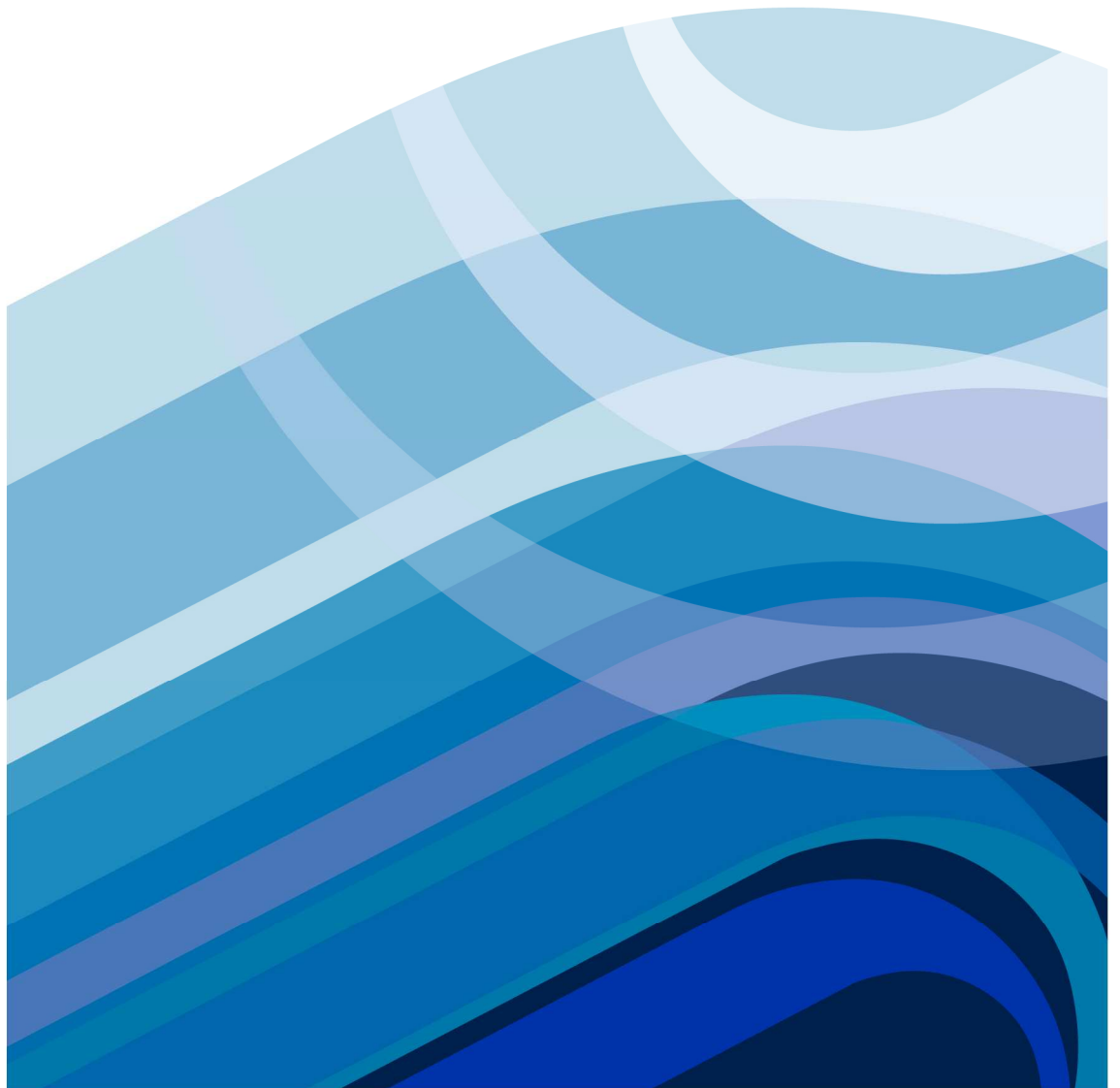




# **Second Seawater Desalination Plant Site Alternatives and Considerations**

Compiled July 2007



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## Introduction

Since 2001, the south of Western Australia has been subject to severe drought conditions. Average inflow into Perth's metropolitan dams has dropped to less than 90 gigalitres a year, compared with 340 gigalitres in 1975. However with increasing growth in Perth and across the State, demand for water continues to increase.

