

**Review of water quality profile monitoring licence conditions for the
Adelaide Desalination Plant:
June 2014**

**Prepared for
AdelaideAqua Pty Ltd
Report number 6 in the series**

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EXECUTIVE SUMMARY

Purpose

This document represents a report on the extent to which monitoring of water quality from selected sites in the vicinity of Port Stanvac meets with the EPA Licence conditions for the construction and operation of the Adelaide Desalination Plant (ADP) over the period February 2009 to 12-Dec-2013. The monitoring reports were associated with the construction (including commissioning) of the desalination plant (by AdelaideAqua D&C Consortium – AAD&C) from February 2009 to 12-Dec-2012 and to the operation of the desalination plant (AdelaideAqua Pty Ltd) from 12-Dec-2012 to 12-Dec-2013.

Background

AdelaideAqua Pty Ltd is the operator of the Adelaide Desalination Plant at Port Stanvac South Australia. Operation of the ADP requires the discharge of reject water to the marine environment; this activity was originally conducted under a license issued to AAD&C by the Environment Protection Authority of South Australia (EPA License Number 26902) and subsequently under another license issued to AAPL (EPA License Number 39143). These licenses authorised AAD&C and AAPL to undertake a series of activities of environmental significance under Schedule 1 Part A of the Environment Protection Act 1993 (the Act). The licenses had specific requirements in relation to “Discharges to Marine Waters” that are the subject of this report.

Section 14 (305-626) of the license requires that the licensee must ensure that:

1. An independent review of all marine monitoring is conducted by independent specialist(s) as approved in writing by the EPA prior to the review commencing;
2. All marine monitoring from the period commencing with the issue of the license and ending 12 months after project handover of the 100 GL desalination plant is included in the review; and
3. The full results of the review are provided to the EPA not more than 18 months after project handover of the 100 GL desalination plant.

The EPA has also advised that prior to appointment, the independent reviewer must be able to demonstrate to the EPA that:

1. They will use their own professional judgment;
2. They will take appropriate specialised advice when the issue is outside their expertise;
3. Their opinions will be reached independently;
4. In forming opinions, they will not be unduly influenced by the views or actions of others who may have an interest in the outcome of the review; and
5. They must declare any real or apparent conflict of interest.

With the approval of the EPA, Anthony Cheshire (the author of this report) was selected by AdelaideAqua Pty Ltd (AAPL) to undertake this review.

Approach

This review of water quality profile monitoring encompassed a study of all documentation provided by AdelaideAqua Pty Ltd which comprised a series of 51 monitoring reports each of which was produced by staff at AAD&C, AAPL or by experts contracted by the parties for that purpose.

Each report has been critically reviewed and key issues that pertain to compliance with the licence conditions have been aggregated into a summary that has been presented in this report.

Specific requirements

To consider the work done against the Scheduled Marine Monitoring Requirements detailed in Attachment A to licenses 26902 and 39143. These being:

1-Dec-2010 through 31-Dec-2012: Water column profiling at 100 m, 500 m and 5000 m north and south of the diffuser location plus 3 reference sites to measure salinity (conductivity), dissolved oxygen (DO), pH, Chlorophyll a, turbidity and water temperature at water depths of 5, 10, 15, 20 and 25 metres. Monthly from the issue of the license.

The purpose of this monitoring program was to validate the diffuser performance against the design specifications.

General requirements

In addition the EPA require that the Independent Reviewer is to undertake a technical review of all marine monitoring results from the commencement date of the License 26902 (D&C) until 12 December 2013 (12 months after plant handover) in order to assess the environmental impact of the desalination plant. This matter will be addressed in a subsequent report.

Conclusion

The selection of sites, range of water quality parameters and the sampling intervals are all consistent with the requirements detailed in the EPA licenses; it is noted that due to logistic constraints, the August 2012 sampling, occurred in early September 2012. The analysis and interpretation of the data that has been provided across the various reports document both the natural and ADP induced variation in water quality both in the near vicinity of the discharge as well as at a more regional scale. The data show that natural variations in water quality respond to seasonal, tidal and general environmental (e.g. weather) processes. Furthermore, although there is evidence in the data of changes in water quality associated with the operation of the plant, the data as presented, suggest that this is limited to the immediate location of the ADP diffuser.

