WATER CORPORATION

Southern Seawater Desalination Project

Operational Environmental Management Framework

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Reference

This document should be cited as:

Water Corporation (2008) *Southern Seawater Desalination Project Operation Environmental Management Plan Draft February 2008.*

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1.0 Overview

1.1 Project Outline

The Water Corporation is a public utility of the State Government of Western Australia responsible for public water supply in accordance with the *Water Corporation Act 1995* (WA) and associated legislation. The Water Corporation's Southern Seawater Desalination Project (SSDP) is considered critical infrastructure for public water supply to the Integrated Water Supply Scheme (IWSS) by the Government of Western Australia.

The Southern Seawater Desalination Project involves the construction and operation of:

- A reverse osmosis seawater desalination plant to produce Up to 100 GL/y, located at Lots 32 and 33 and Part Lot 8 on Taranto Road in the Shire of Harvey (approximately 140km south of Perth). The plant will include:
    - up to four submerged seawater intake pipelines extending up to 600m offshore;
    - a seawater pump station;
    - storage facilities for chemicals;
    - dual media filters (including backwash tanks) and drying beds;
    - a reverse osmosis building;
    - potabilisation and storage facilities for associated process chemicals;
    - drinking water storage tank(s) and pump station(s);
    - up to four seawater brine outlets with diffusers extending up to 1100m offshore; and
    - site amenity buildings for purposes including administration, plant operations control, laboratory, workshop and general storage.
- 100ML water storage facility (in up to 4 storage tanks) with up to 5ML sump located north-east of the town settlement in the Shire of Harvey.
- Approximately 30km of 1400mm diameter cement-lined steel pipeline to connect the plant to the storage facility, and the storage facility to the existing Stirling Trunk Main of the Integrated Water Supply System (IWSS).

The Southern Seawater Desalination Project will be developed in stages. The initial construction and operation for a plant with the production capacity of 50 GL/y and with one water storage tank up to 32 ML capacity. All terrestrial and marine pipelines will be constructed for 100 GL/y capacity at the initial stage of construction including all earthworks. The capacity of the plant and water storage facility will be increased as water supply demand increases.

A map identifying showing the location of the plant, and associated infrastructure is shown in **Figure 1.1**.

The Southern Seawater Desalination Project will produce drinking quality water from seawater abstracted via the inlet pipe. The desalination process allows for the recovery of approximately 42% of the volume of the seawater as drinking water with the remaining water being discharged as a waste brine solution. This brine will be approximately twice as saline as the feed water (i.e. seawater).

The intake pipelines will extend from the shore up to 600m offshore and the outlet pipelines up to 1100m offshore. The outlet pipe discharge system will include multi-port diffuser(s) which will facilitate mixing in the Low Ecological Protection Area (LEPA) surrounding the outlet diffuser(s) (see Figure 1.2). The multi-port outfall is designed to reduce the salinity increase to 1 ppt or less above ambient conditions at the boundary of the LEPA. The LEPA is surrounded by a High Ecological Protection Area (HEPA). LEPAs and HEPAs are defined in the State Environmental (Cockburn Sound) Policy 2005 (Government of Western Australia, 2005).

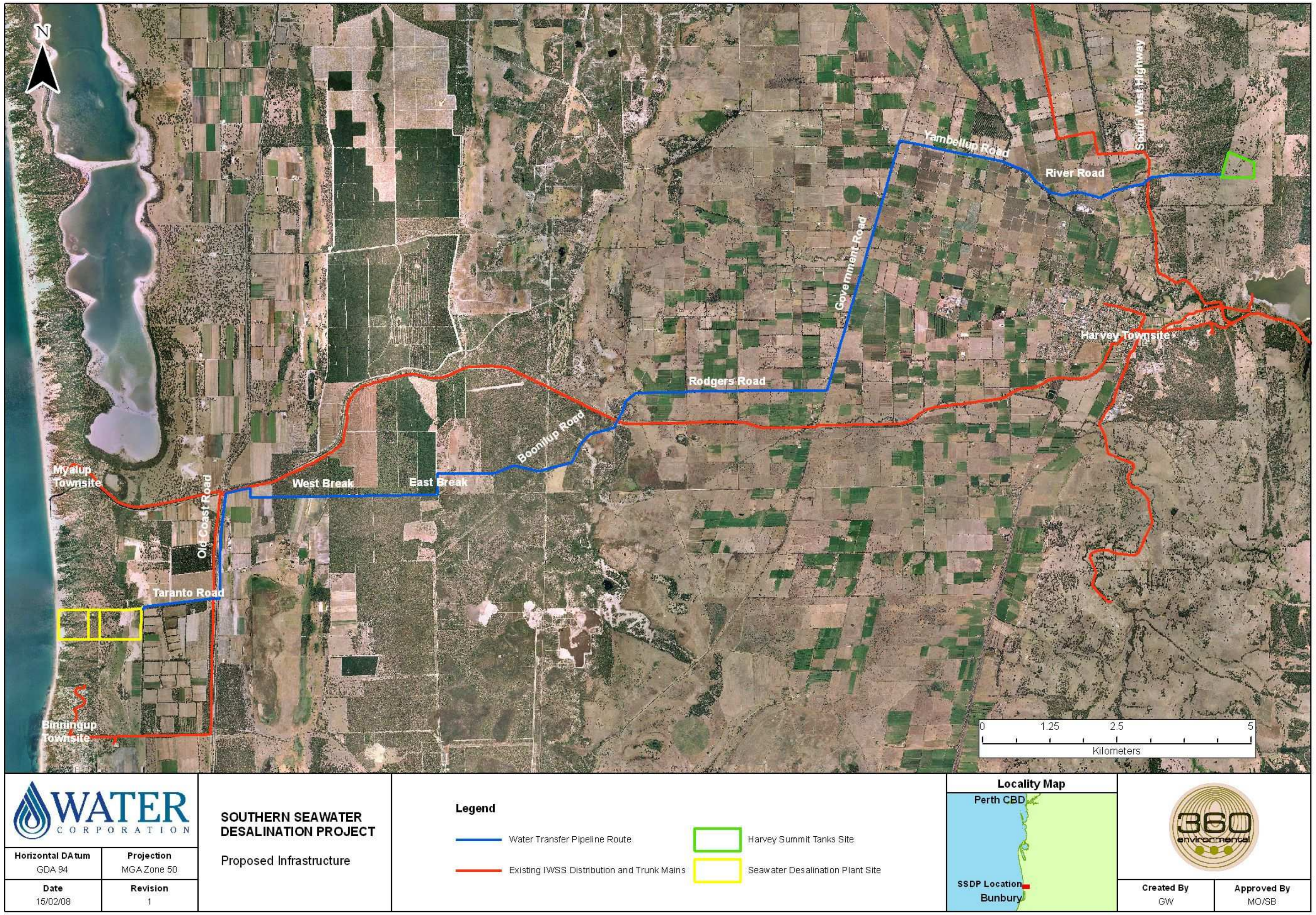
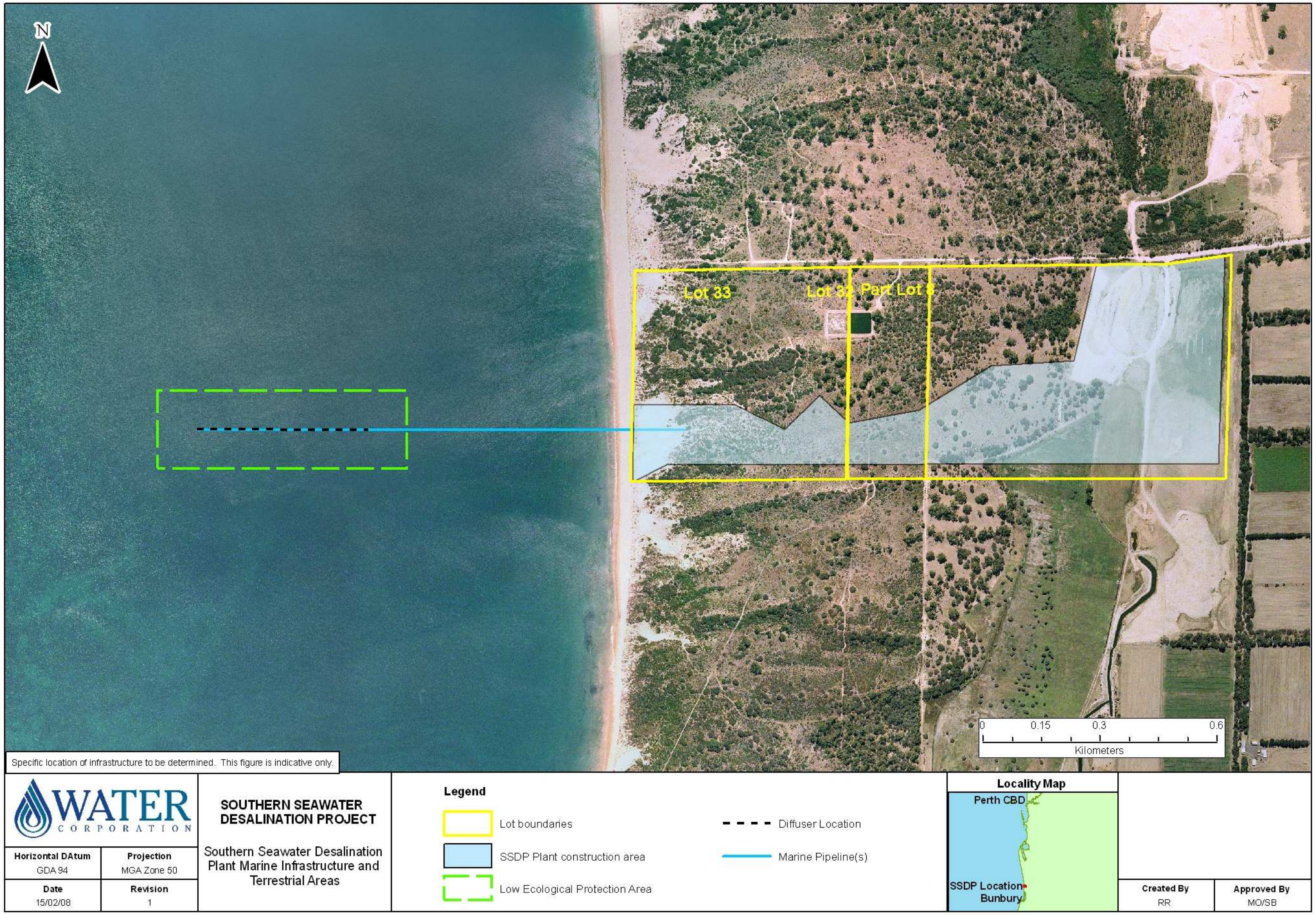