In response to these changing conditions the Water Corporation is developing a range of alternatives to reduce water consumption and increase supply, outlined in the *Security Through Diversity* strategy. Many of the strategies aimed at reducing water consumption have been very successful and will continue to be used.

In November 2006 the Corporation achieved an important milestone with the start of operations of the first Perth Seawater Desalination Plant, which is now delivering 17 per cent of the Integrated Water Supply Scheme (IWSS). It has demonstrated that desalination is a reliable and climate independent source of water.

However, the decline in rainfall has meant that an additional climate independent water source will be required in the coming years to secure water supply for the people of Western Australia.

On 15 May 2007 Alan Carpenter announced that a second seawater desalination plant at Taranto Road in Binningup would be the next major source for the IWSS.

This report outlines the various alternative sites that have been considered in leading to the selection of Taranto Road near Binningup as the site for the new desalination plant.

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## Metropolitan Sites

A new desalination plant cannot be developed on the site of the Perth Seawater Desalination Plant (in Kwinana) due to limited land area.

There are no other potentially suitable industrial estates in the vicinity of the metropolitan area close to the coast and within close proximity to the Integrated Water Supply Scheme (IWSS).

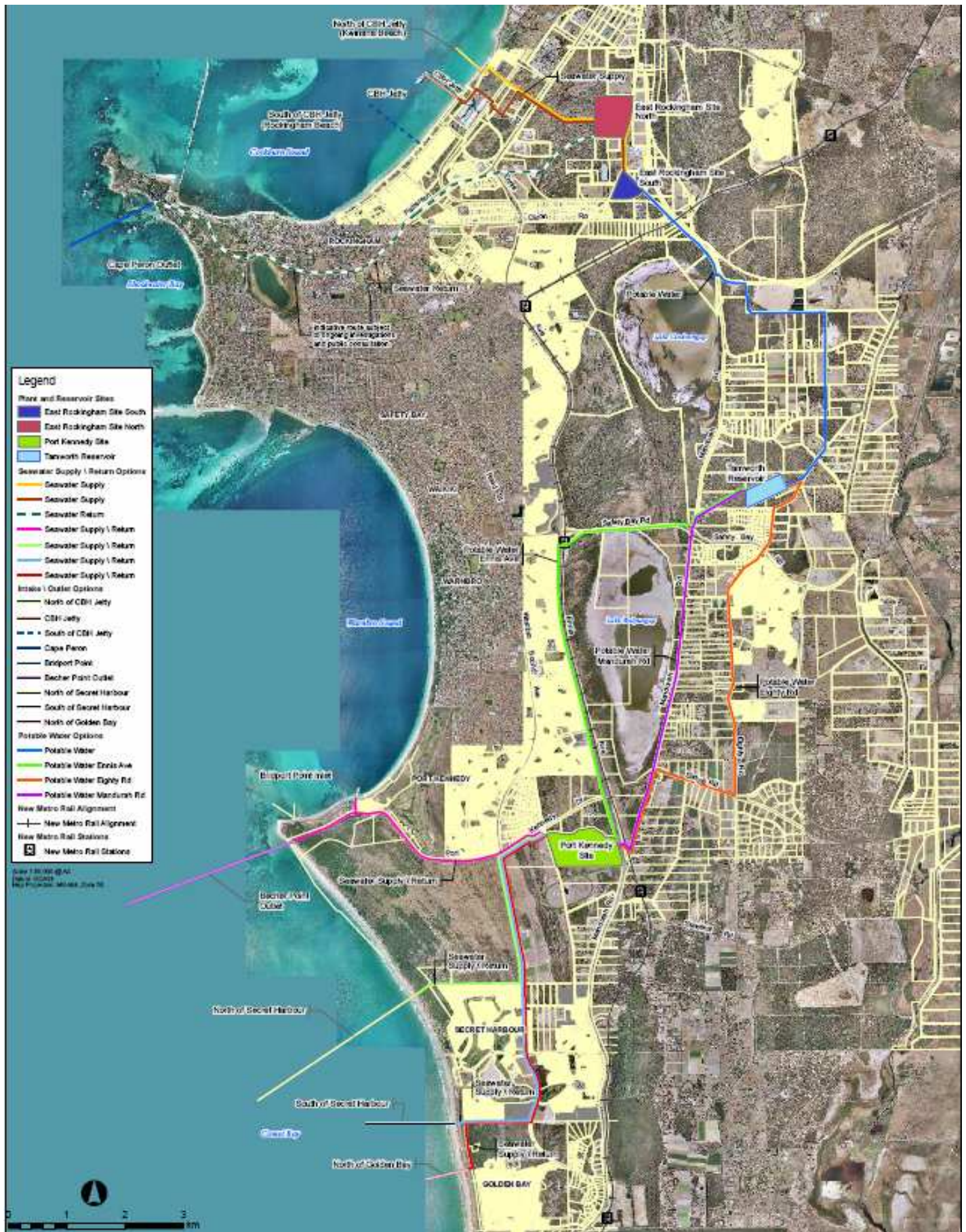
In 2005 the Water Corporation referred a proposal for a seawater desalination plant containing three potential sites (two at East Rockingham and one at Port Kennedy) to the Environmental Protection Authority.

