

# Alkimos

Wastewater Treatment Plant  
– Public Environmental Review



November 2005

# Alkimos

## Wastewater Treatment Plant – Public Environmental Review



**Invitation to Make a Submission**

**Executive Summary**

**Public Environmental Review Document:**

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# Alkimos

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**Invitation to  
Make a Submission**



## Invitation to make a submission

The Environmental Protection Authority (EPA) invites people to make a submission on this proposal. If you are able to, electronic submissions e-mailed to the EPA Service Unit project officer would be most welcome.

The Water Corporation of Western Australia proposes to construct a Wastewater Treatment Plant (WWTP) at Alkimos. Treated wastewater will be disposed of through an ocean outlet, extending approximately 3.5km offshore from the coast adjacent to the WWTP.

In accordance with the Environmental Protection Act, a Public Environmental Review (PER) has been prepared which describes this proposal and its likely effects on the environment.

The PER is available for a public review period of 10 weeks from 14 November 2005, closing on 23 January 2006.

Comments from government agencies and from the public will assist the EPA to prepare an assessment report in which it will make recommendations to government.

### Where to get copies of this document

Printed copies of this document may be obtained from:  
Barbara Jones  
629 Newcastle Street  
LEEDERVILLE WA 6007  
Phone: 9420 2182  
e-mail: [barbara.jones@watercorporation.com.au](mailto:barbara.jones@watercorporation.com.au)

Hard copies of the PER may be purchased at a cost of \$10, or a CD-ROM version will be provided free of charge by the Water Corporation.

An electronic copy of the PER and associated consultant reports are available from the Water Corporation website at:  
[http://www.watercorporation.com.au/community/community\\_alkimos\\_environment.cfm](http://www.watercorporation.com.au/community/community_alkimos_environment.cfm)

### Why write a submission?

A submission is a way to provide information, express your opinion and put forward your suggested course of action - including any alternative approach. It is useful if you indicate any suggestions you have to improve the proposal.

All submissions received by the EPA will be acknowledged. Submissions will be treated as public documents unless provided and received in confidence subject to the requirements of the Freedom of Information Act, and may be quoted in full or in part in each report.

### Why not join a group?

If you prefer not to write your own comments, it may be worthwhile joining with a group or other groups interested in making a submission on similar issues.

Joint submissions may help to reduce the workload for an individual or group, as well as increase the pool of ideas and information.

If you form a small group (up to 10 people) please indicate all the names of the participants. If your group is larger, please indicate how many people your submission represents.

### Developing a submission

You may agree or disagree with, or comment on, the general issues discussed in the PER or the specific proposals. It helps if you give reasons for your conclusions, supported by relevant data. You may make an important contribution by suggesting ways to make the proposal environmentally more acceptable

When making comments on specific proposals in the PER:

- clearly state your point of view;
- indicate the source of your information or argument if this is applicable; and
- suggest recommendations, safeguards or alternatives.

### Points to keep in mind

By keeping the following points in mind, you will make it easier for your submission to be analysed:

- Attempt to list points so that issues raised are clear. A summary of your submission is helpful;
- Refer each point to the appropriate section, chapter or recommendation in the PER;
- If you discuss different sections of the PER, keep them distinct and separate, so there is no confusion as to which section you are considering;
- Attach any factual information you may wish to provide and give details of the source; and
- Make sure your information is accurate.

### Remember to include:

- your name;
- address;
- date; and
- whether you want your submission to be confidential.

The closing date for submissions is: 23 January 2006.

Submissions should ideally be emailed to:

[Jaclyn.Goad@environment.wa.gov.au](mailto:Jaclyn.Goad@environment.wa.gov.au)

OR addressed to:  
Environmental Protection Authority  
PO Box K822  
PERTH WA 6842  
Attention: Jaclyn Goad

More information on how to make a submission can be obtained from the free pamphlet, "Environmental Impact Assessment – How to Make a Submission" available from the Environmental Protection Library, telephone: (08) 9222 7127, or by calling the Project Officer, Jaclyn Goad on (08) 9222 8642.

# Alkimos

## Wastewater Treatment Plant – Public Environmental Review



### Executive Summary



# Executive Summary

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## Executive Summary

### Development Overview

In the 1970s the Water Corporation of Western Australia (Water Corporation) identified the need for a wastewater treatment plant (WWTP) north of the Beenyup WWTP, to service the planned continued residential growth in Perth's metropolitan North West Corridor. Projected growth in the Alkimos wastewater catchment indicates that approximately 60 million litres per day (ML/d) of wastewater will require treatment at the Alkimos Waste Water Treatment Plant (AWWTP) by 2040. Ultimately, plant inflows could grow to 160ML/d.

A major consideration for the Water Corporation in siting the new wastewater scheme in a coastal location is securing the advantage of a gravity system. Such a system avoids the pumping of wastewater to the treatment plant, with the associated high energy demands in perpetuity and the emergency overflow issues associated with failure of the system pumps and power supplies. Examination of a range of options also indicated that incorporation of an ocean outlet is critical to secure long-term wastewater planning for the northern corridor.

### Location

Alkimos is located approximately 40km north-west of the Perth CBD in the North West Corridor north of Quinns Rock beach and south of Yanchep beach. The proposed wastewater treatment plant and ocean outlet at Alkimos will be constructed in the Coastal Ward of the City of Wanneroo.

The existing coastal environment in the vicinity of the proposed works consists largely of vegetated or partially vegetated sand dunes (Quindalup and Spearwood Dunes System) and sandy, relatively wide beaches.

Alkimos has a Mediterranean climate being semi-arid with wet mild winters and warm dry summers. The prevailing wind direction is southerly to south westerly but with a strong easterly component in summer (mornings). The area is known for high quality sandy beaches enjoying clear, clean waters and moderately sheltered wave conditions.

### Site for the WWTP

The Water Corporation is proposing two sites. Site A is located between 300 to 1000 metres from the Alkimos shoreline behind the foredunes. Site B is located between 1000 and 1700 metres from the coast at a higher point in the landscape. One site will be implemented.

Site A is shown in the current Metropolitan Regional Scheme (MRS). Site B is depicted in the MRS

Amendment No. 1029/33 currently under consideration by the EPA.

In February 2004, the Alkimos Wastewater Treatment Works Coordinating Committee (Lot 101 Committee) was established. This enabled stakeholders to discuss the key planning issues in the Alkimos area including the location of the AWWTP. In conjunction with developers LandCorp and Alkimos Development Pty Ltd (Developers) and DPI, it was resolved to pursue Option B with Option A remaining as a fall back position should any environmental, technical or commercial impediments be identified with Option B.

### Scope of the Proposal

The proposal involves the construction, operation and maintenance of a WWTP at Alkimos, to be developed in stages up to an operational capacity of 160 ML/day beyond 2050. It involves the associated treated waste water disposal strategy via an ocean outlet, with future opportunities for wastewater re-use.

The Water Corporation now proposes to construct Stage 1 of the AWWTP at site B, with an ocean outlet. Site B was chosen as the agreed site for the AWWTP so that the land most desirable for urban development, to the west, could be available for residential development and the development of the beach as a regional focal point. Site A is an alternative if Site B proves unsuitable

The review of Site A is being conducted under assessment number 1582 and Site B assessment number 1529. Comparative tables are presented, as required by the environmental assessment process, to enable the EPA to fulfil its requirements in providing ministerial advice.

### Key Environmental Factors

Key Environmental Factors requiring consideration in the Public Environmental Review (PER) are presented in Table ES.1.

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The Environmental Protection Authority (EPA) has identified the following key environmental factors (Table ES.1) including objectives, for the Alkimos project. The potential impacts, proposed environmental management and predicted outcomes for these factors are included.