Figure 1.1 Overview map showing project infrastructure

Figure 1.2 Schematic of the outlet and the Low Ecological Protection Area (LEPA) surrounding the diffuser(s)



1.2 Purpose of this OEMF

This Operation Environmental Management Framework (OEMF) contains the following management plans:

1. Whole Effluent Toxicity Testing Management (Section 4.0)
2. Diffuser Performance Monitoring (Section 5.0).
3. Discharge Water Quality Monitoring (Section 6.0).
4. Benthic Habitat Monitoring (Section 7.0)
5. Chemical and Dangerous Goods Management Plan (Section 8.0).
6. Waste Management Plan (Section 9.0).

These plans outline the actions that will be implemented to minimise any potential impacts on the environment associated with the operation of the Southern Seawater Desalination Plant. It is a primary objective that all environmental impacts during operation are avoided or minimised as far as practicable.

It is the purpose of this OEMF to:

1. meet statutory environmental requirements for the project;
2. identify actions to manage impacts on the environment that may occur as a result of operational activities; and
3. demonstrate transparency and accountability to community and government by identifying environmental management actions and making this OEMF publicly available.

1.2.1 Environmental Requirements of OEMF

This OEMF focuses on the management actions to be implemented during operation by operational staff. Supporting information is available upon request, or is contained in the Environmental Impact Assessment (Public Environmental Review) document available at www.watercorporation.com.au.

This OEMF will be further developed with the assistance of the relevant stakeholders for each component of the management plan. Stakeholders will be consulted during the Environmental Impact Assessment (Public Environmental Review) so that they have the opportunity to provide input into the project's environmental management actions.

1.3 Specifications

The materials and methodology stated in this plan are correct as of the publication date. The following changes to materials and methodologies will not invalidate this plan:

1. Changes to materials that do not result in additional or different environmental impacts.
2. Minor changes to methodologies that do not lessen environmental monitoring and/or additional or result in different environmental impact.

Changes to the materials or methodology that may result in reduced monitoring and/or cause a significant environmental impact will be referred to the relevant advisory agencies prior to implementation of the change.

This plan should be read in conjunction with the applicable Ministerial Conditions and other regulatory approvals (e.g. Works Approval, Licence).

1.4 Implementation of Contingency Actions

The OEMF outlines a number of contingency actions that may be used in the event that the management actions proposed do not achieve the purpose stated in each management plan.

1.5 OEMF Training

All staff involved in the operation of the SSDP Plant will receive training on relevant management plans within this OEMF. The names of the people trained on this OEMF will be recorded in an

OEMF Training Log along with the date and the specific plans for which that training was conducted.

1.6 Environment Policy

This OEMF is consistent with the Water Corporation's Environmental Policy (see Appendix 1). The policy can be found at the Water Corporation's website www.watercorporation.com.au.

1.7 Infrastructure Operation

This OEMF addresses matters related to operation. A separate Construction Environmental Management Framework (CEMF) contains management plans relating to construction.

1.8 Amendments arising from Public Environmental Review

This document may be amended following assessment of the Public Environmental Review. This document (as amended) will be made publicly available on the Water Corporation's website prior to operation.

2.0 Definitions

The terms used in this OEMF have the following meanings:

Brine or Brine Stream means the seawater concentrate from the reverse osmosis treatment process

Bund means an embankment of earth or a wall constructed of brick, stone or concrete to form the perimeter of a compound that will prevent lateral movement of the material contained within the embankment or wall.

CTD is the abbreviation for a conductivity/ temperature/ depth profiler.

Desalination Effluent means the effluent that is being discharged via the outlet pipeline and diffuser(s). Typically the desalination effluent will consist of the brine stream or a combination of the brine stream and injected seawater (the seawater being injected to increase dilution) plus any chemicals used in the treatment process.

EC10 is an estimate of the concentration causing an observable adverse effect on 10% of the population of a test organism.

EC50 is an estimate of the concentration that causes an observable adverse effect on 50% of the population of a test organism; Germination-concentration that results in 50% germination of zoospores; Larval development- concentration that results in 50% of larva deformed; Reproduction-concentration that results in 50% less fecundity when compared to controls.

High Ecological Protection Area is defined in the State Environmental (Cockburn Sound) Policy 2005 (Government of Western Australia, 2005) as an area afforded high protection in which small changes are allowed to the quality of water, sediment or biota (i.e. small changes in contaminant concentrations with no resultant detectable changes beyond natural variation in the diversity of species and biological communities, ecosystem processes and abundance/biomass of marine life).

IC10 is an acronym for “Inhibition Concentration 10%”, which is the concentration required to inhibit 10% of a parameter such as growth or luminescence in a test organism.

IC50 is an acronym for “Inhibition Concentration 50%”, which is the concentration required to inhibit 50% of a parameter such as growth or luminescence in a test organism. Typically a reduction in a biological response when compared with controls (e.g. Growth: Concentration that results in 50% less growth when compared to controls);

Limit of Reporting – the lowest concentration of an analyte that can be determined with an acceptable precision and accuracy.

LOEC - Lowest Observed Effect Concentration Function of concentration tested

Low Ecological Protection Area is defined in the State Environmental (Cockburn Sound) Policy 2005 (Government of Western Australia, 2005) as an area in which large changes are allowed to the quality of water, sediment or biota (i.e. large changes in contaminant concentrations that could cause large changes beyond natural variation in the natural diversity of species and biological communities, rates of ecosystem processes and abundance/biomass of marine life, but which do not result in bioaccumulation/biomagnification in near-by high ecological protection areas).

NOEC - No Observed Effect Concentration

Plant site means the site of the seawater desalination plant including Lots 32 & 33 Taranto Road Binningup, Part Lot 8 (to the southern boundary of Lots 32 and 33) Taranto Road Binningup, and includes the seawater pipelines located on part of Reserve 29628 (to the southern boundary of Lots 32 and 33) and the Indian Ocean (to the southern and northern boundaries of Lots 32 and 33) to a nominal distance of 1100m out to sea.