LICENCE CONDITION: WATER QUALITY PROFILE MONITORING

In the following the specific requirements pertaining to the licence condition (water quality profile) are summarised along with information about the documents that have been reviewed.

Documents reviewed for this licence condition:

Document Name	Reference
2009 08 WQCS .pdf	Kildea, T.N., (2009). Appendix A - Water Quality Data Summary, 8 th August, 2009. Australian Water Quality Centre, Adelaide.
2009 09 WQCS.pdf	Kildea, T.N., (2009). Appendix B: Water Quality Data Summary. Australian Water Quality Centre, Adelaide.
2009 11 WQCS.pdf	Kildea, T.N., (2009). Appendix C: Water Quality Data Summary. Australian Water Quality Centre, Adelaide.
2009 12 WQCS.pdf	Kildea, T.N., (2009). Appendix D: Water Quality Data Summary. Australian Water Quality Centre, Adelaide.
2010 01 WQCS.pdf	Kildea, T.N., (2010). Appendix E: Water Quality Data Summary. Australian Water Quality Centre, Adelaide.
2010 02 WQCS.pdf	Kildea, T.N., (2010). Appendix F: Water Quality Data Summary. Australian Water Quality Centre, Adelaide.
2010 03 WQCS.pdf	Kildea, T.N., (2010). Appendix G: Water Quality Data Summary. Australian Water Quality Centre, Adelaide.
2010 04 WQCS.pdf	Kildea, T.N., (2010). Appendix H: Water Quality Data Summary. Australian Water Quality Centre, Adelaide.
2010 05 WQCS.pdf	Kildea, T.N., (2010). Appendix I: Water Quality Data Summary. Australian Water Quality Centre, Adelaide.
2010 06 WQCS.pdf	Kildea, T.N., (2010). Appendix J: Water Quality Data Summary. Australian Water Quality Centre, Adelaide.
2010 07 WQCS.pdf	Kildea, T.N., (2010). Appendix K: Water Quality Data Summary. Australian Water Quality Centre, Adelaide.
2010 08 WQCS.pdf	Kildea, T.N., (2010). Appendix L: Water Quality Data Summary. Australian Water Quality Centre, Adelaide.
2010 09 WQCS.pdf	Kildea, T.N., (2010). Appendix M: Water Quality Data Summary. Australian Water Quality Centre, Adelaide.
2010 10 WQCS.pdf	Kildea, T.N., (2010). Appendix N: Water Quality Data Summary. Australian Water Quality Centre, Adelaide.
2010 11 WQCS.pdf	Kildea, T.N., (2010). Appendix O: Water Quality Data Summary. Australian Water Quality Centre, Adelaide.
2010 12 WQCS.pdf	Kildea, T.N., Andreacchio, L. and Eygenraam, M. (2010). . Australian Water Quality Centre, Adelaide.