**Table ES.1 Environmental Factors and Management**

Environmental Factor	EPA Objective	Existing Environment	Potential Impact	Environmental Management	Predicted Outcome
<b>Principles of Environmental Protection</b>					
Precautionary Principle	<ul style="list-style-type: none"> <li>• To avoid serious or irreversible damage to the environment; and</li> <li>• To assess a risk-weighted consequence of proposed options.</li> </ul>	Sites A and B are located in an area of high ecological biodiversity and geohieritage significance. Site A is located predominantly on undefined geological units of Quindalup Dunes over Spearwood Dunes surrounded by the second (Q3) phase of the Quindalup system. Site B is located further east and higher in the landscape at the intersection of the second (Q3) and third phases (Q2) of the Quindalup geological sequences.	Site A will have limited impact on the dune system. The works associated with Site B will interrupt the interface between the second (Q3) and third phases (Q2) of the Quindalup Dune system and the linkages between the vegetation associations dependent upon them.	The Water Corporation will, as far as practicable, minimise the ecological footprint of its development, and offer to the conservation estate areas identified as of high ecological value within its buffer zone to augment/complement those identified in the MRS amendment.	<p>Geohieritage and ecological associations will be significantly impacted by both sites.</p> <p>Site A offers greater conservation opportunities in maintaining continuity of the geohieritage phases and their associated ecological communities associated with Q1, Q3 and Q4.</p> <p>Site B offers conservation opportunities in maintaining continuity of the geohieritage phases and their associated ecological communities associated with Q1, Q2 and Q3 to a lesser extent.</p>

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Environmental Factor	EPA Objective	Existing Environment	Potential Impact	Environmental Management	Predicted Outcome
		<p>The AWWTP will be in reasonable proximity to housing and urban development consistent with the Metropolitan Region Scheme.</p>	<p>The use of Site A results in the commercial and retail node and associated urban development proposed within the south west corner of the buffer not being able to be built as planned. This will significantly impact on the regional beach development proposed in the area and, in addition, reduce the amenity of the beach as a regional focal point. A lesser developed beach front (i.e. kiosks, surf clubs, etcetera) within the Site A buffer would remain compatible. The beach itself will be suitable for recreational use for both Site A and B.</p>	<p>The Water Corporation will establish, maintain and manage a buffer around the AWWTP.</p>	<p>Site B offers the opportunity for housing and commercial development to the west of the site in closer proximity to the coast. This would enable the proposed regional beach development proposed in the area.</p>

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Environmental Factor	EPA Objective	Existing Environment	Potential Impact	Environmental Management	Predicted Outcome
Intergenerational Equity	<ul style="list-style-type: none"> <li>To ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.</li> </ul>	<p>The Alkimos region is one of high biodiversity and ecological function.</p> <p>The AWWTP will be infrastructure with a large footprint and high energy demands in relatively close proximity to residential development.</p>	<p>The construction of the AWWTP and the associated ocean outlet will require the clearing 23.2 ha for Site A or 28.2 ha for Site B (see Table 4.2, launch site 1B).</p> <p>High energy consumption, greenhouse gas emissions and odour impacts, growing into the future as the plant capacity expands.</p>	<p>The Water Corporation will, as far as practicable, minimise the ecological footprint of its development.</p> <p>The Water Corporation will:</p> <ul style="list-style-type: none"> <li>reduce long term energy consumption through gravity conveyancing and TWW disposal to the ocean;</li> <li>reclaim and reuse wastewater as far as practicable; and</li> <li>build the wastewater system to achieve the lowest whole of life cost by reducing dependence on energy consumption and make provision for the recovery of energy from the treatment process.</li> </ul>	<p>The environmental health, diversity and productivity of the area will be significantly altered by the urban development and the AWWTP. The buffer offers some limited opportunity (in an Island Biogeographical sense) for maintenance of the ecological systems for future generations.</p> <p>Energy consumption and resultant emissions will be as low as reasonably practicable.</p>
Conservation of Biodiversity and Ecological Integrity	<ul style="list-style-type: none"> <li>To conserve biological diversity and ecological integrity.</li> </ul>	<p>The Alkimos region is one of high biodiversity and ecological function supporting Priority Three flora species and a number of reptiles, birds and mammals of conservation significance (see Flora and Fauna, below).</p>	<p>The construction of the AWWTP and the associated ocean outlet will require the clearing 23.2 ha for Site A or 28.2 ha for Site B (Table 4.2, launch site 1B) and the removal in part or full flora and vegetation systems and fauna habitat.</p>	<p>The Water Corporation will, as far as practicable, minimise the ecological footprint of its development, and offer to the conservation estate areas identified as of high ecological value within its buffer zone to augment/complement those identified in the MRS amendment.</p>	<p>The biological diversity and ecological integrity of the Alkimos area will be significantly disrupted by the urban development and the AWWTP. The buffer offers some limited opportunity for conservation of the ecological systems for future generations.</p>

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Environmental Factor	EPA Objective	Existing Environment	Potential Impact	Environmental Management	Predicted Outcome
Valuation, pricing and Incentives	<ul style="list-style-type: none"> <li>To ensure environmental factors have been included in the valuation of assets and services;</li> <li>To ensure that the "polluter pays" principle is applied in the containment, avoidance or abatement of pollution;</li> <li>To ensure the users of goods and services (including the use of natural resources and assets) pay for the full life cycle costs of their provision; and</li> <li>To ensure that the achievement of environmental goals be pursued in the most cost effective manner.</li> </ul>	<p>Competing values of urban development and environmental protection in the Northwest Corridor exist. Although the Alkimos region is one of high biodiversity and ecological function, it is equally of high value for development to provide for social and economic vibrancy.</p>	<p>Some of the disrupted environmental values will be off-set by community benefit and economic vibrancy in the region.</p>	<p>The balance between environmental values and development of the Alkimos region will be determined by the MRS Amendment 1029/33.</p> <p>The Water Corporation:</p> <ul style="list-style-type: none"> <li>has undertaken a whole of life economic assessment of the AWWTP as part of its Capital Investment Program;</li> <li>routinely funds the installation of new, pollution prevention technologies for WWTP systems, and clean-up and repair of incidents as they occur;</li> <li>applies the tariffs for provision of wastewater treatment services as set by Government; and</li> <li>will locate, design and install the wastewater treatment and conveyancing system according to best industry standards.</li> </ul>	<p>The attainment of environmental goals through site selection, design, construction and operation of the WWTP will be as cost effective as possible in the context of the MRS amendment.</p>

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Environmental Factor	EPA Objective	Existing Environment	Potential Impact	Environmental Management	Predicted Outcome
Waste Minimisation	<ul style="list-style-type: none"> <li>To take all reasonable and practicable measures to minimise the generation of waste and its discharge to the environment.</li> </ul>	<p>Sewage volumes to the AWWTP are population based. Real opportunities do not exist for the Water Corporation to control the volume. However opportunities exist for wastewater and biosolids re-use, and energy recovery, dependent upon regulatory and policy settings and size of the plant.</p>	<p>Failure to explore and implement waste recovery and reuse will put an increasing burden upon the receiving environment (ocean, air-shed and land) in the context of diminishing space and social acceptability.</p>	<p>The Water Corporation will:</p> <ul style="list-style-type: none"> <li>undertake several pilot projects (e.g. Managed Aquifer Recharge) to assess the viability a of re-use opportunities and implement them as soon as the technical, environmental, public health, political and societal acceptability is established;</li> <li>manage and monitor the reuse of Bio-solids in accordance with the Western Australian Guidelines for Direct Land Application of Bio-solids and Bio-solids Products as required by Part V Environmental Licences; and</li> <li>reclaim biogas for electricity generation as the scale of the plant increases.</li> </ul>	<ul style="list-style-type: none"> <li>Reduction in treated waste water (TWW) to the ocean with commensurate reduction in demand on the integrated water supply system.</li> <li>Reduction of biosolids to landfill.</li> <li>Reduction in biogas emissions.</li> <li>Reduction in energy demand from third parties</li> </ul>

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Environmental Factor	EPA Objective	Existing Environment	Potential Impact	Environmental Management	Predicted Outcome
<b>Biophysical</b>					
Flora and Vegetation (terrestrial)	<ul style="list-style-type: none"> <li>To maintain the abundance, diversity, geographic distribution and productivity of flora and vegetation communities.</li> </ul>	<p>The Alkimos region is one of high biodiversity and ecological function supporting Priority Three flora species including:</p> <ul style="list-style-type: none"> <li><i>Astroloma microcalyx</i>;</li> <li><i>Conostylis pauciflora</i>;</li> <li><i>Sarcozona bicarinata</i>;</li> <li><i>Hibbertia spicata</i>; and</li> <li><i>Stylidium maritimum</i></li> </ul> <p>Twelve Floristic Community Types are inferred, including FCT 26a.</p> <p>Four vegetation units on Limestone might be considered significant because they are poorly represented locally or regionally being:</p> <ul style="list-style-type: none"> <li><i>Frankenia pauciflora</i> Very Low to Low Shrubland;</li> <li><i>Melaleuca huegelii-M.systema</i> Low Shrubland to Open Low Heath;</li> <li><i>Melaleuca huegelii-Dryandra sessilis</i> Open Low Heath; and</li> <li><i>Melaleuca huegelii-M.systema-Dryandra sessilis</i> Open Heath to Low Shrubland</li> </ul> <p>No declared rare flora (DRF) species were recorded for Site A or Site B.</p>	<p>The construction of the AWWTP and the associated ocean outlet will require the clearing 23.2 ha for Site A or 28.2 ha for Site B (see Table 4.2, launch site 1B).</p> <p>Clearing will lead to loss of flora and fauna habitat.</p>	<p>The AWWTP at Site A is not expected to have any impact on the Priority Three species as both are common and widespread in the locality. At Site B no priority species are affected, however loss of a unique <i>Nuytsia florabunda</i> Closed Low Heath and <i>Banksia and Xanthorrhoea</i> Low Woodlands may remove important habitat (see Fauna below)</p>	<p>The development of the AWWTP will impact upon flora and vegetation. Limited conservation opportunities within the odour buffer for representative communities and species exist in the context of the proposed regional development.</p>