The Port Kennedy site is a Water Corporation owned wastewater treatment plant site. The proposal for a desalination plant at Port Kennedy included a number of potential intake and outlet points located at Secret Harbour Bay, Golden Bay, Bridport Point and Becher Bay. These, on average, are approximately 7 kilometres from the proposed plant site.

The two potential plant sites identified in East Rockingham are owned by the Water Corporation. The proposed outlet point would be located at Point Peron and two potential intake points were identified on Cockburn Sound in Rockingham. Pump stations would be required on the beach at the intake point to draw the water into the plant.

Figure 1 shows some of the sites and pipeline routes considered.

Figure 1



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## **Port Kennedy**

The proposed plant site is in a high population density area and the intake and outlet points would be located on heavily trafficked beaches. The pipelines linking the plant to the intake and outlet points and to the IWSS would travel through highly populated residential areas, causing significant disruption to the local community both during construction and throughout the life of the plant during maintenance activities.

Pump stations would be required on the beach at the intake and outlet points and pipelines would be required to connect into the plant. Some of the potential intake and outlet sites are unsuitable for co-locating facilities, which would mean separate pump stations and pipeline corridors for intake and outlet works.

Desk top studies have identified a number of threatened ecological communities in the vicinity of the Secret Harbour Bay and Golden Bay pump station sites.

The discharge and inlet works are likely to have serious impacts on penguin and whitebait nursery areas.

The Minister for the Environment made the decision that a desalination plant should not be built at the site. In November 2006, the Premier Alan Carpenter stated that the Government would not approve a desalination plant in Port Kennedy.

The Water Corporation is in the process of withdrawing the proposal from the EPA approval process.

## **East Rockingham**

Two potential sites in East Rockingham were identified as possible desalination plant sites.

The pipelines linking the plant to the intake and outlet points would travel through highly populated residential areas, causing significant disruption to the local community during construction and throughout the life of the plant during maintenance activities.

Detailed investigation showed significant environmental and social impacts associated with intake and outlet pipe routes for the East Rockingham sites, as well as technical engineering issues.

The proposed intake point is near mussel growing beds, and would potentially disrupt the activities of the local mussel industry. There are water quality issues and potential increased operations and maintenance costs due to the high concentration of mussel spat at the intake point.

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The potential intake points at Kwinana Beach and the proposed outlet point at Point Peron are in high population density areas.

The pipeline carrying the freshwater from the desalination plant to the IWSS would have had to skirt ecologically significant lands including a Bush Forever site and the Rockingham Lakes Regional Park, causing potential environmental issues. In particular the pipe route adjacent to Lake Richmond was not likely to obtain environmental approval due to the environmental and social disruption associated with its construction.