Pollution means the direct or indirect alteration of the environment to its detriment or degradation, to the detriment of an environmental value, or is of a prescribed kind from an emission (as defined by the *Environmental Protection Act 1986* (WA)).

Pycnocline is a region where decreasing temperature and salinity with depth results in corresponding increases in density.

3.0 Abbreviations

The following abbreviations used in this OEMF have the following meanings:

Terms

ANZECC	Australia and New Zealand Environment and Conservation Council
APHA	American Public Health Association
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ASTM	American Society for Testing and Materials
AQIS	Australian Quarantine and Inspection Service
OEMF	Operational Environmental Management Framework
DAF	Department of Agriculture and Food (WA)
DEC	Department of Environment and Conservation (WA)
DEWHA	Department of Environment, Water, Heritage and the Arts (Commonwealth)
DIA	Department of Indigenous Affairs (WA)
DoCEP	Department of Consumer and Employment Protection (WA)
DoF	Department of Fisheries (WA)
DoH	Department of Health (WA)
DoW	Department of Water (WA)
DPI	Department for Planning and Infrastructure (WA)
FESA	Fire and Emergency Services Authority (WA)
FPC	Forest Products Commission (WA)
HEPA	High ecological protection area
IWSS	Integrated Water Supply Scheme
LEPA	Low ecological protection area
LOR	Limit of Reporting
MRWA	Main Roads Western Australia
MSDS	Materials Safety Data Sheet
NATA	National Association of Testing Authorities
OC	Organochlorine
USEPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
WAPC	Western Australian Planning Commission
WET	Whole effluent toxicity

Measurement

cm	Centimetre
dB	Decibels of noise
GL/y	Gigalitres per year
ha	Hectare
kg	Kilograms
kg/ha	Kilograms per hectare
km	Kilometre
m	Metre
m^2	Square metre
mg/kg	Milligrams per kilogram
mg/L	Milligrams per litre
ML	Megalitre
ML/y	Megalitres per year
^{o}C	Temperature in degrees Celsius
ppt	Parts per thousand
psu	Practical salinity units (equivalent to ppt for practical purposes)

4.0 Whole Effluent Toxicity Testing Management

4.1 Context

A whole effluent toxicity (WET) testing methodology was developed for the Perth Seawater Desalination Plant to compare the discharge with the specifications in the Cockburn Sound Environmental Protection Policy (Government of Western Australia, 2005) and the supporting Manual of Standard Operating Procedures for monitoring against the Cockburn Sound Environmental Quality Criteria (2003-2004) (EPA, 2005). This methodology has been adopted (with some minor modifications based on accumulated learning from the testing of the Perth Seawater Desalination Plant desalination effluent) for the Southern Seawater Desalination Project.

The use of living test organisms (i.e. WET testing) is a reliable way to measure the potential biological impacts of the brine discharge on the surrounding environment. Indigenous organisms are chosen to maximise the relevance of the test results for the system under consideration.

4.2 Purpose

The purpose of this WET testing is to compare the discharge from the desalination plant with the ecosystem protection target at its boundary with the low ecological protection area (LEPA) surrounding the ocean outlet diffuser(s). WET testing methodology is based on the principles in USEPA (2003a, 2003b), APHA (1989) and ASTM (1998) protocols. Testing will be conducted at a NATA accredited laboratory in accordance with ANZECC/ARMCANZ (2000) whole effluent toxicity protocols.

4.3 Performance Indicators

1. Design/actual dilution compared to dilution determined using EC10 (the concentration that causes an effect on 10% of the population) and IC10 (inhibition concentration 10%) values obtained from each WET test.

4.4 Management Actions

4.4.1 Sampling Design

1. WET testing of the desalination plant discharge will occur twice[1] during operation using a sample obtained:
    a. Within three (3) months of establishment of a brine discharge, and
    b. Twelve (12) months after establishment of a brine discharge.
2. The following tests will comprise the WET testing:
    a. 15 minute Microtox test using the marine bacteria *Vibrio fischeri*;
    b. 48 hour macroalgal germination test using the marine brown kelp *Ecklonia radiata*;
    c. 48 hour mussel larval development test using the marine blue mussel *Mytilis edulis;*
    d. 72 hour algal growth test using the unicellular marine alga *Isochrysis galbana;*
    e. 24 Day copepod reproduction test using the estuarine copepod *Gladioferens imparipes;* and
    f. 7 day larval fish growth test using the marine fish pink snapper *Pagrus auratus.*
3. Testing will follow the WET methodology (section 4.5).
4. Reports will be submitted to the DEC for the WET tests conducted as per 1(a) and 1(b). These reports will contain:
    a. Explanation of methodology and approach.
    b. Presentation and discussion of results for the tests 2(a) to 2(f).

c. A discussion of any instances where WET testing indicates that the design dilution of the discharge at the boundary of the LEPA 80% species protection target and the HEPA 95% species protection target [2].

4.4.2 Microtox Test

5. The 15 minute Microtox test will be used as a range finding test to ensure that the concentrations selected for the chronic bioassays will bracket the EC50. The 15 minute acute toxicity test using the growth of the luminescent marine bacteria *Vibrio fischeri* will be based on the method listed in the Microtox Manual: A Toxicity Testing Handbook, Microbics, 1992[3].

4.4.3 Microalgae[4]

6. The 72 hour sub-chronic toxicity test using the growth of the marine alga *Isochrysis galbana* will be based on the method described by Stauber *et al.* (1994).
7. Tests will be performed in a temperature controlled laboratory using untreated microplates, which will be rinsed with dilution water prior to testing.
8. A filtered seawater control will be tested concurrently. A number of concentrations will be tested with four replicates each. The concentrations will be based on the results of the Microtox *Vibrio fischeri* test.
9. After 72 hours, the growth of the algae will be measured, and growth for each replicate will be calculated and compared with the control growth to obtain a percentage decrease in growth. The IC50 and IC10 will be determined using a probit analysis with the appropriate statistical program.

4.4.4 Macroalgae

10. A 48 hour sub-chronic toxicity test using the germination of the marine macroalga *Ecklonia radiata* will be undertaken based on the method described by Burridge *et al.* (1999).
11. Zoospores will be collected from adult specimens. The *E. radiata* specimens will be collected from sites that are unlikely to be affected by contamination.
12. Various concentrations of the water sample will be tested with three replicates each. The concentrations will be based on the results of the Microtox *Vibrio fischeri* test[5].
13. After 48 hours, the numbers of germinated gametes will be measured by counting a total of 40 of germinated and non-germinated gametes using a microscope. The EC50 and EC10 will be determined by using a probit analysis with the appropriate statistical program.

4.4.5 Copepods[6]

14. A modified 21-28 day acute toxicity test using the reproduction of the Swan River copepod *Gladioferens imparipes* will be undertaken based on the method described by the US EPA (2003a) Daphnid, Survival and Reproduction Test Method 1002.0.
15. Six concentrations will be tested based upon the results obtained from the Microtox *Vibrio fischeri* toxicity testing. Exposure to these concentrations will be for 24 hours. After this time, the Copepods will be placed in diluent water.
16. At day 15, after maturation, male and female copepods will be placed in the same well. Water changes and feeding will continue as previously.
17. Every second day the number of neonates produced by the female will be counted and recorded. These results will be used to calculate the EC50.
18. The concentration of sample resulting in a 50% decrease in the numbers of neonates produced compared with the control copepod (26 day EC50) will be determined using a probit analysis with the appropriate statistical program.

4.4.6 Mussels[7]

19. The 48 hour sub-chronic toxicity test using the larval development of the marine mollusc *Mytilis edulis* will be based on ASTM E724-98 (1998).
20. Collected male and female specimens will be induced to spawn using temperature shocks, and sperm and eggs will collected then added together to fertilise the eggs. Specimens will be collected from sites that that are unlikely to be affected by contamination.

21. The discharge will be tested at various concentrations (obtained from Microtox *Vibrio fischeri* testing) with three replicates each.