Document Name	Reference
Water Quality Characterisation Report_August 2009_November 2010.pdf	Kildea, T.N. and Andreatchio, L. (2010). Adelaide Desalination Project: Water Quality Characterisation Study. Summary report August 2009 to November 2010.. Australian Water Quality Centre, Adelaide.
2011 01 WQCS.pdf	Kildea, T.N., (2011). Adelaide Desalination Project: Water Quality Characterisation Study, January 2011. Australian Water Quality Centre, Adelaide.
2011 02 WQCS.pdf	Kildea, T.N., (2011). Adelaide Desalination Project: Water Quality Characterisation Study, February 2011. Australian Water Quality Centre, Adelaide.
2011 03 WQCS.pdf	Kildea, T.N., (2011). Adelaide Desalination Project: Water Quality Characterisation Study, March 2011. Australian Water Quality Centre, Adelaide.
2011 04 WQCS.pdf	Kildea, T.N., (2011). Adelaide Desalination Project: Water Quality Characterisation Study, April 2011. Australian Water Quality Centre, Adelaide.
2011 05 WQCS.pdf	Kildea, T.N., (2011). Adelaide Desalination Project: Water Quality Characterisation Study, May 2011. Australian Water Quality Centre, Adelaide.
2011 06 WQCS.pdf	Kildea, T.N., (2011). Adelaide Desalination Project: Water Quality Characterisation Study, June 2011. Australian Water Quality Centre, Adelaide.
2011 07 WQCS.pdf	Kildea, T.N., (2011). Adelaide Desalination Project: Water Quality Characterisation Study, July 2011. Australian Water Quality Centre, Adelaide.
2011 08 WQCS.pdf	Kildea, T.N., (2011). Adelaide Desalination Project: Water Quality Characterisation Study, August 2011. Australian Water Quality Centre, Adelaide.
2011 09 WQCS.pdf	Kildea, T.N., (2011). Adelaide Desalination Project: Water Quality Characterisation Study, September 2011. Australian Water Quality Centre, Adelaide.
2011 10 WQCS.pdf	Kildea, T.N., (2012). Adelaide Desalination Project: Water Quality Characterisation Study, October 2011. Australian Water Quality Centre, Adelaide.
2011 11 WQCS.pdf	Kildea, T.N., (2012). Adelaide Desalination Project: Water Quality Characterisation Study, November 2011. Australian Water Quality Centre, Adelaide.
2011 12 WQCS.pdf	Kildea, T.N., (2012). Adelaide Desalination Project: Water Quality Characterisation Study, December 2011. Australian Water Quality Centre, Adelaide.
2012 01 WQCS.pdf	Kildea, T.N. and Andreatchio, L. (2012). Adelaide Desalination Project: Water Quality Characterisation Study, January 2012. Australian Water Quality Centre, Adelaide.
2012 02 WQCS.pdf	Kildea, T.N. and Andreatchio, L. (2012). Adelaide Desalination Project: Water Quality Characterisation Study, February 2012. Australian Water Quality Centre, Adelaide.
2012 03 WQCS.pdf	Kildea, T.N. and Andreatchio, L. (2012). Adelaide Desalination Project: Water Quality Characterisation Study, March 2012. Australian Water Quality Centre, Adelaide.

Document Name	Reference
2012 04 WQCS.pdf	Kildea, T.N. and Andreacchio, L. (2012). Adelaide Desalination Project: Water Quality Characterisation Study, April 2012. Australian Water Quality Centre, Adelaide.
2012 05 WQCS.pdf	Kildea, T.N. and Andreacchio, L. (2012). Adelaide Desalination Project: Water Quality Characterisation Study, May 2012. Australian Water Quality Centre, Adelaide.
2012 06 WQCS.pdf	Kildea, T.N. and Andreacchio, L. (2012). Adelaide Desalination Project: Water Quality Characterisation Study, June 2012. Australian Water Quality Centre, Adelaide.
2012 07 WQCS.pdf	Kildea, T.N. and Andreacchio, L. (2012). Adelaide Desalination Project: Water Quality Characterisation Study, July 2012. Australian Water Quality Centre, Adelaide.
2012 09 11 WQCS.pdf	Kildea, T.N. and Andreacchio, L. (2012). Adelaide Desalination Project: Water Quality Characterisation Study, September 2012. Australian Water Quality Centre, Adelaide.
2012 09 21 WQCS.pdf	Kildea, T.N. and Andreacchio, L. (2012). Adelaide Desalination Project: Water Quality Characterisation Study, September (Part B) 2012. Australian Water Quality Centre, Adelaide.
Water Quality Characterisation report_October 2012.pdf	Kildea, T.N. and Andreacchio, L. (2012). Adelaide Desalination Project: Water Quality Characterisation Study October 2012. Australian Water Quality Centre, Adelaide.
Water Quality Characterisation report_November 2012.pdf	Kildea, T.N. and Andreacchio, L. (2013). Adelaide Desalination Project: Water Quality Characterisation Study, November 2012. Australian Water Quality Centre, Adelaide.
Water Quality Characterisation report_December 2012.pdf	Kildea, T.N. and Andreacchio, L. (2013). Adelaide Desalination Project: Water Quality Characterisation Study, December 2012. Australian Water Quality Centre, Adelaide.
Water Quality Characterisation report_January 2013.pdf	Kildea, T.N. and Andreacchio, L. (2013). Adelaide Desalination Project: Water Quality Characterisation Study, January 2013. Australian Water Quality Centre, Adelaide.
Water Quality Characterisation report_February 2013.pdf	Kildea, T.N. and Andreacchio, L. (2013). Adelaide Desalination Project: Water Quality Characterisation Study, February 2013. Australian Water Quality Centre, Adelaide.
Water Quality Characterisation report_March 2013.pdf	Kildea, T.N. and Andreacchio, L. (2013). Adelaide Desalination Project: Water Quality Characterisation Study, March 2013. Australian Water Quality Centre, Adelaide.

