frequency of blooms during construction or when operating.

A number of other issues raised by the Site Selection Committee were provided in previous reports to the Committee. For completeness these are included below:

Nutrient distribution

The SSC asked the Panel to advise on potential adverse impacts from nutrient discharge from the outlet structure.

The Panel advises that there will be no net increase in nutrients arising from the operation of the desalination plant.

Risk assessment

The SSC requested that the Panel consider the risks associated with each site.

A full risk assessment will be undertaken once a final site has been selected, a construction methodology has been specified and detailed design has progressed. Risks identified at the next stage of development would be managed in the usual way, by the identification of the risk, how to mitigate the risk and monitoring of the effectiveness of the mitigation.

Reports still to be Received

A key report that will inform on many of the issues raised is the Oceanographic modelling report (sometimes referred to as the 'Far-field' modelling). This report being undertaken by the SARDI Marine Group Preliminary data was detailed in a memo previously by SARDI to the MSRP and SSC. The final report includes details of the Boston and Proper Bay water movements (including 12 months of new data collection), 5yr dispersion modelling (far-field movement) of the brine discharge (validated by the new data) and particle tracking modelling (with a focus on predicted intake impacts on particles) This report is due for delivery by SARDI to SAW mid-October 2022.

A second key report required to assess the suitability of the proposed plant relates to the diffuser design and the dilution and movement of brine discharge in the near-field zone. Initial work in the site selection stages has indicated the 40:1 dilution criterion can be achieved at the short-listed site locations. The MSRP understand that the near-field modelling report will be developed during the detailed design stage and will form part of the Development Approval.