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Environmental Factor	EPA Objective	Existing Environment	Potential Impact	Environmental Management	Predicted Outcome
Fauna (terrestrial)	<ul style="list-style-type: none"> <li>To maintain the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels.</li> </ul>	<p>The Alkimos region is one of high biodiversity and ecological function possibly supporting a number of reptiles, birds and mammals of conservation significance.</p> <p>Reptiles include:</p> <ul style="list-style-type: none"> <li>are the carpet python (Level 1);</li> <li>the black striped snake (Level 2); and</li> <li>seven other reptiles (Level 3).</li> </ul> <p>Birds include:</p> <ul style="list-style-type: none"> <li>Carnaby's Black Cockatoo (Level 1) potentially triggering the EPBC Act; and</li> <li>Peregrine Falcon (Schedule 4).</li> </ul> <p>Mammals include:</p> <ul style="list-style-type: none"> <li>possibility of the Chudich being present as a vagrant (Level 1);</li> <li>Western Brush Wallaby (Level 2, Priority 4); and</li> <li>Quenda (Level 2, Priority 5)</li> </ul>	<p>The construction of the AWWTP and the associated ocean outlet will require the clearing of 23.2 ha for Site A or 28.2 ha for Site B (Table 4.2, launch site 1B). Both Sites will result in the reduction or loss of potentially important habitat. Of particular concern is the reduction or loss of habitat for species of Conservation Value Level 1.</p>	<p>The Corporation recognises the potential to minimise impact on fauna and habitat, and to contribute to regional protection of fauna through its management planning for buffer zone land it will control. The Corporation is also proposing to conserve bush areas of Banksia woodland and the Dryandra sessilis thickets where practicable that are known to be feeding grounds for Carnaby's Cockatoo, a protected fauna species.</p>	<p>Conservation of fauna habitat and linkages to the maximum extent possible in the context of the MRS amendment.</p>

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Environmental Factor	EPA Objective	Existing Environment	Potential Impact	Environmental Management	Predicted Outcome
Geophysical					
Geo-heritage	<ul style="list-style-type: none"> <li>To minimise impact on identified geoheritage values and their associated flora and fauna communities within the buffer of the AWWTP and augment any conservation values identified within the Metropolitan Region Scheme.</li> </ul>	The coastal dune formations in the Alkimos area have been identified as having national and world geo-heritage significance. The WWTP at Site A or B, the ocean outlet assembly and launch facility, site excavation spoil disposal, and the associated infrastructure have the potential to adversely impact on the dune system landform.	Site A will have limited impact on the dune system. The works associated with Site B will interrupt the interface between the second (Q3) and third phases (Q2) of the Quindalup Dune system and the linkages between the vegetation associations dependent upon them.	Management of the respective odour buffer zones offers an opportunity to conserve portions of the nested parabolic dune system.	<p>Geoheritage and ecological associations will be significantly impacted by both sites.</p> <p>Site A offers greater conservation opportunities in maintaining continuity of the geoheritage phases and their associated ecological communities associated with Q1, Q3 and Q4.</p> <p>Site B offers conservation opportunities in maintaining continuity of the geoheritage phases and their associated ecological communities associated with Q1, Q2 and Q3 to a lesser extent.</p>

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Environmental Factor	EPA Objective	Existing Environment	Potential Impact	Environmental Management	Predicted Outcome
<b>Marine Environment</b>					
Marine ecosystem (Sediment, benthic habitat and water column).	<ul style="list-style-type: none"> <li>To maintain the abundance, diversity, geographic distribution and productivity of the marine ecosystem around the Alkimos Ocean Outlet (AOO).</li> </ul>	The Alkimos coastal environment consists of sandy beaches, exposed reef structures lying within a relatively stable coastline with parallel reef structures in a reasonably remote area of the coastline.	<ul style="list-style-type: none"> <li>Construction of the pipeline, and discharge of treated wastewater has the potential to elevate nutrients, toxins and bacteria in proximity to the outlet and hence increase productivity of the benthic habitat, algae and phytoplankton within the vicinity of the affected areas.</li> <li>Possible loss of marine habitat due to the construction of the ocean outlet depending upon option taken (i.e. tunnelling).</li> <li>Adverse impact on water quality and the long term "health" of benthic habitats.</li> <li>Possible breaches in the social values identified for the coastal waters in the Alkimos region.</li> </ul>	<p>The Water Corporation will develop the Alkimos Marine Monitoring and Management Plan which will :</p> <ul style="list-style-type: none"> <li>identify environmental values to be met;</li> <li>establish and spatially define environmental quality objectives (EQOs);</li> <li>define the levels of protection for ecosystem health;</li> <li>specify monitoring and management regimes to ensure the EQOs are met;</li> <li>specify surveys , their frequency and parameters for investigation;</li> <li>specify reporting and review procedures and frequency; and</li> <li>specify intervention strategies to manage upset or non-compliant conditions.</li> </ul> <p>The Water Corporation will identify and maintain management zones for nutrients and toxicants around the AOO. The Water Corporation will operate the AWWTP such that all nutrient and toxicant related criteria are met.</p>	<p>All E2 (high protection area) nutrient related criteria will be met at the boundary of the Management Zone (see Figure 4.17).</p> <p>All E2 toxicant criteria will be met at the boundary of the Mixing Zone for toxicants (see Figure 4.18)</p>

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Environmental Factor	EPA Objective	Existing Environment	Potential Impact	Environmental Management	Predicted Outcome
<b>Pollution Management</b>					
Air quality (odour)	<ul style="list-style-type: none"> <li>To ensure that odour emissions do not adversely affect environmental values or the health, welfare and amenity of people and land-uses.</li> </ul>	<p>The AWWTP will be located within the Alkimos Dune system. At Site A, modelling suggests an odour buffer of 600m will be sufficient. Similarly, at Site B an odour buffer of 600 m, supplemented with an extra 200m to the west and north-west to take into account the odour "ponding" phenomenon is required.</p>	<p>Wastewater arriving at the AWWTP will be odorous. Uncontrolled, this could lead to a high rate of emission of odours from the treatment plant. Unmanaged odours emitted from the AWWTP, would have the potential to adversely impact on the amenity of occupants and users of land surrounding the plant.</p>	<p>The Water Corporation will manage odours from the WWTP by:</p> <ul style="list-style-type: none"> <li>siting and designing the AWWTP to minimise odour impacts from the plant on surrounding land-uses as far as practicable, using best practice odour emission control design and operation;</li> <li>delineating and managing an odour buffer zone and permitting only compatible land-uses within the buffer, through Water Corporation ownership and control of the buffer; and</li> <li>achieving agreed odour criteria within the odour buffer.</li> </ul>	<p>Extent and distribution of odour and the resultant size and shape of an amenity buffer will ensure no unacceptable odour exposures.</p>

## Key Characteristics

The AWWTP development will be staged in modules, ahead of demand forecast to be placed upon it. It must be recognised that wastewater treatment technology and potentially the site layout is likely to evolve over the life of this facility as it develops.

The notional staging is identified in the key characteristics of Sites A and B (see Table ES.2). Estimates of the staged demand are based on current population growth projections (Auret 2004).