Document Name	Reference
Water Quality Characterisation report_April 2013.pdf	Kildea, T.N. and Andreacchio, L. (2013). Adelaide Desalination Project: Water Quality Characterisation Study, April 2013. Australian Water Quality Centre, Adelaide.
Water Quality Characterisation report_May 2013.pdf	Kildea, T.N. and Andreacchio, L. (2013). Adelaide Desalination Project: Water Quality Characterisation Study, May 2013. Australian Water Quality Centre, Adelaide.
Water Quality Characterisation report_June 2013.pdf	Kildea, T.N. and Andreacchio, L. (2013). Adelaide Desalination Project: Water Quality Characterisation Study, June 2013. Australian Water Quality Centre, Adelaide.
Water Quality Characterisation report_July 2013.pdf	Kildea, T.N. and Andreacchio, L. (2013). Adelaide Desalination Project: Water Quality Characterisation Study, July 2013. Australian Water Quality Centre, Adelaide.
Water Quality Characterisation report_August 2013.pdf	Andreacchio, L. and Kildea, T. (2013). Adelaide Desalination Project: Water Quality Characterisation Study, August 2013. Australian Water Quality Centre, Adelaide.
Water Quality Characterisation report_September 2013.pdf	Andreacchio, L. and Kildea, T.N. (2013). Adelaide Desalination Project: Water Quality Characterisation Study, September 2013. Australian Water Quality Centre, Adelaide.
Water Quality Characterisation report_October 2013.pdf	Andreacchio, L. and Kildea, T.N. (2013). Adelaide Desalination Project: Water Quality Characterisation Study, October 2013. Australian Water Quality Centre, Adelaide.

Specific requirement (see Attachment A – Marine Monitoring Schedule):

1-Dec-2010 through 31-Dec-2012: Water column profiling at 100 m, 500 m and 5000 m north and south of the diffuser location plus 3 reference sites to measure salinity (conductivity), dissolved oxygen (DO), pH, Chlorophyll a, turbidity and water temperature at water depths of 5, 10, 15, 20 and 25 metres. Monthly from the issue of the license.

The purpose of this monitoring program was to validate the diffuser performance against the design specifications.

Overall summary in relation to water quality profile monitoring

The aim of the study was to characterise the water quality of the Port Stanvac region, by measuring a series of water quality parameters through the water column. These parameters comprised:

- Salinity (conductivity)
- Dissolved oxygen
- pH
- Chlorophyll a

- Turbidity
- Water temperature

Specific objectives for the monitoring program were:

1. To conduct monthly water column profiling 100 m, 500 m and 5 km north and south of the potential diffuser location for the Adelaide Desalination Plant, at depths 5 m, 10 m, 15 m, 20 m and 25 m;
2. To conduct monthly water column profiling of three offshore reference sites to determine natural changes in background concentrations in Gulf St Vincent. Reference sites are located 10 km offshore, adjacent to the Port Stanvac coastline.

