

**Review of diffuser performance validation (b) monitoring licence  
conditions for the Adelaide Desalination Plant:  
June 2014**

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## EXECUTIVE SUMMARY

### Purpose

This document represents a report on the extent to which monitoring of diffuser performance validation (b) 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 licence issued to AAD&C by the Environment Protection Authority of South Australia (EPA Licence Number 26902) and subsequently under another licence issued to AAPL (EPA Licence Number 39143). These licences 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 licences had specific requirements in relation to “Discharges to Marine Waters” that are the subject of this report.

Section 14 (305-626) of the licence 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 licence 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 diffuser performance validation (b) monitoring encompassed a study of all documentation provided by AdelaideAqua Pty Ltd which comprised a series of 4 monitoring reports each of which was produced by staff at AAD&C, AAPL or by experts contracted by the parties for that purpose and included a critique by the EPA of one interim report.

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 Licences 26902 and 39143. These being:

Licence 26902 & 39143: Hydrodynamic modelling based on salinity and current data collected during this monitoring program. To be completed within 12 months of “project handover of the 100 GL desalination plant”.

## 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 Licence 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

AAPL contracted Water Technology Pty Ltd to develop a hydrodynamic model utilizing the salinity and current data collected during the monitoring program. The initial purpose of the model was to inform the design of the diffuser array for the ADP and particularly to determine the extent to which the diffuser would achieve the required dilution of water in the immediate vicinity of the outfall and the extent to which any resultant saline plume would be transported and/or further mixed and diluted under a variety of tidal and flow conditions (particularly under ebb tide and low wind conditions).

The reports for this licence condition have evaluated the performance of the system and the utility of the model (in hindcast mode) under the various tidal and weather conditions.

## LICENCE CONDITION: DIFFUSER PERFORMANCE VALIDATION (B) MONITORING

In the following the specific requirements pertaining to the licence condition (diffuser performance validation (b)) are summarised along with information about the documents that have been reviewed.

Documents reviewed for this licence condition:

Document Name	Reference
Outfall Dilution Modelling Assessment 2009_Final.pdf	Womersley, T. et al., (2009). Adelaide Desalination Project Outfall Dilution Modelling Assessment. Water Technology Pty Ltd. Note: Document No: H332401-1000-05-124-0018
251201R01v03.pdf	Mills, R. and Womersley, T. (2012). Adelaide Desalination Plant Outfall Dilution Modelling Validation. Water Technology Pty Ltd.
EPA condition 21 letter.pdf	Gubbin, T., (2013). Adelaide Desalination Plant Outfall Modelling Validation Report Review. A letter to AAPL from the Operations Division, Environment Protection Authority.
251201R01v04.pdf	Mills, R. and Womersley, T. (2014). Adelaide Desalination Plant Outfall Dilution Modelling Validation. Water Technology Pty Ltd.

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

Licence 26902 & 39143: Hydrodynamic modelling based on salinity and current data collected during this monitoring program. To be completed within 12 months of “project handover of the 100 GL desalination plant”.

### Overall summary in relation to diffuser performance validation (b)

Water Technology Pty Ltd was contracted to develop and validate the final design of the outfall diffuser for the ADP; in part this required the development of a hydrodynamic model that utilized the salinity and current data collected during the monitoring program and this model was used to assess performance in respect of:

- Initial dilution of the saline concentrate discharge equivalent to 50:1; and
- Rapid dispersion of the saline concentrate into the surrounding sea water.

Subsequent reports were intended to validate the design by comparing a range of hydrodynamic and salinity measurements obtained from around the outfall (when operating at 100% capacity during a dodge tide) to a modelled hindcast of the hydrodynamic and desalination plant operating conditions over the same period. The validation complemented the studies reported under Licence Condition 20 which was essentially the same other than it undertook an evaluation of the plant operating at 10% capacity.

These studies evaluated a core element of the design of the outfall in that the process by which the saline enriched brine is discharged and mixed into the receiving water is critical to managing the environmental risk associated with the operation of the plant. The diffuser

array causes the waste water stream to rapidly mix with surrounding waters and thereby dilutes the waste stream such that the spatial scale of the mixing zone is kept to a minimum. The level of dilution achieved is a key performance measure and importantly needs to be in the order of 50:1 to ensure that any increases in salinity associated with the operation of the plant do not have a measureable effect on surrounding environments.

In an earlier phase of the work the EPA provided a critique of the modelling report (Gubbin 2013). This critique noted that there was a marked discrepancy between the modelled current flows in the vicinity of the diffuser when compared to the measured flows; importantly the critique noted that the hydrodynamic model under-represented the observed current velocities in the near vicinity of the diffuser. By and large the model failed to accurately estimate the velocities during a ebb tide event but more generally did not accurately reflect the amplitude of velocity changes across tidal cycles (although it did model the tidal frequency with a high degree of fidelity).

The inability of the model to operate in a hindcast mode would seem to be more a result of the fact that the model was starved of parameterization data from the local (Port Stanvac) region. The closure of the marine baseline monitoring station at Port Stanvac meant that the model needed to rely on a phase-shifted set of data on shelf waves and meteorological forcings from Thevanard (over 400 km away on the coast of the Great Australian Bight). Given this it would not be reasonable to expect the model to deliver a result which was consistent with the observed real-time outcomes.

While I agree therefore with the critique, I do not believe that this finding substantively impacts on the assessment of environmental effect: importantly, now that the ADP has been built and operated under a variety of weather and tidal conditions, there is a substantial quantity of empirical data on the rate of dilution of the waste stream. These data, comprise actual field measurements, and are therefore much more valuable than any model prediction and allow us to conclude (based on actual observations and measurements) that dilution is rapid and occurs over a spatial scale that will achieve the level of environmental protection that is being sought.

## 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.

<b>Date</b>	<b>Activity</b>
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