**Table ES.2 Key Characteristics Table Sites A and B**

Characteristic	Site A		Site B																	
<b>Indicative life of project</b>	Staged capacity to be implemented for both sites as follows: <table border="1"> <thead> <tr> <th>Indicative Timing</th> <th>Installed Capacity (ML/d) of inflow</th> </tr> </thead> <tbody> <tr> <td>2009/10</td> <td>10</td> </tr> <tr> <td>2020</td> <td>40</td> </tr> <tr> <td>2030</td> <td>60</td> </tr> <tr> <td>2040</td> <td>80</td> </tr> <tr> <td>2050</td> <td>120</td> </tr> <tr> <td>Beyond 2050</td> <td>160</td> </tr> </tbody> </table>						Indicative Timing	Installed Capacity (ML/d) of inflow	2009/10	10	2020	40	2030	60	2040	80	2050	120	Beyond 2050	160
Indicative Timing	Installed Capacity (ML/d) of inflow																			
2009/10	10																			
2020	40																			
2030	60																			
2040	80																			
2050	120																			
Beyond 2050	160																			
<b>Treatment process</b>	Wastewater will be treated to an advanced secondary standard most likely based upon the activated sludge process similar to that recently constructed at Woodman Point WWTP, achieving a high degree of nitrogen removal. Additional treatment processes will be utilised to make the treated wastewater "fit for purpose" for disposal and re-use opportunities as and when they become available/viable. Odours will be vented via an approximately 50m tall stack.																			
<b>Treated wastewater quality (annual average)</b>	<b>2009</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>Beyond 2050</b>														
BOD <sup>1</sup> (mg/L)	20	20	20	20	20	20														
Suspended solids (ss) (mg/L)	30	30	30	30	30	30														
Total nitrogen (TN) (mg/L)	7	8	9	10	15	15														
Total phosphorus (TP) (mg/L)	12	12	12	12	12	12														
Thermo-tolerant coliforms (cfu/100ml)	10 <sup>5</sup>	10 <sup>5</sup>	10 <sup>5</sup>	10 <sup>5</sup>	10 <sup>5</sup>	10 <sup>5</sup>														
<b>Treated wastewater disposal</b>	<p><b>Ocean outlet</b> Discharge up to 40ML/d advanced secondary treated wastewater beyond 2009. Duplication of the outlet may be required in the future, dependent upon availability of other disposal/reuse options at that time.</p> <p><b>Dilutions</b> The average dilution of the wastewater stream in the ocean will be at least 1:300 with the dilution being above 1:200 99% of the time within 100m of the AWWTP Ocean Outlet diffuser</p>																			
<b>Toxicant concentrations</b>	Projected loads and flows will result in toxicant concentrations meeting the ANZECC & ARMCANZ 80% species protection guideline values for bio-accumulating toxicants within 100m of the AWWTP Ocean Outlet diffuser and meeting the ANZECC & ARMCANZ 99% species protection guideline values for bio-accumulating toxicants beyond 100m from the AWWTP Ocean Outlet Diffuser.																			
<b>Water reclamation and re-use</b>	<p><b>Managed aquifer recharge (MAR) (up to 120ML/d)</b> Up to 75% of the volume of treated wastewater from the AWWTP can be reclaimed through advanced treatment technologies such as Reverse Osmosis (RO).</p> <p><b>Ocean outlet (up to 40ML/d)</b> The remaining 25% (up to 40ML/d) of the volume of the treated wastewater, containing the excess treated wastewater from the AWWTP and the concentrate from the advanced treatment technologies utilised will require disposal to the ocean.</p>																			
<b>Power requirements</b>	3 MW (ultimate)																			
<b>Power source</b>	Western Power grid																			
<b>Volume of excavation</b>	180,000 cubic metres			3,000,000 cubic metres																
<b>Clearing of vegetation required</b>	WWTP site (including batters) 15ha Ocean outlet launch Site 1B <sup>2</sup> 6.6ha Access roads within buffer 0.8ha Haul roads within buffer 0.0ha Quinns sewer route-within buffer to WWTP 0.85ha <b>Total for WWTP 23.2ha</b>			19ha 6.6ha 0.7ha 1.3ha 0.6ha <b>28.2ha</b>																
<b>Odour buffer</b>	600m. Majority of western portion of buffer located over ocean. No housing planned to the west of the site.			Minimum of 600m to the north, east and south; 800m to the north west and west due to the "ponding" phenomenon. <sup>3</sup>																

<sup>1</sup> biological oxygen demand

<sup>2</sup> preferred launch site

<sup>3</sup> there may be potential to reduce the buffer to the south east to 450m and depending upon possible engineering solutions, the 800m to 600m

## Treatment Processes

The development of the AWWTP will be in stages, ahead of the forecast demand. It must be recognised that wastewater treatment technology and potentially the site layout are likely to evolve with process advances as the facility develops. The design for the first stage is subject to finalisation and flexibility needs to be maintained to meet odour and other environmental and process requirements. At this point in time all or some of the following processes are envisaged:

- screening and grit removal tanks at the eastern end of the site;
- primary sedimentation tanks;
- secondary treatment by an advanced version of activated sludge (for example by Sequencing Batch Reactors or other process configuration designed to maximise nitrogen removal);
- sludge thickening;
- sludge digesters (anaerobic digestion when primary treatment installed);

- gas engines for energy recovery (when primary treatment installed);
- digested sludge storage tanks;
- a sludge dewatering building, wherein sludge is dewatered using centrifuges (as at the Subiaco, Beenyup and Woodman Point treatment plants);
- treated wastewater balancing lagoons;
- outlet flume, in the west of the site;
- water reclamation plant;
- product-water tank(s); and
- odour control extraction and scrubbing plants, with discharge via vent stacks.

The treatment processes will be re-evaluated at each stage when the capacity of the AWWTP is upgraded.

## Wastewater Treatment Plant Type and Staging

The AWWTP will be based on advanced versions of the activated sludge process and developed in stages over the next 50-100 years. Current inflow projections have been used to develop the following staging strategy, shown in Table ES.3.

**Table ES.3 Notional Staging - Baseline Treatment**

Year	Average Daily Flow (ML/d)	Installed Capacity (ML/d)	Description of Liquid Process	Treated Wastewater Quality as Annual Mean, (mg/L)	Sludge Treatment
2009 /10	6	10	<b>STAGE 1:</b> Inlet works (temporary). Extended aeration activated sludge.	SS < 20 BOD < 30 TN < 7 TP<10	Sludge thickening. Aerobic digestion. Sludge dewatering. Cake to beneficial use.
2020	10	40	<b>STAGE 2:</b> Inlet works (permanent). Extended aeration.	SS < 20 BOD < 30 TN < 8 TP<10	As above
2030	40	60	<b>STAGE 3:</b> Expansion of above processes. Possible introduction of primary treatment step to recover raw sludge for energy recovery and reduce energy consumption in activated sludge process.	As above, except for TN which will increase to 15mg/L if primary treatment step introduced.	As above for biological sludge. Possible introduction of anaerobic digestion for raw primary sludge. Possible introduction of energy recovery.
2040	60	80	<b>STAGE 4:</b> Expansion of above processes.	As above, except for TN which will increase to 15mg/L if primary step introduced.	As above for biological sludge. Probable introduction of anaerobic digestion for raw primary sludge. Probable introduction of energy recovery.
2050	80	120	<b>STAGE 5:</b> Expansion of above processes assumed. Primary treatment. Activated sludge.	SS < 20 BOD < 30 TN < 15 TP<10	Sludge thickening. Anaerobic digestion. Sludge dewatering. Energy recovery.
Ultimate	120	160	Expansion of above processes assumed.	To be determined.	To be determined

## Alkimos Ocean Outlet

As part of this proposal, the Water Corporation intends to:

- construct a land outlet pipeline connecting the AWWTP to the ocean outlet;
- excavate a submarine trench to accommodate an ocean outlet of approximately 3,500m in length. The inner 2000m will be laid sloping downwards, the outer 1500m will follow the profile of the existing seabed;
- install by the bottom-pull method, a 1000mm to 1200mm diameter pipeline;
- backfill the trench to secure pipeline stability and restore the original seabed profile;
- commission, operate, maintain and monitor the ocean outlet in accordance with established asset management plans; and
- maintain access to a launching site for possible future duplication of the ocean outlet. It should be noted that the subsequent site may not coincide with the initial site.

Launch Site 1B is the preferred option to minimise impact on significant vegetation identified at the location. This option will result in the clearing of approximately 6.6ha of vegetation.

The pipeline would be laid at grade or flat through the inner reef, and laid over the middle reef profile to minimise excavation. Two small outlet ports (80mm) would be placed on top of the pipeline at high points in the middle reef (approx 2500m from shoreline) to release air and prevent flotation. This would require excavation up to 5m deep through the inner reef system, and the preparation of a shallow trench up to 2m deep through the middle reef. The pipeline would also be buried from the shoreline where depths are less than 5m to avoid visibility from the land. Trenches would be backfilled to restore reef and seabed profiles.

Hydraulic design considerations determine that a pipeline diameter of 1000mm to 1200mm is required (final sizing will be determined in detailed design phase).

The offshore reef system is the most significant consideration in the construction of an ocean outlet at Alkimos.

**Table ES.4 Summary of Ocean Outlet Characteristics**

Year	Average Daily Flow (ML/d)	TN (mg/L)	Description	Average Daily N Load With No Reuse (kg/d)	N Load With Maximum Reuse	Comment
2009/10	6	7-10 7-10	<b>STAGE 1</b> (proposed): Capacity: 40ML/d Offshore length: 3500m Diffuser depth: 20m Diffuser length: 300m Diffuser ports: 100 of 100mm diameter Initial dilution: 200x	60  (400 kg/d at Stage 1 capacity)	To be determined.	Approval sought for Stage 1 based on maximum Stage 1 capacity. Maximum annual TN load of 150 tonne (based on a mean daily load of 400kg/d).
2030	40	9-10	<b>STAGE 2</b> (if required): Capacity: 80ML/d Offshore length: TBA Diffuser depth: TBA Diffuser length: TBA	400	To be determined.	If further marine disposal required, separate approval will be sought around 6 years before Stage 1 capacity exceeded.
2050	80	15 Primary treatment and energy recovery installed	<b>STAGE 3</b> (if required): Capacity: 160ML/d Offshore length: TBA Diffuser depth: TBA Diffuser length: TBA	1200	To be determined.	As above.
Ultimate	160	15		2400	To be determined.	As above.