22. After 48 hours, the numbers of abnormal larvae will be measured by counting the number of normal and abnormal larvae using a microscope. The EC50 and EC10 will be determined by using a probit analysis with an appropriate statistical program.

4.4.7 Larval Fish[8]

23. The seven day sub-chronic toxicity test using growth of the larval pink snapper *Pagrus auratus* will be undertaken based on methods described by the USEPA (2003b) Test Method 1004.0 Sheepshead Minnow Larval Survival and Growth Test.

24. Various concentrations of collected water will be tested (based on the results obtained from the Microtox *Vibrio fischeri* toxicity tests) with three replicates.

25. Newly hatched larvae will be randomly allocated to each treatment.

26. Larvae will be monitored once per day at each water change and any mortality will be observed and recorded. The concentration of sample resulting in a 10% and 50% decrease in growth will be compared with the control fish to determine IC50 and IC10 values. The IC50 and IC10 will be determined by using a probit analysis with the appropriate statistical program.

4.5 Methodology

Grab samples downstream of all waste streams that enter the discharge pipe will be collected at the outlet during stable operation. Diluent will be collected from a site approximately 2km to the south of the diffuser(s) in the same water depth as the diffuser(s) (10-12m depth)[9]. The exact location will be recorded in accurate geographic coordinates. In the laboratory, test samples will be analysed for pH, salinity and temperature immediately prior to testing. The sample will be filtered (e.g. 0.45 microns) to remove all macroinvertebrates, microalgae and the majority of the bacteria that may confound toxicity test results.

Ecotoxicity testing will occur as soon as practicable after water sampling, and filtered seawater samples will be maintained at the appropriate temperature for each test throughout the testing period. Each toxicity test will use up to fifty dilutions of the seawater concentrate to represent the design dilution (within the LEPA) of the desalination effluent at high discharge rates.

Data (as shown in Table 4.1) will be placed in the BurrliOZ (Campbell et al., 2000) software to calculate a value designed to protect 95% (the target protection value for the HEPA) of the species from effects due to toxicants discharged from the proposed desalination plant with 50% confidence levels.

Table 4.1 Details of WET tests including the testing duration and applicable performance indicator

Test	Duration	Effect Concentration
Microalgae	72 hour	IC10
Macroalgae	48 hour	EC10
Copepod[6]	28 day test with 24 hour exposure	EC10=EC50/5
Mussel	48 hour	EC10
Larval Fish	7 day	IC10

The BurrliOZ software is designed to estimate the protecting concentrations of chemicals (and associated dilutions) such that a given percentage of species will not be affected. The estimations of the protecting concentrations will be computed by fitting the Burr III distribution to the toxicity data generated by the WET testing.

4.6 Additional Information

[1]Monitoring frequency

This monitoring frequency is considered sufficient because WET testing of the existing reverse osmosis Perth Seawater Desalination Plant (PSDP) (Geotechnical Services, 2008), shows that specifications in the Cockburn Sound Environmental Protection Policy (Government of Western Australia, 2005) and the supporting Manual of Standard Operating Procedures for monitoring against the Cockburn Sound Environmental Quality Criteria (2003-2004) (EPA, 2005) are met with a considerable margin of safety (the Southern Seawater Desalination Project plant will be similar in design to the PSDP). Further, Water Consultants International (2006), as part of a worldwide review of reverse osmosis desalination plants stated "detailed and quantified studies of the impact of desalination discharges on marine life surrounding

Caribbean coral islands provides strong evidence of little or no impact, even when using unsophisticated discharge design".

[2]Trigger Criteria

A High Protection Zone (HEPA) is adjacent to the Low Ecological Protection Area (LEPA) surrounding the diffuser(s) discharging the desalination effluent. The Manual of Standard Operating Procedures – For Environmental Monitoring against the Cockburn Sound Environmental Quality Criteria (2003-2004) (EPA, 2005) states that for a High Protection Zone (HEPA):

If five species have been assessed and the statistical distribution method used, the dilution of the effluent (as % effluent) … should be protective of at least 95% of species

This means that the dilution at the LEPA/HEPA boundary should be higher than that which results in a measurable effect on 5% of species. In terms of concentrations, the concentration of brine at the LEPA/HEPA boundary should be lower than that which results in a measurable effect on 5% of species.

[3]Microtox Test

The marine bacteria *Vibrio fischeri* is a ubiquitous bacteria found in marine ecosystems throughout the world. *V. fischeri* displays a high sensitivity to a broad range of chemicals and is used throughout the world for determining toxicity of water, soil and sediment samples.

[4]Microtox Test

Unicellular algae form the base of the food chain in the marine system. These algae are primary producers in the marine system and provide food for larval, juvenile and adult crustaceans and molluscs. The microalgal species *Isochrysis galbana* was selected as the microalgal species to assess the toxicity of the discharge. This species was selected because it is widely distributed in Australian waters and the availability of temperate and tropical strains make it particularly suitable for site specific toxicity testing (Stauber *et al.* 1994). This species has been commonly used in toxicity tests throughout Australia for the past 15 years, and therefore, a large amount of information on this species is available.

[5]Macroalgae

The marine macroalga *Ecklonia radiata* provides both food and habitat for a range of other organisms in near-shore coastal areas. *E. radiata* is common along the temperate Western Australian coast (Wernberg et al. 2004). Therefore, *E. radiata* was selected as a suitable test organism for assessing the environmental impacts of the discharge. Toxicity tests using *E. radiata* have been performed on marine discharges throughout temperate Australia (e.g., Bidwell et al 1998, Burridge et al. 1999).

[6]Copepods

Copepods are a major part of the marine food chain as they represent a first order consumer, and they, in turn, provide food for larval fish and crustaceans. The Swan River copepod *Gladioferens imparipes* was selected to represent the copepod species in Cockburn Sound for the Perth Seawater Desalination Plant. Further, toxicity testing has been performed on this species for the last 10 years (Evans et al 2000).

Despite the theoretical suitability of the copepod *Gladioferens imparipes* for WET testing, data from WET testing of copepod reproduction using *Gladioferens imparipes* for the Perth Seawater Desalination Plant desalination effluent discharge shows that it is not possible to obtain consistent EC10 results (Geotechnical Services, 2008). However, reliable EC50 values can be obtained. For this reason, Warne (2008*)* recommended replacing the EC10 with the EC50 divided by 5.

Warne (2008) points out that the standard copepod test is an acute test while the other tests are sub-chronic and that acute and chronic toxicity test results should not be combined when using species sensitivity distribution methods. For this reason the standard copepod test has been modified, as was done for the Perth Seawater Desalination Plant (PSDP) tests (Geotechnical Services 2008*),* by reducing the time that the copepods are exposed to the desalination effluent to 24 hours. This is also closer to the duration that free drifting organisms such as copepods would be exposed to the desalination effluent (CWR, 2007c). Because of the energetic environment offshore of Binningup and subsequent high levels of dilution (KBR, 2008b), this exposure time is likely to be shorter than for the PSDP.

Consideration was given to substituting the copepod WET tests with the prawn *Penaeus monodon*. However, this prawn test is an acute test and would lead to acute and chronic toxicity test results being combined – contrary to the recommendations of Warne (2008). For this reason, the modified copepod test will be used.

[7]Mussels

The blue mussel, *Mytilis edulis*, is a first order consumer, filtering bacteria, microalgae and other small particles from the water column. *M. edulis* is found in temperate waters throughout the world, and in Western Australia it is found south of Geraldton. *M. edulis* has been used in toxicity tests throughout the world since 1980.

[8]Larval Fish

The pink snapper, *Pagrus auratus*, is a temperate marine fish commonly found associated with reefs. *P. auratus* is commonly found along the Western Australian coast where juveniles find appropriate habitat and food within seagrass beds.

[9]Site for Diluent

Modelling (KBR, 2008b) shows that the desalination effluent will be fully mixed within 2km of the discharge point and will therefore have little effect at this distance. Further, currents flow to the north the majority of the time, thus reducing the likelihood that the sample site to the south will be affected by the desalination effluent discharge. Finally, sites to the north can be affected by discharge from the Harvey Diversion Drain, so a southern site is preferred.