Over the course of this monitoring program a comprehensive data set was compiled on water quality profiles (over depth) from a series of 6 transects that were placed 100 m, 500 m and 5,000 m to the north and south of the ADP diffuser (Figure 1). Along each of these transects data was collected monthly at a series of stations that run from near to the shore out to sea; sampling stations were placed at locations where the water depths were 5, 10, 15, 20 and in some cases 25 m (due to local bathymetry 25 m sites could not be situated on the two northern most transects). In addition 3 offshore reference stations (10 km from the coast) have been sampled (two at 30 m depth and the northern most at 25 m).

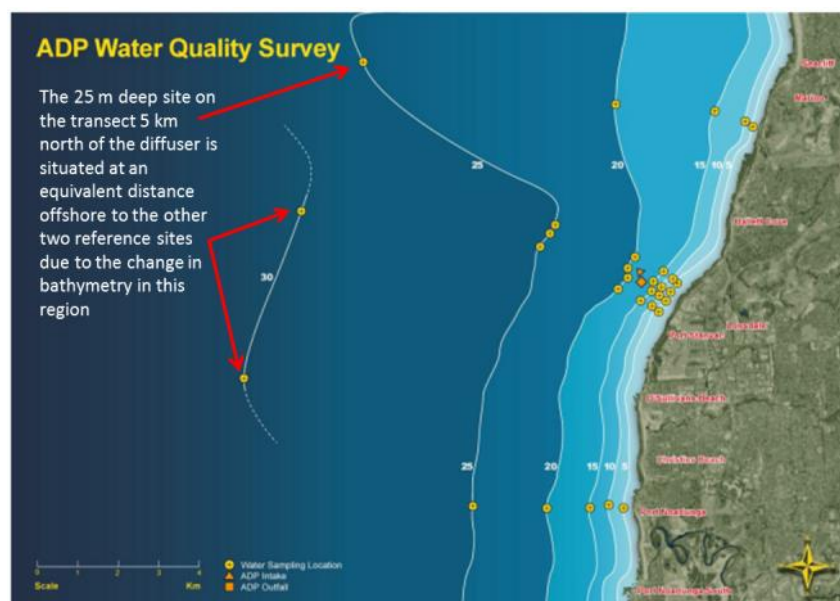


Figure 1 - Map showing locations of study sites (adapted from the various reports by Kildea et al.) Note that the 25 m depth contour deviates to the west heading offshore in the vicinity of the northern-most transect. The 25 m site is thus situated approximately 10 km off-shore and is taken as one of the reference sites for the study.

Water quality maps and in some cases vertical profile plots have been drawn up to illustrate changes in recorded values for temperature, oxygen, pH, TDS, chlorophyll a and conductivity at each station. In the later series of reports data have also been plotted to show the relationship between ambient salinity and the salinity recorded from selected stations 100 m from the ADP diffuser. The last 7 reports have extended this further to provide data on the

salinity at selected stations 100 m from the ADP diffuser, augmented with data on the daily rate of saline concentrate discharge on the days that monitoring was undertaken.

Collectively the data presented in this series of reports demonstrate that the monitoring was:

- consistent with the requirements detailed in the licence conditions and
- been appropriately analysed to allow an assessment of the spatial extent over which the reject water has an influence over key water quality parameters.

Appendix A KEY DATES IN PLANT CONSTRUCTION AND OPERATION

The following provides a list of key dates in the construction and operation of the plant. This material provides background to the review and in particular places the analysis and interpretation of each of the monitoring reports into context with the activities that were occurring on-site in the period leading up to the monitoring event.

Date	Activity
01-Feb-2009	Construction activities commenced
16-Nov-2009	Maritime platform arrived on site
08-Jul-2010	Maritime platform completed operations
01-Jun-2011	First discharge and first intake of seawater
14-Oct-2011	First Water – plant production was (30 MLD)
21-Mar-2012	SP1 – Full production from first half the plant (150 MLD)
31-May-2012	SP2 – Full production from second half of the plant (150 MLD)
24-Oct-2012	Performance test – plant running at full production for 7 days (150 MLD)
07-Nov-2012	Performance test – plant running at full production for 7 days (150 MLD)
21-Nov-2012	Reliability test – continuous running at various production rates
12-Dec-2012	Plant handover from commissioning