## Re-use Options Using Treated Wastewater at AWWTP

The State Government has set a target of 20% recycling of treated wastewater by 2012 in the State Water Strategy, released in February 2003.

There are a number of options to achieve the 20% target, and these can be described under four scheme categories:

- **Category 1 – Industrial**
- **Category 2 – Green Space**  
Irrigation of public parks, golf courses and possibly domestic back gardens.
- **Category 3 – Agricultural**  
Irrigation of agricultural areas.
- **Category 4 – Indirect Potable**  
Use of recycled water to augment scheme water supplies.

The opportunities for water reuse at the AWWTP include:

1. Carabooda market gardens;
2. Environmental benefits;
3. Gngangara Mound;
4. Supply to local community; and
5. Drinking water supplies.

## Infiltration

The Water Corporation seriously considered short term disposal of secondary treated wastewater via infiltration ponds in an environmentally acceptable manner. The Water Corporation has rejected infiltration as an interim option for disposal of treated wastewater due to the uncertainty from modelling surrounding the:

- fate and transport of nutrients to the near shore; and
- probability of exceedance of the high protection (E2) level criteria and protection at the beach.

The Water Corporation is continuing to work with regulators and local stakeholders to define the most sustainable approaches for regional water recycling on the Swan Coastal Plain. Currently reuse options are more suited to the Beenyp WWTP as the initial Treated Wastewater (TWW) flows from Alkimos are minor in comparison. It is clear that further scientific investigations and government policy changes are required before reuse options become viable options for the TWW from the AWWTP.

Managed aquifer recharge and direct reuse will require health, environmental, community and political acceptance and policy change before they become practical.

## Landform and Soils

The landforms and soils shown in the study area are Quindalup Dune system and Spearwood Dune system

units in the buffer areas and Quindalup with some Spearwood in the Footprint Areas (Weston 2005).

There are six Quindalup dune system units in the study area: Q1 (the oldest phase), Q2 (The second oldest phase), Q3 (the third oldest phase), Q4 (the youngest phase), Qp (undulating landscapes with deep calcareous sands overlying limestone) and Qs (undulating landscapes with shallow calcareous sand over limestone with rocky outcrops).

## Flora and Vegetation

### Regional Setting

The Project Area is in the Swan Coastal Plain Biogeographic Region of the South-West Botanical Province (Thackway and Cresswell 1995, and Gioia in Paczkowska and Chapman 2000). The Swan Coastal Plain is the area west of the ranges between, approximately, Jurien, Watheroo and Dunsborough.

### Vegetation Complexes

Hedde *et al.* (1980) shows the vegetation of the Project Area, at a scale of 1:250,000, as Cottesloe Vegetation Complex – Central and South (52) on the Spearwood Dune System and Quindalup Vegetation Complex (55) on the Quindalup Dune System.

### Plant Associations

Beard (1979, 1981) shows, at scales of 1:250,000 and 1:1,000,000, the Project Area's Spearwood vegetation as Banksia Low Woodland (bLi) on limestone and the Quindalup vegetation as Coastal Heath and Thicket ( $a_{26}m_4Zc/a_{23,32}Sc$ ) dominated by *Acacia lasiocarpa*, *A. rostellifera*, *A. cyclops* and *Melaleuca systena*.

### Floristic Community Types

Government of Western Australia (2000, Volume 2, p.30) lists six floristic community types that are centred on Spearwood dunes in the Perth Metropolitan Region and eight that are centred on Quindalup dunes there. The Spearwood floristic community types are 24, 25, 26a, 26b, 27 and 28, and the Quindalup types are 29a, 29b, 20a2, 30c2, 30b, S11, S13 and S14.

### Biodiversity

Griffin 1993, in his study of the flora of the Quindalup Dunes between the Swan and Irwin Rivers, recorded more than 300 native species and many aliens.

A flora and vegetation survey for the project area was undertaken by Syrinx (2005). Six vegetation units, including cleared, were defined and mapped for Site A.

The two Priority Three flora recorded are *Conostylis pauciflora*, which is on slopes of dunes, and *Sarcozona bicarinata*, a few plants of which are on the crest of the limestone hill.

One or two other species of flora listed as significant were also recorded on the limestone hill, the limestone taxa *Grevillea preissii* and, possibly, *Pimelea calcicola*.

No plant taxon listed as Threatened pursuant to Schedule 1 of the *Environment Protection and Biodiversity Conservation Act* (EPBC) was recorded in Site A. In addition, no plant taxon gazetted as Declared Rare Flora (DRF) under the *Wildlife Conservation Act (1950)* was found there or is likely to occur there.

A relatively small population of the Priority Three species *Sarcozona bicarinata* is on the crest of the limestone hill near the centre of Site A, and the Priority Three species *Conostylis pauciflora* is on slopes of dunes around the periphery of Site A.

The Project is not expected to have any significant impact on the Priority Three species, as both species are common and widespread.

Fifteen vegetation units, including cleared, were defined and mapped for Site B. Nine of them are in the Quindalup Dune System, and the other six are in the Spearwood Dune System.

Over 80% of Site B is in the Quindalup Dune System; the remainder, in the eastern part of Site B, is in the Spearwood Dune System.

There are also small areas on the dunes of *Acacia saligna* Scrubs to Heaths (As), *Acacia rostellifera* Heaths (Ar), *Acacia cochlearis* Closed Heath to Open Heath (Ac) and *Nuytsia floribunda* Closed Low Heath and Open Low Woodland (Nf: there are five small trees in the woodland part).

The two Priority Three flora recorded there are *Conostylis pauciflora*, which is on slopes of dunes, and, possibly, *Sarcozona bicarinata*. A few plants of the *Sarcozona* are on the crest of the limestone hill on the eastern boundary, and some may be inside Site B. The non-Priority significant *Lechenaultia linarioides* was found at several locations in Site B.

## Terrestrial Fauna

The vegetation of Site A or Site B and their respective buffers can broadly be described as coastal heathlands and woodlands overlying Quindalup and Spearwood dune systems. Near coastal localities were dominated by heath with gullies of *Acacia* and *Scaevola*, with interior localities supporting climax *Banksia* and *Eucalyptus tottiana* woodland with dense heaths of *Dryandra sessilis*.

Of particular significance are species listed under the WA *Wildlife Conservation Act (1950)*, the Commonwealth *Environment Protection and Biodiversity Conservation Act (1999)*, as priority by CALM, and considered as regionally significant, such

as birds that have declined in the Perth area (Government of Western Australia 2000).

## Potential Issues and Impacts

The major impact will be the loss of vertebrate fauna habitat caused by the clearing of land, which is expected to result in the localised loss of vertebrates that are too small or immobile to relocate to unaffected areas.

### Proposed WWTP Site A

The environment and fauna habitats for Site A are strongly influenced by dunal systems that are of most recent origin close to the coast. The AWWTP lies entirely within Alkimos Lot 101 and supports generally degraded heaths on dunes and broad swales. Weed invasion and degradation are particularly high in the broad swales. Some Tuart trees *Eucalyptus gomphocephala* are located beyond and to the south of the plant. In terms of fauna biodiversity and habitat destruction the clearing of land proposed for the WWTP at Site A is of relatively low significance as the proposed site sits within a swale of cleared, mostly degraded land with some rocky limestone outcrops with low heath which is surrounded by stabilised tertiary dunes known as habitat three (see Section 3.3.4).

### Site A Buffer

The 600m buffer of Site A encompasses a range of habitats from beach and foredunes in a Bush Forever zone, tertiary dunes of the Quindalup system which accounts for the majority of the Site A buffer (approximately 70%), heath with outcropping limestone the next largest habitat (approximately 20%) that is represented in the area and a small area of *Banksia* woodlands on Spearwood sands in the north-east. Levels of degradation and weed invasion in the Quindalup system are higher within this buffer zone than to the north and south.

### Proposed WWTP Site B

Site B is located partially in Lot 101 and Lot 102 and supports generally degraded heaths with burnt *Acacia* shrubland to 1m high. The topography consists of weathered tertiary dunes and broad swales.

### Site B Buffer

At 600m the buffer for Site B overlaps extensively with that of Site A. It includes large areas of Quindalup dunes with moderately degraded vegetation, but includes most of the grove of Tuarts (Bamford 2005). Almost half of this buffer zone incorporates *Banksia* woodlands north of the site.

The extended buffer (800m) to the west takes in Tuarts not included in the 600m buffer, but much of the additional area consists of Quindalup tertiary dunes with moderately degraded vegetation.

The Water Corporation is working with Developers to identify engineering solutions that may enable the buffer at Site B to be brought back to 600m in the future.