4.7 Contingency Actions

If the design dilution, which is a conservative estimate of the actual dilution (CWR, 2007b), is not protective of 95% of species i.e. the design dilution is less than the target dilution) then an additional set of tests will be undertaken. If these additional tests show that the design dilution is not protective of 95% of species, contingency actions could include:

1. Measuring the actual dilution at the LEPA/HEPA boundary using the methodology of CWR (2007b) and then comparing that dilution to the target dilution (actual dilution is likely to be higher than the design dilution).

2. Seeking the establishment of a Moderate Ecological Protection Area between the LEPA and the HEPA.

3. Identifying the chemicals contributing to the toxic effects and reducing the usage of those chemicals or substituting them.

4. Review operational procedures. For example, seawater injection could be increased at low flow rates to increase dilution.

5. Review the diffuser(s) design and modify the diffuser(s).

DEC will be advised if contingency actions are being investigated and the outcomes of those investigations.

4.8 Relevant Legislation

1. *Environmental Protection Act 1986* (WA).

5.0 Diffuser Performance Monitoring

5.1 Context

Water quality profile monitoring of the desalination discharge will be conducted to provide quantification of desalination effluent dilution at the boundary of the low ecological protection area (LEPA). The program's monitoring activities consist of profile sampling of salinity, temperature and dissolved oxygen at selected monitoring points. Salinity profiles will be used to calculate the increase in salinity and the dilution of the desalination effluent discharge. The dilution will be applied to the toxicant concentration data obtained from implementing the Discharge Water Quality Monitoring Plan to estimate toxicant concentration at the LEPA boundary. The estimated toxicant concentration will be compared with the ANZECC/ARMCANZ (2000) guidelines at the boundary of the LEPA and the high ecological protection area (HEPA).

Three types of monitoring locations have been chosen for the water quality profile monitoring:

1. *LEPA boundary*, 100m from the diffuser(s)
2. *Near LEPA*, 500m from the diffuser(s), directly north or south of the monitoring sites on the LEPA boundary.
3. *Reference*, 1250m from the diffuser(s)[1], directly north or south of the monitoring sites on LEPA boundary.

5.2 Purpose

The purpose of the water quality profile monitoring is to determine that the salinity increase at the boundary of the LEPA meets salinity criteria.

5.3 Performance Indicators

1. Salinity increase based on comparing the salinity at the LEPA boundary with the background salinity. The salinity increase is not to exceed 1 ppt more than 95% of the time and is not to exceed 1.3 ppt.

5.4 Management Actions

5.4.1 Water Quality Sampling Design

1. Two replicate vertical profiles measuring salinity, temperature and dissolved oxygen will be conducted at the following monitoring stations:
   a. 100m north of the mid-point of the diffuser(s)
   b. 100m south of the mid-point of the diffuser(s)
   c. 500m north of the mid-point of the diffuser(s)
   d. 500m south of the mid-point of the diffuser(s)
   e. 1250m north of the mid-point of the diffuser(s)
   f. 1250m south of the mid-point of the diffuser(s)
2. The data will be collected as prescribed in the 'Methodology' section below.
3. Testing will be conducted every two months to capture seasonal and operational variation with the first post-commissioning monitoring conducted after establishment of brine discharge. Monitoring will be conducted over a 12 month period with the first and final tests no closer together than 10 months.
4. The accuracy of the instruments will be sufficient to meet the Limit of Reporting (LOR) as per Table 5.1.
5. All instruments will be maintained and calibrated according to the manufacturers' specifications.

Table 5.1 Required Limit of Reporting

Parameter	LOR
Dissolved oxygen (DO)	± 0.1 $mg.L^{-1}$
Salinity	± 0.05 ppt
Temperature	± 0.1℃

5.4.2 Diffuser Inspection

6. The diffuser(s) and outlet pipeline will be visually inspected on a regular basis. Inspection methods may include divers, towed cameras/video or remotely operated vehicles. The frequency of inspection will be in accordance with the Ministerial Conditions/Commitments.

5.4.3 Reporting

7. A report will be submitted to the DEC within three months of the final sampling. The report will include calculations of the salinity increase and desalination effluent dilution at the boundary of the LEPA and at the stations 500m from the diffuser(s).

8. CTD (salinity is a function of Conductivity, Temperature and Depth) profile data will also be included in the report. The salinity increase will be compared to salinity requirements in the Ministerial Conditions.

5.5 Methodology

Salinity data collected at the sampling sites at the edge of the LEPA will be used to determine seawater salinity (temperature corrected) measured at no closer than 0.5m increments (with at least 30 seconds of data at each sampling depth) in the bottom 5m of the water column[2]. Pycnocline affect attributable to the diffuser(s) discharge will be identified and only those depths below the pycnocline averaged to assess diffuser(s) performance. However, if a pycnocline cannot be clearly identified, it shall be defined in accordance with the method of Roberts and Toms (1987) (also see Roberts *et al.* 1997).

At each station wind speed, wind direction, current speed and current direction will be estimated or measured manually for the period of 24 hrs before the time of measuring the seawater salinity. The background seawater salinity will be as measured by the on-line seawater intake meter in the desalination plant, averaged over the time of the diffuser monitoring sampling. This will then be used to calculate the background salinity of the seawater. Should the on-line instrument not be functioning at the time of sampling, an alternative calibrated instrument may be used. Failing this, the depth average salinity from the reference sites may be used to determine the background salinity (S_{S}) of the seawater.

The seawater discharge will be as measured by the on-line wastewater outlet meter (from which salinity will be calculated) or a substitute instrument, averaged over the time of the diffuser monitoring sampling.

The increase in salinity (ΔS) at the monitoring sites on the LEPA boundary will be calculated as:

$$\Delta S = S_M - S_S$$

while the dilution or dilution factor at the monitoring sites on the LEPA boundary will be calculated using the following formula:

$$\text{Dilution Factor} = D = (S_B - S_S) / \Delta S$$

where:

S_B = salinity of the desalination effluent discharge
S_M = salinity at the monitoring station
S_S = background salinity of the seawater (at the inlet).

5.6 Additional Information

[1]Monitoring Sites

The reference sites coincide with sites used in the project's baseline water quality monitoring.

[2]Alternate salinity measurement method

If it is impractical to obtain measurements at 0.5 m increments in the vertical (for example, due to large waves moving the deploying vessel and instruments large distances vertically), then 5 vertical profiles obtained from a constantly descending instrument may be averaged to provide a representative profile.

5.7 Contingency Actions

If the diffuser inspection as per Section 5.4.2 shows the diffuser(s) and/or outlet pipe requires maintenance, then that maintenance will be scheduled and implemented.

Contingency actions will be triggered if the salinity increase at the edge of the LEPA (ΔS) is greater than 1ppt for more than 5% of the time or if ΔS exceeds 1.3ppt. Contingency actions may include the following:

1. The diffuser(s) will be inspected.
2. If the diffuser(s) needs maintenance, then that maintenance will be implemented and the salinity monitoring will be repeated.
3. Review operational procedures. For example, seawater injection could be increased at low flow rates to increase dilution.
4. Implement additional testing as per the Whole Effluent Toxicity Management Plan to determine if the higher levels of salinity are having an unacceptable ecological impact.
5. Review the diffuser design and modify the diffuser(s).

5.8 Related Plans

Discharge Water Quality Monitoring
Benthic Habitat Monitoring

5.9 Relevant Legislation

1. *Environmental Protection Act 1986* (WA).

6.0 Discharge Water Quality Monitoring

6.1 Context

The desalination effluent discharge stream will be monitored continuously for some parameters and at selected intervals for other parameters to provide information on operations, toxicants (metals), process additive chemicals and nutrient loading.

In general, substances that are in the intake seawater will be approximately doubled in concentration before being discharged in the brine stream. Dilutions of 25 to 50 within the Low Ecological Protection Area (LEPA) would result in these substances increasing in concentration by around 4% to 2% respectively compared to background seawater concentrations. Additional dilution beyond the LEPA will reduce this increase in concentration even further. Hence, it is only if a substance is added during the treatment process, as opposed to being present in the seawater intake stream, that there is the potential for any environmental impact.

Unlike thermal desalination plants, reverse osmosis desalination plants do not result in concentrations of metals increasing measurably beyond the approximate doubling discussed above. However, given the potential toxicity of some metals, monitoring of the desalination effluent stream for metals will be carried out as a safeguard.