The proposed route is partially located within future road reserves and easements but is currently inaccessible due to private property and quarry activities.

The further investigation of the East Rockingham sites has identified significant environmental, social and technical issues, and both sites are considered unsuitable for a second seawater desalination plant.

The Water Corporation is in the process of withdrawing the proposal from the EPA approval process.

## **Potential sites between Jurien and Bunbury**

Investigations of the coastal strip from Jurien Bay to Bunbury to identify potential desalination plant sites have been undertaken since early 2004.

Desktop studies were undertaken to identify possible locations, and further engineering and environmental assessments carried out on some of the potentially feasible options.

Initial studies included environmental constraints assessments, as well as consideration of social and technical factors. The requirement of the investigation was to identify potential locations that could sustain the intake and brine discharge from a 45 gigalitre per year desalination plant with potential to increase to 100 gigalitre per year in the future.

Potential desalination plant sites have been identified on the basis of the following characteristics:

- be close to the ocean
- offer easy integration into the Integrated Water Supply Scheme
- offer access to a suitable power source
- be environmentally compatible, with minimal environmentally sensitive areas
- be at least 10ha in size to accommodate plant components
- have available buffers required for chlorination facilities
- have compatible surrounding land uses (industrial, rural, park and recreation)
- ideally, be Corporation owned.

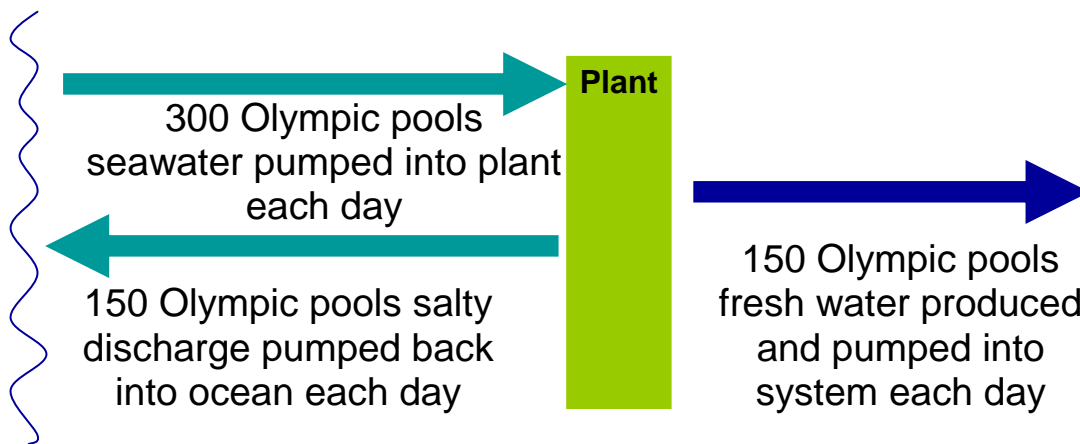
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## Proximity to the Ocean

Proximity to the coast is an extremely important requirement because of the enormous quantities of seawater, freshwater and brine discharge transported into and out of the plant. For the ultimate 100 gigalitre capacity plant, approximately 600 million litres of seawater will be pumped into the plant each day, the equivalent of 300 Olympic swimming pools.

Figure 2 shows the movement of water into and out of the plant.

Figure 2



Seawater is pumped into the plant, and freshwater and brine discharge is pumped out of the plant using large pumping stations. It is important to minimise the distance the water must be transported in order to minimise the power requirements and carbon emissions.

Sites that were more than 4 kilometres inland were seen as undesirable. If the plant is close enough to the coast the seawater can be gravity fed into the plant, with substantial power savings.