## Management Strategy

Although some habitat loss will be inevitable mitigation strategies include the potential to plan development so that some wildlife conservation within the future urban landscape is possible. Some of the buffer zone around the WWTP will be retained with native vegetation from different habitat types to provide a linkage for the fauna to surrounding areas.

## Marine Environment

### Coastal Processes

The construction and operation of the Alkimos ocean outlet is unlikely to significantly impact the coastal processes in the Alkimos nearshore or offshore region.

The energetic coastal environment in the vicinity of the proposed Alkimos ocean outlet will work to dilute and disperse the treated wastewater discharged from the ocean outlet. These conditions will also break down any density stratification potentially produced by the introduction of less dense treated wastewater to the marine environment.

The potential for impacts to the local sediment movement and shoreline stability from the construction and physical presence of the ocean outlet are considered minimal because the pipe will be buried in the beach/intertidal zone.

### Benthic Habitat

The area offshore of Alkimos is undisturbed with regard to dredging or land reclamation works, so there have been no historic losses of Benthic Primary Producer's Habitat (BPPH) within the 50km<sup>2</sup> management unit.

The current coverage of BPPH within the management unit is therefore approximately 41 to 43% of the 50km<sup>2</sup> BPPH management unit consists of vegetated habitats.

The recolonising faunal and algal communities would be similar to those previously found in the area, although seagrass species are unlikely to recolonise this region. Experience with other ocean outlet pipelines in Perth coastal waters is that the pipe will be rapidly colonised by faunal and algal communities found on reef habitat in the region.

The method of pipeline placement and anchoring will greatly affect the direct losses of benthic habitat which occur. The operation of the Alkimos ocean outlet will result in elevated nutrient concentrations in the local area, although significant environmental effects are not expected. The design and location of the diffusers will

determine the area of seabed, and the habitat types, influenced by elevated nutrient concentrations.

Studies of sediment quality conducted for the Perth Long Term Ocean Outlet Monitoring (PLOOM) programme suggest that current ocean outlets operated by the Water Corporation at Sepia Depression, Swanbourne and Ocean Reef have not unacceptably impacted sediment quality adjacent to the outlets. The exposed physical oceanographic setting of the Alkimos ocean outlet, together with the coarse, calcareous sediment characteristics of the area, are likely to aid in the dispersal and further mitigation of any potential sediment quality impacts from the Alkimos ocean outlet.

### Management Zones

Management zones have been generated for the Alkimos ocean outlet. The WA Department of Health is responsible for managing public health in WA's marine waters. This relates specifically to the protection of seafood and primary and secondary contact activities. There is no shellfish harvesting or primary contact recreation in the vicinity of the outlet as such there is no need to set boundaries to manage to meet shellfish harvesting or primary contact criteria.

Because of the different factors of interest, management zones should be broken down into the following categories:

- Nutrient effects; and
- Toxicant effects.

All E2 Environmental Quality Objectives (nutrient related) criteria are expected to be met at the edge of the identified management zones.

Outside of the mixing zone (E4), all E2 ecosystem criteria for toxicants are met.

## Air Quality

### Odour Emissions

The Alkimos region will form part of a large urban waste water catchment to the north and north east of Perth, thus wastewater will travel in the sewers for hours before it reaches the treatment plant. Biological activity in sewage decomposes the organic constituents, generating odorous gas.

Hence, the wastewater arriving at the AWWTP will be odorous.

The following measures will be adopted to minimise the emission of odours and their impact on the community:

- Design and construction of the collection system to minimise odour generation prior to arrival at the plant (gravity sewers);

- Design, construction and operation of treatment plant to minimise odour release;
- Collection and scrubbing of odorous gases liberated within the plant enclosures; and
- Provision of a buffer zone appropriate to the particular site and plant.

At the design ultimate capacity of 160ML/d, the predicted average odour emission at ground level is 27,000 Odour Units per second (OU/s), which is the sum of residual odour leakage from the covered tanks as a result of minor leaks, pressure variations under the covers due to wind effects, inspections to enable plant operations and maintenance activities (CEE 2004).

This represents a very high level of odour containment, and is a lower release of odour than expected from the much smaller Subiaco WWTP after the 2004 upgrade to control odour at that plant (CEE 2004).

At Site A, the zone in which a distinct odour (5 OU or more) could occur for 8 hours or more per year was predicted to extend 600m to the west of the plant boundary, 600m to the north, 500m to the east and 450m to the south (CEE 2005). These predicted distances are the basis for the recommended buffer zone for the plant at Site A. Note that a significant part of the recommended buffer zone extends offshore and hence does not involve any commitment of land.

At Site B, the zone in which a distinct odour (5 OU or more) could occur for 8 hours or more per year was predicted to extend 600m to the west of the plant boundary, 600m to the north, 500m to the east and 450m to the south (CEE 2005). These predicted distances are the basis for the recommended buffer zone for the plant at Site B, subject to the discussion on odour ponding below.

During odour management investigations conducted to date, awareness has arisen that the siting of the AWWTP within the basin at Site B creates conditions under which odour may pond and accumulate in the basin during low wind, atmospheric inversion conditions. The accumulated odour-laden air would then be flushed from the basin when wind speeds increased and/or the inversion breaks. Such conditions and the potential odour impact is not adequately reflected by the normal dispersion modelling upon which the buffer zone dimension is established.

Accordingly, it is considered that ponding:

- will lead to a 40% increase in odour levels downwind of a treatment plant built within a basin; and
- Site B will require an 800m wide buffer zone to the west and north-west of the plant.

## Geoheritage

The proposed AWWTP is located in the more northerly Whitfords-Lancelin Coastal Sector, described by Semeniuk (2004) as representing the final stage in the

series of coastal landforms, being a sequence of more recent parabolic dunes perched on an older limestone plateau. The dunes were formed by progressive erosion of the cusped foreland and the resultant sand was driven inland by strong south-westerly winds, which have moderated over geological time scales.

The system is a parabolic dune feature two kilometres (km) wide, extending inland for four km. Three individual dune types occur within this feature:

- parallel dunes;
- nested parabolic dunes; and
- blow-outs.

The notion that the whole dune complex (beyond the immediate impacts of the AWWTP and its buffer), or at least a part which contains a representative chronological sequence should be preserved reduces in significance if the geoheritage and associated ecological values in the area are to be developed for urban and commercial purposes, as proposed in the MRS Amendment 1029/33.

## Social Issues

### Aboriginal Heritage

#### *Ethnographical Survey*

In 1990, an Aboriginal Site Survey of the AWWTP was conducted by R.O'Connor and G.Quartermaine. As a result of the survey, no ethnographic sites were located or identified.

#### *Archaeological Survey*

As a result of research undertaken at the Heritage and Culture Division, Department of Indigenous Affairs W.A., it was established that no registered Aboriginal archaeological sites are located within the boundaries of the designated AWWTP Project Area.

### European Heritage

The Heritage Council of WA has confirmed that there are no places of European heritage identified as being located on Lot 101 at Alkimos.

## Consultation

### Long Term Planning and Consultation

A community consultation program took place to ensure that the community was given the opportunity to raise issues or concerns regarding all wastewater treatment practices and disposal. The consultation was conducted from October 1993 to the present.

More than 55 stakeholders were identified for the Alkimos Project.

The Water Corporation developed and implemented a comprehensive consultation and communication program with the identified stakeholder groups during

the PER preparation. Information was disseminated and issues were identified and resolved through a number of channels including:

- Ongoing Liaison and Discussion with Stakeholder Groups
- Face to Face Meetings, Briefings and Presentations to Key Stakeholders
- Project Information Brochures
- Project Newsletters
- Shopping Centre Displays
- Public Information Forums
- Feedback Forms
- Website
- Advertising
- Market Research

Queries raised by the general community were, broadly speaking, focused on the:

- buffer zone and potential for odour;
- need for a coastal location for the plant;
- need for an ocean outlet; and
- potential for re-use.

Evidence suggests that the Water Corporation's information materials were useful in raising community understanding of the project and issues raised by the community. 55% initial support for the development rose to 83% support after information was reviewed.

## Visual Amenity

Potential issues and impacts include the following:

- the WWTP may be visible to a varying extent in the landscape and within the vista from urban and coastal areas. For Site A, under the existing MRS, the WWTP may be visible from close to the boundary of Lot 101 from elevated viewing points;
- for Site A and Site B, the approximately 50m high vent stack will be approximately 15-20m above the ridge of the highest dune surrounding the WWTP;
- for Site A, approximately 180,000 cubic metres of soil will be cut from the swale floor that lies within the surrounding dunes and redeposited to fill in the hollows, creating a footprint of 15ha in order to provide the required 14ha site for the WWTP; and
- for Site B, approximately 3 million cubic metres of soil and rock will be excavated creating a footprint of 19ha of disturbed landform to achieve the required 14ha site for the WWTP which, depending upon the final subdivisional layout, may be visible from the urban development located to the west.