Some of the additive chemicals used in pre-treatment processes can contain nitrogen. In turn, nitrogen can stimulate the growth of algae. For this reason, nitrogen and some of its compounds will be monitored and an annual nitrogen load estimated.

6.2 Purpose

The purpose of the discharge water quality monitoring is to quantify:

1. Flow volumes, flow rates and salinity of the discharge
2. Nutrient (nitrogen and phosphorus) load being discharged
3. The concentration of toxicants (metals) in the discharge
4. The concentration of process additive chemicals in the discharge.

6.3 Performance Indicators

1. Measurements are undertaken and reported
2. Detection of any toxicants (metals) added during the treatment process.

6.4 Management Actions

6.4.1 Operational Monitoring

1. Operational monitoring of the desalination plant will provide data for direct or indirect determinations of:
   a. Daily total volume and daily average flow rate of the desalination effluent discharged to marine waters.
   b. Daily total volume and daily average flow of the brine component of the desalination effluent discharged to marine waters.
   c. Daily average salinity of the inlet seawater and the desalination effluent discharged to marine waters.

6.4.2 Sampling Design for Desalination Effluent and Inlet Stream Sampling

1. Testing will be conducted twice a year with the first post-commissioning monitoring conducted within three months of establishment of brine discharge. Monitoring will continue for two years (four testing periods) after commissioning.
2. Three replicate grab samples will be taken of the seawater desalination effluent stream (i.e. downstream of where waste streams enter the discharge pipe) and of the inlet stream.
3. Samples will be analysed at a NATA accredited laboratory; to the detection limits where practicable, shown in Table 6.1, Table 6.2 and Table 6.3.
4. Sampling techniques will be consistent with those recommended in ANZECC/ARMCANZ (2000) and EPA (2005) including safe handing and sampling procedures[1].
5. All instruments will be calibrated and maintained according to manufacturers' specifications.

6.4.3 Data Analysis for Desalination Effluent and Inlet Stream Sampling

6. The net additional annual nitrogen load to marine waters due to the operation of the desalination plant will be calculated for the forms of nitrogen listed in Table 6.1.
7. The increase in concentration for each toxicant in Table 6.2 will be calculated as a concentration ratio (the ratio of desalination effluent concentration divided by inlet concentration).

6.4.4 Reporting

8. Results of the sampling will be reported annually and will include:
   a. Data as required by section 6.4.1 of this management plan
   b. Data as required by section 6.4.3 of this management plan for the duration of the desalination effluent and inlet stream sampling
   c. Any concentration ratio above 2 will be noted and discussed.

6.5 Additional Information

[1] Sampling Information

Water samples will be collected in accordance with Standard procedures consistent with AS. 5667. Analyte concentration will be measured to at least half the trigger level concentrations. The general approach to the sampling method will be pursuant to ANZECC/ARMCANZ (2000b). All samples will be appropriately labelled and tracked, and chain-of-custody documentation will be appropriately stored and maintained.

Sampling Compounds

The following list specifies the compounds (toxicants and nutrients) that will be measured during water quality sampling from the seawater concentrate discharge. The specific analysis for process chemicals will be determined prior to sampling of the desalination effluent stream.

Table 6.1 Water Quality Monitoring Parameters – General Water Quality and Nutrients

Analyte	Unit	LOR
Alkalinity (mg $CaCO_3$/L)	mg $CaCO_3.L^{-1}$	1
Total dissolved solids, TDS (mg/L)	$mg.L^{-1}$	5
Ammonium	µg $N.L^{-1}$	3
Nitrite and Nitrate	µg $N.L^{-1}$	2
Total Nitrogen	µg $N.L^{-1}$	50
Ortho-phosphorus	µg $P.L^{-1}$	2
Total Phosphorus	µg $P.L^{-1}$	5

Table 6.2 Water Quality Monitoring Parameters - Toxicants

Analyte	Unit	LOR
Filterable, Al	$mg.L^{-1}$	0.01
Total Al	$mg.L^{-1}$	0.01
Arsenic, As	$mg.L^{-1}$	0.002
Boron, B	$mg.L^{-1}$	0.003
Cadmium, Cd	$mg.L^{-1}$	0.002
Chromium, Cr[1]	$mg.L^{-1}$	0.001
Copper, Cu	$mg.L^{-1}$	0.001
Lead, Pb	$mg.L^{-1}$	0.002
Filterable Manganese, Mn	$mg.L^{-1}$	0.0002
Total Manganese, Mn	$mg.L^{-1}$	0.0002
Mercury, Hg	$mg.L^{-1}$	0.0005
Molybdenum, Mo	$mg.L^{-1}$	0.0005
Nickel, Ni	$mg.L^{-1}$	0.004
Selenium, Se	$mg.L^{-1}$	0.002
Silver, Ag	$mg.L^{-1}$	0.001
Vanadium, V	$mg.L^{-1}$	0.001
Zinc, Zn	$mg.L^{-1}$	0.002

Table 6.3 Water Quality Monitoring Parameters – Process Additive Chemicals

Analyte	Unit	LOR
Coagulating agent	$mg.L^{-1}$	TBD
Antiscalant	$mg.L^{-1}$	TBD
Filterable Iron, Fe	$mg.L^{-1}$	0.003
Total Fe	$mg.L^{-1}$	0.003

TBD = To BeDetermined

6.6 Contingency Actions

Contingency actions may include the following:

1. If the annual nitrogen load exceeds an allowed load then:

   a. The use of alternative process chemicals with a lower nitrogen content will be explored

   b. Chlorophyll-a data will be collected in the surrounding marine waters to determine the extent of any algal stimulation associated with nitrogen in the desalination effluent

   c. Based on the algal stimulation in marine an increase in the allowed nitrogen load could be sought.

2. If a concentration ratio exceeds 2 for a toxicant then:
   a. Whole effluent toxicity testing may be conducted on the desalination effluent as per the Whole Effluent Toxicity Testing Management Plan.
   b. Additional samples may be analysed to determine the bio-available fraction.
   c. The estimated concentration (C) of the toxicant at the boundary of the Low Ecological Protection Area will be compared with ANZECC/AARMCANZ (2000) guideline trigger values for Low, Medium and High Ecological Protection Areas. The concentration (C) will be determined using:

$$C = (C_B + DC_S) / (1 + D)$$

where:

C_B = concentration of the toxicant in the desalination effluent discharge

C_S = concentration of the toxicant in the seawater (at the inlet)

D = the dilution in the LEPA (this can be obtained from implementing the Diffuser Performance Monitoring Plan or from theoretical or empirical relationships – also see Centre for Water Research, 2007).

6.7 Related Plans

Diffuser Performance Monitoring

6.8 Relevant Legislation

1. *Environmental Protection Act 1986*
2. *Occupational Safety and Health Act 1984*

7.0 Benthic Habitat Monitoring

7.1 Context

The marine benthic habitats in the vicinity of the Southern Seawater Desalination Plant were characterised using towed underwater video taken in December 2007 (UWA, 2008d). Habitats comprised (i) no biota (i.e. free of obvious fauna in video footage), (ii) vegetation and sessile invertebrates, (iii) sessile invertebrates and (iv) vegetation.

The area mapped was described by UWA (2008) as highly energetic (by natural wave energy), with large areas of reef pavement devoid of biota and where biota occurred they occupied a small proportion of the total reef surface. Megaripples and sediment sheets were observed midshore suggesting that sediment was highly mobile. The mosaic of seaweeds and benthic invertebrates was most developed on reefs 300-500m offshore with areas further inshore exhibiting an extensive pavement bare of invertebrates and seaweed due to the pavement being frequently covered and scoured by shifting sands.

Marine macroflora (including seaweeds and seagrasses) species occur at a distance from approximately 500m offshore to greater than 2500m offshore from the Seawater Desalination Plant site. More specifically, seagrass beds are more than 1200m from the shore along the pipe alignment. The seawater intake and outlet pipelines will be located along an alignment that generally contains bare sand and shell material. From 500m or so offshore the outlet pipelines and diffuser(s) are within a few hundreds of metres of marine flora and/or fauna.

Construction works may impact on the marine flora in close proximity to those works (Oceanica, 2008). The application of this Plan in relation to construction impacts is specified in the Seawater Pipeline Management Plan which is within the Construction Environmental Management Framework.

A worldwide review did not find any significant impacts on surrounding flora and fauna associated with the discharge of highly diluted brine from reverse osmosis desalination plants (Water Consultants International, 2006).