## Environmental constraints

A desktop environmental study of all land along the coast from Jurien Bay to Bunbury has been completed. Environmental constraints taken into account in the selection of potential sites included:

- Land immediately adjacent to Marine Conservation Reserves
- Land immediately adjacent to estuarine environments
- Land immediately adjacent to river mouth environments
- Land immediately adjacent to Fish Habitat Protection Areas (FHPAs)
- Land immediately adjacent to waters with potential for fouling
- Land immediately adjacent to marine areas of Aboriginal significance
- Land immediately adjacent to known and protected shipwrecks

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- Land included in a reserved National Park, Nature Reserve, Conservation Park, State Forest or Regional Park (collectively referred to within this document as 'Reserves')
  - Land and waters declared to be protected under the Ramsar Convention
  - Land declared to be protected under the *Environment Protection (Swan Coastal Plains Lakes) Policy 1992* (referred to as EPP lakes)
  - Land declared as a Conservation Category Wetland (CC Wetlands)
  - Land declared in the Directory of Important Wetlands (DI Wetlands)
  - Land declared as the location and buffer of Threatened Ecological Communities (TECs)
  - Land known to include Declared Rare Flora (DRF) or be known to support Threatened or Endangered Fauna
  - Land declared for protection under Bush Forever
  - Land declared for conservation under the Systems Conservation Reservations, namely Systems 5 and 6
  - Land recognised by the Department of Environment and Conservation as an Environmentally Sensitive Area (ESA)
  - Land identified as being of World, National or Commonwealth Heritage value
  - Protected sites on the Register of the National Estate (RNE)
  - Land identified as a Registered Site on the Aboriginal Site Register under the *Aboriginal Heritage Act 1972*
  - Land zoned 'Urban' or 'Urban Deferred' under a Region or Town Planning Scheme
  - Land used for military training.

Potential sites north of Perth have been ruled out for the time being due to the difficulty in connecting to the IWSS and other utilities infrastructure such as power, gas and communications.

Suitable locations immediately south of Perth are limited because of the extensive ecologically significant wetland systems along the coastline.

The coastline between the Leschenault Estuary and Lake Preston has water quality and environmental constraints, which restrict the options for locating the intake and outlet pipe work for a desalination plant anywhere else in that area.

The Binningup site is the only site identified which is available south of Perth. Preliminary environmental investigations indicate favourable marine bathymetry and coastal processes.

Preliminary marine investigations of bathymetry and coastal dynamics, indicate that of the four sites identified north of Perth, the Breton Bay site has the most preferable marine characteristics.

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## Preferred Site – Taranto Road, Binningup

The Binningup Wastewater Treatment Plant (WWTP) site, at Taranto Road, in the Shire of Harvey, has been selected as the location for the second major seawater desalination plant.

Specifically the Taranto Road site has:

- Near coast location reduces energy and infrastructure requirements
- Open ocean that ensures adequate water mixing
- Close proximity and reasonable access to the Integrated Water Supply Scheme (25km)
- Reasonable access to power network (10km)
- Potential risks to the marine and terrestrial environments can be minimised and managed
- The site is ample size for plant and buffers (40ha)
- Water Corporation owned site and the land is immediately available.

The site is relatively large in relation to the land area required for the plant and offers significant flexibility for alternative site layouts, building design and landscaping. There is a wide range of alternative layouts that can be considered while preserving the environmental values that are known to exist such as old growth Tuarts, peppermint trees and the coastal dune system.

## Kemerton Industrial Park

The Corporation has completed a review to identify potential sites inland to Taranto Road, for the desalination plant

The feasibility assessment included a desktop study and took into consideration the current and future planning for the Kemerton Industrial Park, environmental constraints and infrastructure requirements. Cost estimates were developed for the most suitable options.