## Proponent Commitments and Environmental Management

The Water Corporation has made commitments to implement or undertake various activities to ensure that any environmental impacts associated with the project are manageable. Table ES.5 summarises the commitments and their objectives.

The actions specified in Table ES.5 become binding on the Water Corporation under the Ministerial Conditions of Approval.

Within these commitments, a number of management plans are identified, collectively providing the suite of documentation underpinning the Water Corporation's management of the AWWTP, its buffer and the ocean outlet.

The Water Corporation will develop the following management plans to specify the actions necessary to effectively manage the AWWTP:

- Vegetation and Flora Management Plan;
- Fauna Management Plan; and
- Marine Monitoring and Management Plan.

To complete the Environmental Management suite, other monitoring and reporting procedures will be developed as part of the Water Corporation's standard operating procedures within its Quality Management System. These include:

- Construction management;
- Biosolids management;
- Green House Gas (GHG) emissions reporting;
- Odour monitoring and reporting;
- Community engagement plan; and
- Complaint/response register.

Table ES.5 Summary of Proponents Commitments for AWWTP Proposal

Summary of Proponents Commitments for AWWTP Proposal - Principles of Environmental Protection				
Topic	Objective	Actions	Timing	Advice
Precautionary Principle	<ul style="list-style-type: none"> <li>To avoid serious or irreversible damage to the environment; and</li> <li>To assess a risk-weighted consequence of proposed options.</li> </ul>	1. The Water Corporation will undertake the following measures to address the precautionary principle: <ul style="list-style-type: none"> <li>provide a sustainability assessment and comparative analysis of the WWTP site options;</li> <li>design construct and operate the plant using best industry practice;</li> <li>ensure, as far as practicable, failure modes in the conveyancing and treatment system "fail safe";</li> <li>prepare management plans for key environmental factors where appropriate;</li> <li>monitor review and report operational and environmental performance; and</li> <li>revise standard operating procedures and quality management systems and management plans in line with the findings of such reviews.</li> </ul>	During design, construction and operation.	Water Corporation, EPA
Intergenerational Equity	<ul style="list-style-type: none"> <li>To ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.</li> </ul>	2. The Water Corporation will: <ul style="list-style-type: none"> <li>reduce long term energy consumption through gravity conveyancing and TWW disposal to the ocean;</li> <li>reclaim and reuse wastewater as far as practicable; and</li> <li>build the wastewater system to achieve the lowest whole of life cost by reducing dependence on energy consumption and make provision for the recovery of energy from the treatment process.</li> </ul>	During design, construction and operation	Water Corporation
Valuation, pricing and incentives	<ul style="list-style-type: none"> <li>To ensure environmental factors have been included in the valuation of assets and services;</li> <li>To ensure that the "polluter pays" principle is applied in the containment, avoidance or abatement of pollution;</li> <li>To ensure the users of goods and services (including the use of natural resources and assets) pay for the full life cycle costs of their provision; and</li> <li>To ensure that the achievement of environmental goals be pursued in the most cost effective manner.</li> </ul>	3. The Water Corporation: <ul style="list-style-type: none"> <li>has undertaken a whole of life economic assessment of the AWWTP as part of its Capital Investment Program.</li> <li>routinely funds the installation of new, pollution prevention technologies for WWTP systems as they emerge, and clean-up and repair of incidents as they occur;</li> <li>applies the tariffs for provision of wastewater treatment services as set by Government;</li> <li>will locate, design and install the wastewater treatment and conveyancing system according to best industry standards.</li> </ul>	During design, construction and operation.	Water Corporation

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**Summary of Proponents Commitments for AWWTP Proposal - Principles of Environmental Protection**

Topic	Objective	Actions	Timing	Advice
Waste Minimisation	<ul style="list-style-type: none"> <li>To take all reasonable and practicable measures to minimise the generation of waste and its discharge to the environment.</li> </ul>	<p>4. The Water Corporation will:</p> <ul style="list-style-type: none"> <li>undertake several pilot projects (e.g. Managed Aquifer Recharge) to assess the viability a of re-use opportunities and implement them as soon as the technical, environmental, public health, political and societal acceptability is established.</li> <li>manage and monitor the reuse of Biosolids in accordance with the Western Australian Guidelines for Direct Land Application of Biosolids and Biosolids Products as required by Part V Environmental Licences.</li> </ul>	Ongoing	EPA, DoE, HDWA, Water Corporation
Conservation of Biodiversity and Ecological Integrity	<ul style="list-style-type: none"> <li>To conserve biological diversity and ecological integrity.</li> </ul>	<p>5. The Water Corporation will, to the extent practicable, conserve high value floral communities and associations and their fauna habitats within the buffer zone of the AWWTP.</p> <p>6. The Water Corporation will prepare a Vegetation and Flora Management Plan and a Fauna Management Plan addressing:</p> <ul style="list-style-type: none"> <li>topsoil and vegetation mulch management;</li> <li>prevention of the destruction of any of the four species of Priority Flora recorded in the project area;</li> <li>protection of high value fauna habitat;</li> <li>collection of provenance seed to be used in subsequent rehabilitation;</li> <li>management of weeds;</li> <li>controlling vehicular and public access;</li> <li>fire management ; and</li> <li>rehabilitation of high value disturbed land.</li> </ul> <p>7. The Water Corporation will prepare a Marine Monitoring and Management Plan for the Alkimos Ocean Outlet addressing the:</p> <ul style="list-style-type: none"> <li>monitoring of biota, sediment and water quality;</li> <li>management and mitigation strategies derived from a risk based assessment of the monitoring necessary to maintain acceptable environmental performance, and</li> <li>report findings periodically to relevant stakeholders.</li> </ul> <p>The monitoring and management plans identified above are dealt with in more detail in the Environmental Management section below.</p>	During construction and operation	EPA, CALM and Water Corporation

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**Summary of Proponents Commitments for AWWTP Proposal – Environmental Management - Marine**

Topic	Objective	Actions	Timing	Advice
Alkimos Marine Monitoring and Management Plan	<ul style="list-style-type: none"> <li>To ensure the marine environment is protected.</li> </ul>	8. The Water Corporation will prepare and implement an Alkimos Marine Monitoring and Management Plan.	Prior to commencement of discharge to the marine environment at Alkimos.	EPA DoE
	<ul style="list-style-type: none"> <li>To ensure consistency in field and laboratory procedures; and</li> <li>To ensure that data collected are scientifically valid, comparable and adequate to meet the monitoring programme objectives.</li> </ul>	9. The results, interpretations and recommendations of the Alkimos Ocean Outlet Marine Monitoring and Management Plan will be reported annually to the Department of Environment and key stakeholders. Results will be interpreted with reference to relevant national, state and site-specific guidelines. Where appropriate, annual reporting will include a 'report card' style format. 10. All components of the Alkimos Ocean Outlet Marine Monitoring and Management Plan will be regularly reviewed to ensure that meaningful results are obtained, that the objectives are still appropriate and the programme is appropriate to the nature and magnitude of present and predicted impacts.	Annually or triggered by events or trend in data.	EPA DoE
	<ul style="list-style-type: none"> <li>To monitor for treated wastewater characterisation, and respond to potentially significant impacts to marine flora and fauna from discharges from AOO.</li> </ul>	11. The following indicators will be reported:: <ul style="list-style-type: none"> <li>Physical-chemical characteristics</li> <li>Bacteria</li> <li>Nutrient</li> <li>Metals</li> <li>Surfactants</li> <li>Pesticides and herbicides</li> <li>Organics</li> </ul>	<ul style="list-style-type: none"> <li>6-monthly</li> <li>6-monthly</li> <li>6-monthly</li> <li>Annually</li> <li>6-monthly</li> <li>3 yearly</li> <li>3 yearly</li> </ul>	EPA DoE
	<ul style="list-style-type: none"> <li>To undertake initial dilution modelling and calculation of near-field dilutions.</li> </ul>	12. Determine the near-field behaviour of treated wastewater plume and near-field dilutions.	At least annually.	EPA DOE
	<ul style="list-style-type: none"> <li>To undertake ecotoxicological tests.</li> </ul>	13. Undertake chronic toxicity tests on a suite of 5 test species of marine organisms representing at least 4 different taxonomic groups and covering 3 trophic levels.	Once within 12 months of commencement of discharge of treated wastewater and following any significant change in operations or exceedence of toxicant trigger levels.	EPA DoE
	<ul style="list-style-type: none"> <li>To undertake water quality monitoring.</li> </ul>	14. Conduct water quality surveys to monitor: <ul style="list-style-type: none"> <li>Nutrients</li> <li>Primary Productivity</li> <li>Bacteria</li> </ul>	One summer (Dec.-March) synoptic survey per annum. Four seasonal surveys per annum.	EPA DoE
	<ul style="list-style-type: none"> <li>To undertake phytoplankton monitoring.</li> </ul>	15. Undertake water quality surveys to monitor: <ul style="list-style-type: none"> <li>Presence and abundance potentially toxic phytoplankton species</li> <li>Phytoplankton cell count</li> </ul>	Four seasonal surveys per annum.	EPA DoE