7.2 Purpose

The purpose of the Benthic Habitat Monitoring is to assess whether the construction and operation of the Southern Seawater Desalination Project may affect offshore benthic flora and fauna.

7.3 Performance Indicators

Performance will be demonstrated by:

1. Mean depth range that seagrass and sessile macroinvertebrates are found[1].

7.4 Management Actions

7.4.1 Prior to and Soon After Construction

1. The timing requirements are specified in the Seawater Pipeline Management Plan which is within the Construction Environmental Management Framework.

7.4.2 During Operation

2. Benthic habitat monitoring will be conducted between 18 and 30 months of brine discharge based on the methodology[2]. A report will be provided to the DEC within 6 months of the completion of the monitoring.

7.4.3 Method and Data Analysis

3. GIS referenced video footage from monitoring transects will be analysed using the same methodology as UWA (2008).
4. The transects will be the same as those used by UWA (2008) (see Figure 7.1) or a modification to provide greater detail in the vicinity of the outlet pipeline and diffuser(s).
5. All appropriate safety precautions for working in the field including collection and handling of samples, boat handling and diving (where applicable) will be followed by all sampling personnel.
6. Seagrass cover will be compared with previous surveys.
7. Sessile macroinvertebrate cover will be compared with previous surveys.

7.5 Additional Information

[1] Performance Indicators

EPA (2005) outlines two different approaches for monitoring seagrass. The first relates to seagrass shoot density while the second relates to the depth range that seagrass are found over.

The offshore environment in the vicinity of the desalination discharge and construction area is extremely dynamic (for this reason, the only seagrass species present - *Posidonia angustifolia* and *Posidonia coriacea* - are pioneer species). As such, there may be considerable changes in seagrass shoot density and presence/absence at any specific location from one year to the next. Broader mapping of seagrass which shows the depth range that seagrasses are found is considered to be more reliable. The same logic is applied to sessile macroinvertebrates.

[2] Timing of Surveys

The waters offshore of the desalination plant are turbid near the seabed for much of the year. This, means that the survey can only be conducted within a few months of the year is the highest possible quality video footage can be obtained.

[2] Habitat Transects and Categories

The baseline survey conducted by UWA (2008) consisted of a grided towed video design of the target area. This grid consisted of towed video transects every 500 m, equating to 10 transects running north-south and east-west as shown in Figure 7.1.

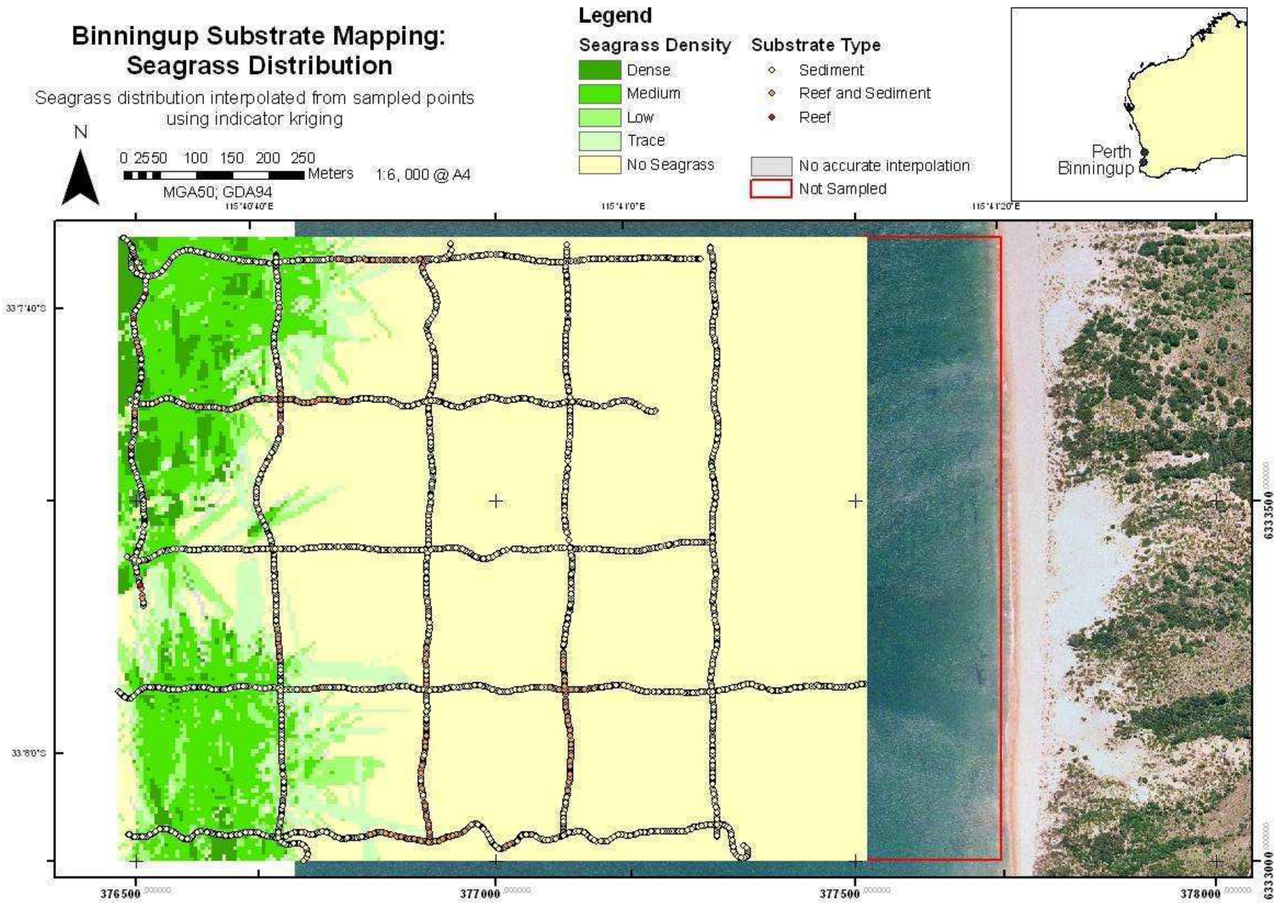


Figure 7.1 Location of transects used by UWA (2008d) and location of seagrass

Resulting underwater towed video imagery was observed and the following categories shown in Table 7.1 used to describe the habitat.

Table 7.1 Categories describing benthic communities for video interpretation.

Substrate	Macroalgae	Seagrass	Sessile invertebrates
Hard (reef/rock)	Undifferentiated	Undifferentiated	Undifferentiated
Can't discern	Mixed brown algae	*Amphibolis*	Sponges
Fractured/Fissured/Broken	Mixed red algae	*Zostera/ Heterozostera*	Ascidians
Unbroken	Mixed green algae	*Halophila*	Bryozoa
Cobbles	*Ecklonia*	*Posidonia*	Hydroids
Boulders/small outcrops	*Sargassum*	*Thalassodendron*	Soft corals, gorgonians
Soft (sediment)	*Caulerpa*		Hydroids
Can't discern	*Scytothalia*		Hard corals
Coarse gravel	Epiphytes		Sea whips
Fine gravel	*Codium*		*Tethya*
Sand			Black coral
Fine sand (silt/clay)			*Pyura*

7.6 Contingency Actions

Contingency actions will be largely dependent on the circumstances that result in changes and loss of seagrass and sessile macroinvertebrate cover. For example, loss of seagrass and/or sessile macroinvertebrates in the vicinity of the discharge area may be the result of winter storms and other inclement weather. Contingency actions in response to significant loss or change in seagrass and sessile macroinvertebrate cover may include:

1. investigation of the cause of seagrass or sessile macroinvertebrate changes

2. investigation of and/or collection of additional water quality monitoring data in order to determine if there are any correlations between the water quality data and the changes

3. re-examination of whole effluent toxicity analysis data and/or conducting additional whole effluent toxicity testing as per the Whole Effluent Toxicity Testing Management Plan to determine if toxicity effects may be responsible. If toxicity effects are present, the contingency actions in the Whole Effluent Toxicity Testing Management Plan may be implemented

4. implementing additional macrobenthic monitoring.