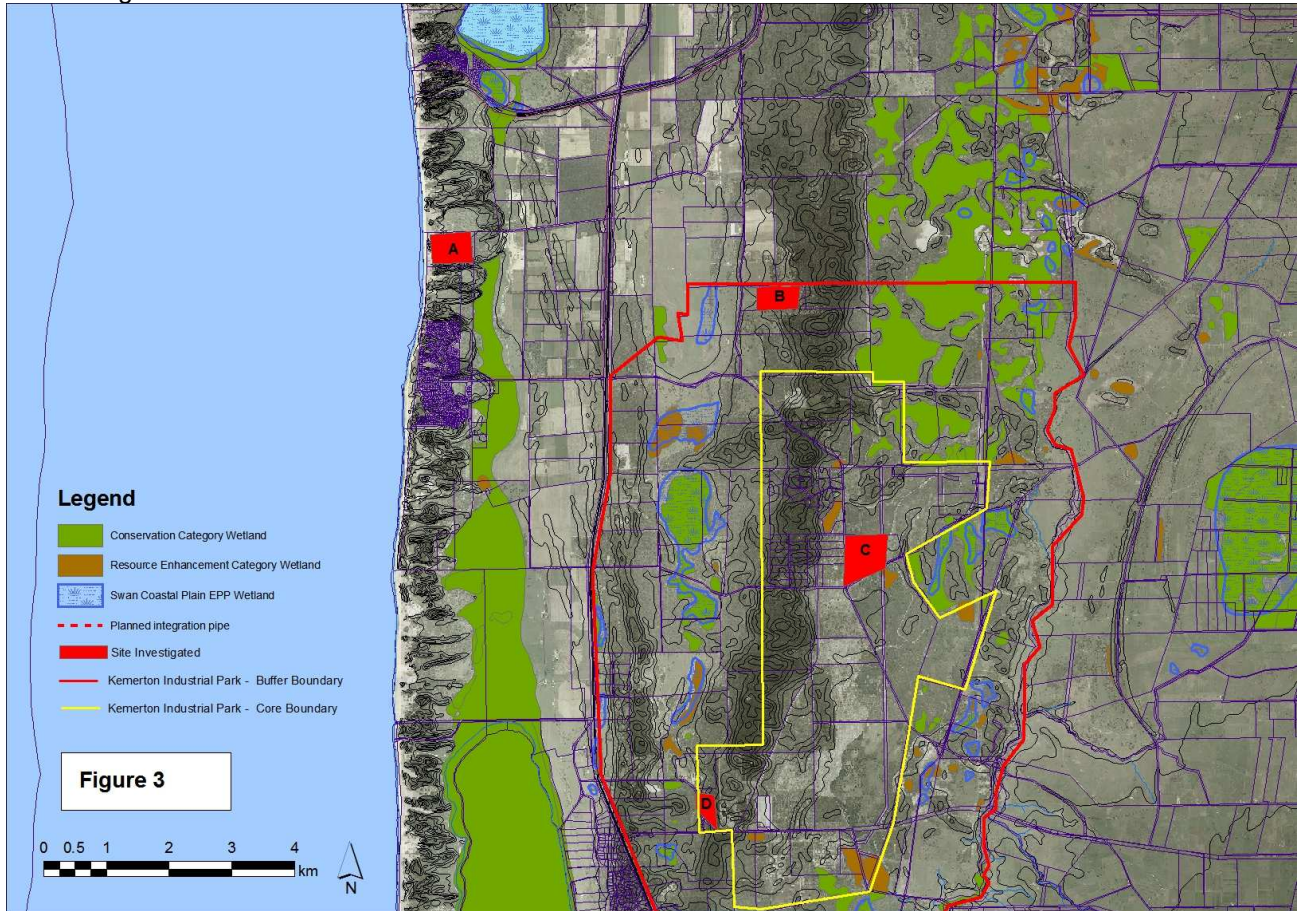
Kemerton Industrial Park is considered an unsuitable location for the plant, based on increased environmental risk and increased cost.

## Kemerton Industrial Park

Assessment of the site options for Kemerton Industrial Park were undertaken on the basis that the intake and outlet would be located at Taranto Road (see intake/outlet constraints), and looked at the immediate 45 GL per year, and the ultimate 100 GL per year schemes.

The sites investigated in the feasibility assessment are indicated on Figure 3.

Figure 3



## Intake/Outlet Constraints

A desalination plant sited at Kemerton Industrial Park would still require all intake and outlet pipelines and associated pump stations to be located at Taranto Road. No other options for intake or outlet are suitable.

The coastline between the Leschenault Estuary and Lake Preston has water quality and environmental constraints which restrict the ability to locate the intake and outlet pipework for a desalination plant anywhere along the coastline.