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Summary of Proponents Commitments for AWWTP Proposal – Environmental Management - Marine				
Topic	Objective	Actions	Timing	Advice
	<ul style="list-style-type: none"> <li>To undertake periphyton monitoring.</li> </ul>	16. Undertake periphyton monitoring to determine periphyton growth (as measured by chlorophyll-a, b and c content).	Annually (summer)	EPA DoE
	<ul style="list-style-type: none"> <li>To undertake sediment quality monitoring.</li> </ul>	17. Undertake sediment quality monitoring to determine: <ul style="list-style-type: none"> <li>Grain-size distribution</li> <li>Nutrients</li> <li>Total organic carbon</li> <li>Organic matter content</li> <li>Carbonate content</li> <li>Metals</li> <li>Pesticides and herbicides</li> <li>Organics</li> </ul>	Five yearly, with the first survey within 12-18 months of commencement of operations.	EPA DoE
	<ul style="list-style-type: none"> <li>To undertake sentinel mussel monitoring.</li> </ul>	18. Undertake sentinel mussel monitoring to determine biological uptake of: <ul style="list-style-type: none"> <li>Metals</li> <li>Pesticides and herbicides</li> <li>Organics</li> </ul>	Five yearly, with the first survey with 12-18 months of commencement of operations.	EPA DoE
Marine Environmental Values	<ul style="list-style-type: none"> <li>To protect the marine ecosystems.</li> </ul>	19. In the event that the EPA's high protection Environmental Quality Criteria are exceeded in the water designated as requiring high protection, specific investigations will be conducted in consultation with the DoE into the risk presented by it to ecological processes and any measures necessary to mitigate those risks.	During operation.	EPA
	<ul style="list-style-type: none"> <li>To determine the toxicity of TWW on marine biota.</li> </ul>	20. Undertake Whole Effluent Toxicity (WET) testing generally following the principles contained in the USEPA, APHA and ASTM protocols in accordance with the protocols set out in ANZECC/ARMCANZ (2000), once initially and following any significant change to operations.	During operation.	EPA DoE
Marine Management and Monitoring	<ul style="list-style-type: none"> <li>To prepare and implement a Monitoring and Management Plan.</li> </ul>	21. Sampling, analysis and interpretation will be undertaken to quickly detect any emerging issues and management control processes will be quickly implemented to resolve the issue. The management plan will be developed in accordance with: <ul style="list-style-type: none"> <li>Manual of Standard Operating Procedures (SOP)</li> <li>An approved monitoring and management programme consistent with EQMF</li> <li>Coastal Water Study and PLOOM program</li> <li>'Environmental Quality Management Framework' (EQMF)</li> </ul>	Before operation.	EPA DoE
	<ul style="list-style-type: none"> <li>To develop draft Environmental Quality Criteria (EQC) for waters adjacent to the proposed Alkimos Ocean Outlet.</li> </ul>	22. The Water Corporation will undertake comparison of the water quality parameters with the appropriate ANZECC/ARMCANZ (2000) Guidelines for fresh and Marine Water Quality and the Revised Environmental Quality Criteria Reference Document (Cockburn Sound), Environmental Protection Authority (2004)	During Operation	EPA DoE
	<ul style="list-style-type: none"> <li>To develop and delineate zones of protection.</li> </ul>	23. The Water Corporation will identify the environmental values that are to be protected in the nearshore waters surrounding the outlet and in cooperation with the EPA determine the spatial designation of the environmental values i.e. low, medium and high protection zones, which will be used to underpin the interpretation of the ecological consequences of the proposal.	Before and During Operation	EPA DoE
	<ul style="list-style-type: none"> <li>To protect the marine ecosystem.</li> </ul>	24. The Water Corporation will monitor nitrogen concentrations (as ammonia and nitrate+nitrite) at the marine water quality monitoring sites.	During Operation	EPA DoE

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Summary of Proponents Commitments for AWWTP Proposal – Environmental Management - Terrestrial				
Topic	Objective	Actions	Timing	Advice
Terrestrial Flora and Fauna	<ul style="list-style-type: none"> <li>To minimise the impacts on the abundance, species diversity, geographic distribution and productivity of vegetation units;</li> <li>To minimise the possible impacts of development upon fauna species and their habitats and preserve regional biodiversity.</li> </ul>	25. The Water Corporation will prepare a Vegetation and Flora Management Plan and a Fauna Management Plan addressing: <ul style="list-style-type: none"> <li>topsoil and vegetation mulch management;</li> <li>prevention of the destruction of any of the four species of Priority Flora recorded in the project area;</li> <li>protection of high value fauna habitat;</li> <li>collection of provenance seed to be used in subsequent rehabilitation;</li> <li>management of weeds;</li> <li>controlling vehicular and public access;</li> <li>fire management ; and</li> <li>rehabilitation of high value disturbed land.</li> </ul>	Before Construction Phase	EPA DoE CALM
Geoheritage	<ul style="list-style-type: none"> <li>To minimise impact on identified geoheritage values and their associated flora and fauna communities within the buffer of the AWWTP and augment any conservation values identified within the Metropolitan Region Scheme.</li> </ul>	26. The Water Corporation will, as far as practicable, <ul style="list-style-type: none"> <li>conserve the geoheritage values within the AWWTP buffer; and</li> <li>augment any conservation values identified within the Metropolitan Region Scheme.</li> </ul>	During construction and operation	EPA, CALM
Greenhouse Gases (GHG)	<ul style="list-style-type: none"> <li>To minimise energy consumption</li> <li>To minimise GHG emissions to as low as reasonably practicable.</li> </ul>	27. The Water Corporation will: <ul style="list-style-type: none"> <li>install a gravity wastewater system to minimise energy consumption from pumping;</li> <li>reduce methane emissions and site energy requirements by recovering biogas to generate electricity as is practicable given the chosen treatment technologies, as economies of scale make this viable in the future;</li> <li>assess and report GHG emissions to the Australian Greenhouse Office (AGO) and State Authorities. This will also include a periodic assessment to review opportunities to further improve energy efficiency and reduce greenhouse gas emissions over time.</li> </ul>	During operation	AGO, Dept Premier and Cabinet Greenhouse Office
Biosolids	<ul style="list-style-type: none"> <li>To reuse biosolids for agricultural and horticultural purposes.</li> </ul>	28. The Water Corporation will: <ul style="list-style-type: none"> <li>reuse bio-solids in accordance with the Western Australian Guidelines for Direct Land Application of Biosolids and Biosolids Products as required by Part V environmental licences</li> </ul>	Prior to and during construction and during ongoing operations	DoE HDWA
Odour	<ul style="list-style-type: none"> <li>To minimise odour emissions;</li> <li>To segregate recipients from odour sources; and</li> <li>To protect the health, welfare and amenity of people and land-uses in proximity to the AWWTP.</li> </ul>	29. The Water Corporation will manage odours from the WWTP by: <ul style="list-style-type: none"> <li>siting and designing the AWWTP to minimise the odour impacts from the plant on surrounding land-uses as far as practicable, using best practice odour emission control design and operation;</li> <li>delineating and managing an odour buffer zone and permitting only compatible land-uses within the buffer, through Water Corporation ownership and control of the buffer; and</li> <li>achieving agreed odour criteria within the odour buffer.</li> </ul>	During operation	DoE EPA

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Summary of Proponents Commitments for AWWTP Proposal – Environmental Management - Social				
Topic	Objective	Actions	Timing	Advice
Community Engagement	<ul style="list-style-type: none"> <li>To ensure that the public and relevant stakeholders have open access to information regarding the environmental performance of the AWWTP and Alkimos Ocean Outlet; and</li> <li>To provide a mechanism to address any significant issues arising from stakeholders</li> </ul>	30. To incorporate into the Water Corporation's Customer Service Program a community engagement plan to: <ul style="list-style-type: none"> <li>address awareness and understanding of the project;</li> <li>ensure that reports on AWWTP environmental performance are readily available to the public;</li> <li>ensure that the results of the monitoring are readily available to the public; and</li> <li>provide a complaints/response process to address matters arising from the project in accordance with the Water Corporation's Corporate Environmental Management System.</li> </ul>	During Environmental Impact Assessment period.	EPA Stakeholders
Aboriginal Heritage	<ul style="list-style-type: none"> <li>To comply with the provisions of the Aboriginal Heritage Act (AHA).</li> </ul>	31. The Water Corporation will undertake appropriate liaison and surveys with the relevant Aboriginal groups, anthropologists to the satisfaction of the Department of Indigenous Affairs.	Prior to Construction	DIA EPA