7.7 Related Plans

Whole Effluent Toxicity Testing Management
Discharge Water Quality Monitoring

7.8 Relevant Legislation

1. *Environmental Protection Act 1986*
2. *Wildlife Conservation Act 1950*
3. *Wildlife Conservation Regulations 1970*
4. *Occupational Safety and Health Act 1984*

8.0 Chemical and Dangerous Goods Management Plan

8.1 Context

A number of chemicals are used during the seawater desalination process and subsequent potibilisation process, including:

- Sulphuric acid
- Ferric sulphate
- Coagulating agent
- Antiscalant
- Calcium carbonate
- Carbon dioxide
- Chlorine
- Fluorosilicic acid
- Sodium hypochlorite
- Sodium bisulphite

These chemicals will be managed by Department of Consumer and Employment Protection (WA) (DoCEP) under the *Dangerous Goods Safety Act (2004).*

8.2 Purpose

The purpose of the chemical management plan is to ensure safe management of transport, storage and use of chemicals at the plant site to prevent any safety or environmental incidents.

8.3 Performance Indicators

Performance will be demonstrated by:

1. Compliance with the prescribed key management actions.

8.4 Management Actions

8.4.1 Prior to Operation

1. All chemicals will be stored in areas designed to applicable Australian Standards and regulatory requirements.

8.4.2 Chemical Storage

2. All licenses required by the Chief Inspector of the DoCEP under the *Dangerous Goods Safety Act (2004)* will be obtained prior to any storage or use of any dangerous goods.
3. Liquid dangerous goods will be stored in a bunded area capable of containing 110% of the volume. For packaged liquid dangerous goods (goods in a number of smaller containers), the goods shall be stored in a covered bunded area capable of containing 110% of the volume of the largest container.
4. Where practicable, dangerous goods will be stored in minimum quantities to minimise the environmental impact if spillage occurs.
5. Incompatible dangerous goods will be segregated.

8.4.3 Record Keeping

6. Material Safety Data Sheets (MSDS) will be maintained for each dangerous good stored on site. The MSDS will be located outside of the compound in which the material is stored. The compound will be placarded in accordance with the DoCEP's *Guidance Note for Placarding*.
7. Deliveries of dangerous goods will only be accepted if they are accompanied by the relevant MSDS, or, if there is an existing and current MSDS for that dangerous good already held on the site.
8. A Dangerous Goods Log(s) will be maintained for all dangerous goods held on the site. The Log(s) will be stored in a secure location at the site entrance or in the main office. The Log(s) will identify the:

a. date on which the goods were received.
b. location(s) at which the goods are stored.
c. volume/quantity stored at each location.
d. date and volume/quantity removed whenever goods are removed from storage.
e. name of the person(s) receiving/removing goods to/from storage on each occasion.

A site plan that identifies the storage location of each dangerous good will accompany the Log.

8.4.4 Safety

9. Measures will be put in place to prevent unauthorised access to dangerous goods.
10. As standard practice, ignition sources (e.g. welding equipment, cigarettes, lighters) will be prohibited within any compound storing dangerous goods.

8.4.5 Training

11. All relevant operations staff will be trained on identification, storage and handling procedures for dangerous goods. Staff will also be trained on response procedures (including use of Spill Response Kits) for accidents and incidents and emergencies involving dangerous goods.

8.4.6 Accidents, Incidents and Emergencies

12. A Spill Response Kit will be installed and maintained for the clean-up and containment of spills to land or water. Each spill kit will contain as a minimum:
    a. universal absorbent pads or pillows or blankets.
    b. labelled plastic contaminated waste bags.
    c. safety gloves.

    Contaminated material from a spill will be disposed of in accordance with the Waste Management Plan.
13. The Chief Inspector of DoCEP will be notified of any accident involving dangerous goods.
14. FESA will be notified of any incident involving dangerous goods that has had, or has the potential to, have a significant impact on the environment or human safety.
15. DEC will be notified of any incident involving dangerous goods that has had, or has the potential to, have a significant impact on the environment.

8.5 Contingency Actions

No contingency actions are proposed**.**

8.6 Related Plans

Waste Management Plan

8.7 Relevant Legislation

1. *Environmental Protection Act 1986*
2. *Dangerous Goods Safety Act (2004)*
3. *Dangerous Goods (Transport) Act 1998*
4. *Occupational Safety and Health Act 1984*

9.0 Waste Management Plan

9.1 Context

Operational works will produce a range of liquid and solid wastes. These wastes include:

- site office paper, packaging and domestic wastes
- thickened sludge from media filter backwash
- desalination effluent discharge.

Inappropriate waste disposal has the potential to contaminate soil, surface water or groundwater and affect visual amenity.

Management of the desalination effluent is addressed in the Whole Effluent Toxicity Testing Management (section 4.0), Diffuser Performance Monitoring (section 5.0), Discharge Water Quality Monitoring(section 6.0) and Benthic Habitat Monitoring (section 7.0) plans.

9.2 Purpose

The purpose of the Waste Management Plan is to outline management actions to:

1. reuse waste materials where possible;
2. recycle wastes where practicable; and
3. dispose of waste streams in an acceptable manner.

9.3 Performance Indicators

Performance will be demonstrated by:

1. Compliance with the prescribed management actions.

9.4 Management Actions

9.4.1 General Office Waste

1. Separately marked waste bins will be provided for:

CATEGORY	DISPOSAL
General wastes.	Dispose on-site in a covered bin to prevent attraction of vermin. Bulk disposal offsite to landfill.
Recyclables (generally glass, paper and plastics).	Bulk dispose offsite to the nearest recycling facility. May be disposed of to landfill if a facility does not exist within 50km of the site[1].

9.4.2 Thickened Sludge from Media Filter Backwash

2. If alternative uses cannot be found for the thickened sludge, it will be disposed of to an appropriate Class III landfill pursuant to the Landfill Waste Classification and Waste Definition (DoE, 2005).

3. The composition of the thickened sludge will be tested prior to disposal to ensure that it meets Class III criteria.

9.5 Additional Information

[1] Waste Bins

General wastes and recyclables may be mixed (i.e. one bin used) if they are subsequently separated at a recycling facility.

9.6 Contingency Actions

The following actions will be undertaken if wastes are not appropriately disposed:

1. investigate the cause
2. alter management actions, if required.

9.7 Related Plans

Chemical and Dangerous Goods Management Plan

9.8 Relevant Legislation

1. *Environmental Protection Act 1986*
2. *Dangerous Goods Safety Act (2004) 1961*
3. *Dangerous Goods (Transport) Act 1998*
4. *Occupational Safety and Health Act 1984*
5. *Waste Avoidance and Resource Recovery Act 2007*

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Legislation referred to in the OEMF can be accessed via the State Law Publisher website at *http://www.slp.wa.gov.au.*

Appendix 1 – Water Corporation Environmental Policy

Introduction

The Water Corporation provides essential water, wastewater and drainage services to the people of Western Australia. We take water from the environment and return drainage water and treated wastewater and its by-products back into the environment.

In doing this, we aim to provide sustainable, safe and reliable water services to customers and the community.

This policy applies to the Statewide operations of the Water Corporation, which includes all activities, services and products provided by the Corporation to its customers, in accordance with its operating licence.

All employees, and where practicable, 'second parties' (Water Corporation agents, alliance participants, contractors and suppliers) will comply with and support implementation of this policy.

Commitment

The Corporation is committed to:

- playing a leading role in the sustainable future of Western Australia's water resources;
- compliance with applicable environmental legal requirements and with other environmental requirements to which the Corporation subscribes;
- preventing pollution and minimising the adverse effects of our activities; and
- excellence and continual improvement in environmental performance, including conserving natural resources and ecological systems and enhancing them where practicable.

How

Our commitments will be met by:

- providing appropriate services, resources and infrastructure to meet our stated objectives;
- identifying, assessing and managing our environmental risks;
- developing and implementing environmental improvement programmes with measurable targets;
- regularly reviewing and auditing our environmental systems and performance;
- developing and maintaining appropriate incident response plans and minimising the adverse environmental consequences of any accidents; and
- promoting efficient use of resources and minimisation of waste.

Our Environmental Management System provides the framework for developing, implementing, monitoring and reviewing our environmental objectives, targets and actions.

PCY230 Environmental Policy
31 October 2007
CDMS#: 375822

Peter D Moore
Chief Operating Officer