Two existing discharge outlets are located at Buffalo Road, south of Binningup - a brine discharge from Verve Energy, and a waste discharge for Lyondell Chemicals, both located in Kemerton Industrial Park. It is expected that a third common-user industrial waste discharge pipe at Buffalo Road will be needed to meet the future needs of the Kemerton Industrial Park.

The current and future discharge in the vicinity of Buffalo Road constitutes a key water quality constraint on the intake structure for the desalination plant. Due to the north flowing ocean currents, the desalination plant intake must be separated a minimum of 5 kilometres from this location to ensure suitable water quality for the plant.

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## **Infrastructure required**

Seawater is transported into the plant through multiple large 1600 millimetre diameter pipes. Brine is transported back to the ocean through large 1600 millimetre diameter pipes. At the Kemerton site these pipelines would need to be around 10 kilometres in length - compared to less than one kilometre for the Taranto Road site.

Pumping the seawater, freshwater and brine discharge into and out of the plant at any location in Kemerton, 10 kilometres from the coast, would require significantly more energy than would be required if the plant were located at Taranto Road.

The fresh water produced by the plant will be pumped through a new pipeline to the existing IWSS at a point north of Harvey. The distance from the plant to the IWSS would be approximately the same whether the plant is located at Kemerton or Taranto Road.

Kemerton Industrial Park is situated to the east of the ridge (see figure 3). The layout of core industrial development areas within the structure plan uses the ridge to attenuate impacts associated with heavy industry. The western slope of the ridge is highly valued for remnant native vegetation.

Potential sites within the Kemerton Industrial Park will require additional pumping to transfer seawater and brine over the main ridge.

A major pumping station would be required at the beach under all options and, as such, power lines would be required from the Kemerton Power Station to Taranto Road regardless of the plant location.

## **Environmental Impacts**

There are many high value ecosystems between the coast and Kemerton Industrial Park. These systems include permanent and seasonal wetlands as well as terrestrial vegetation and ecosystems. The impacts of the construction of multiple long, large diameter pipelines (ultimately five 1600 millimetre diameter pipelines) through these systems are significant. Construction corridors of approximately 50-60 metres would be required, which would permanently destroy the values associated with these ecosystems.

## Cost Estimates

The estimated capital cost to construct the plant at Kemerton Industrial Park would be significantly higher than constructing the plant at Taranto Road, primarily because of the construction of additional pipelines and pumping facilities and the purchase of additional land for the plant and pipeline corridor.

The ongoing cost of operation would also increase because of the additional power requirements.

Cost estimates have been developed for several sites in the Kemerton area including:

- Site B - on the western slopes of the main ridge near Kemerton;
- Site C - within the Kemerton Industrial Park Core
- Site D – on adjacent land to the Kemerton Waste Water Treatment Plant

A differential cost has been determined from preliminary design information for a 45 GL a year plant to show the additional cost of constructing, operating and maintaining the desalination plant at Kemerton, compared to Taranto Road.

Desalination plant site	Taranto Road	Site B – Western slope, industrial buffer	Site C - Core industrial area	Site D – Existing Kemerton WWTP
Construction 45GL/year (outturn 2011)	\$640,000,000	Additional \$141,247,000	Additional \$142,584,000	Additional \$231,333,000
Additional Power Usage (MWh/year)	0	8,940	34,229	16,315
Operations Cost per year (current cost)	\$46,500,000	\$48,012,600	\$52,291,356	\$49,260,446
Length of Inlet 1600mm Pipe	300m	2 x 10,000m	2 x 11,370m	2 x 14,230m
Length of Outlet 1600mm	150m	10,000m	11,370m	14,230m
Length of IWSS connection 1400mm	Approximately 25,000m	Approximately 23,000m	Approximately 22,000m	Approximately 30,000m
Powerlines 132kv	9,460m	4,460m	2,990m	8,150m
Powerlines 22kv	0m	9,460m	9,460m	9,460m

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## Further Information

For further information email [desalination@watercorporation.com.au](mailto:desalination@watercorporation.com.au), phone 131375 or visit our website, [www.watercorporation.com.au](http://www.watercorporation.com.au).