



# Case Study Analysis of Brownfield Redevelopments Relevant to the Moolap Coastal Strategic Framework Plan

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Case Study analysis of brownfield redevelopments relevant to the Moolap Coastal Strategic Framework Plan  
Final Report

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# 1. EXECUTIVE SUMMARY

## 1.1 Background

Deakin University was commissioned in March 2016 by the Victorian Government Department of Environment, Land, Water and Planning (DELWP) to develop a research report that would support DELWP's work on the Moolap Coastal Strategic Framework Plan (Moolap Plan). The Moolap Plan examines possibilities for future land uses for the study area which includes the site of Alcoa's former operations at Point Henry and the former Cheetham Saltworks sites in Moolap, a suburb on the Eastern outskirts of the Geelong CBD, Australia. The study area includes more than 1,200 hectares of largely industrial and coastal land. It is a complex site that presents a host of challenges and opportunities for Geelong and the State. (See more at <http://www.delwp.vic.gov.au/moolap>).

## 1.2 The Brief

The brief was to identify a range of brownfield redevelopment case studies that demonstrate attributes that may inform future land use options for the subject site of the Moolap Plan. The case studies consider a range of environmental, economic and social issues related to the redevelopment of saltpans, low-lying land and/or contaminated brownfield sites, and include examples of alternative land uses ranging from exemplary low-impact ecological scenarios through to progressive or iconic urban renewal and regeneration schemes. The primary purpose of these case studies is to develop a high-level, conceptual understanding of a broad range of potential land use options applicable to the subject site, as opposed to providing a deep analysis of each individual scenario. Each case study provides an outline of the particular project's context, drivers, assets, issues, constraints, opportunities and outcomes (where such information is publicly available). This research aims to learn from the experience of international brownfield redevelopments to better understand the risks and opportunities associated with various land use scenarios to inform the development of a strategic framework for the subject site in Moolap.

## 1.3 Research Methodology

Twelve case studies were selected for this research. The selection of case studies was informed by:

- Community feedback provided to DELWP through its community engagement process conducted in late 2015 - early 2016;
- A review of available literature; and
- Discussions with urban design experts including Emma Appleton, Director of the Victorian Design Review Panel in the Office of the Victorian Government Architect; Roz Hansen, Urban Planning advisor and Geelong Authority board member; and Rob McGauran, Architect and Fisherman's Bend Ministerial Advisory Committee member.

The selected case studies are (in alphabetical order):

- Adelaide International Bird Sanctuary, Australia
- Borneo Sporenburg, Amsterdam, Netherlands
- Camargue Regional Nature Park, France
- East Trinity Inlet, Cairns, Australia
- Gardens by the Bay, Singapore
- HafenCity, Hamburg, Germany
- Hammarby Sjöstad, Stockholm, Sweden
- Île de Nantes, France
- Redwood City Saltworks, San Francisco, USA
- Sanctuary Lakes, Point Cook, Victoria, Australia
- Troutdale Reynolds Industrial Park, Oregon, USA
- Wildfowl and Wetlands Trust (WWT) Wetland, London



*Figure 1: Location of case studies*

The primary data source for the case studies was literature collected from:

- Academic databases
- Public websites
- Newspaper articles
- Information provided by relevant architectural, development and urban design firms
- Local governing authorities.

Due to its close proximity and ease of access, the Sanctuary Lakes case study also included a site tour with representatives from DELWP, Sanctuary Living, City of Greater Geelong, Greening Australia, Geelong Field Naturalists, Bird Life Australia, Sanctuary Lakes Residents Group, Brett Lane and Associates, and Deakin University.

Copyright permission has been sought to reproduce images for each case study in this report. In instances where it has not been possible to obtain such permission, hyperlinks have been provided to access publicly available online images.

Additional to the selected case studies is a brief overview of the findings of the Delta Commission in the Netherlands. In 2008 the Delta Commission made 12 recommendations on how to protect the Dutch coast and low-lying hinterland against the consequences of climate change through an integrated long term vision. These recommendations are provided in an appendix to this report as a potential source of inspiration and direction for the Moolap site in regard to issues of flooding and sustainability.

## 1.4 Structure of the Report

The data has been sorted, collated and synthesised to provide a succinct overview of each case study. Each chapter presents a different case study that includes the following information:

- Written description
- Reference table indicating location and context, former land use, new/proposed land use, size, year of development, issues, benefits and dis-benefits, phases of the project, cost and funding mechanism
- Aerial map indicating site boundaries
- Context diagram indicating proximity of site to nearest city/cities
- Land use legend
- Scale comparison diagram of case study site and Moolap site.

## 1.5 Using this Report

This report does not seek to make recommendations on future land uses for the Moolap site. Rather, it provides a broad range of possible scenarios that have been tried and tested in other parts of the world, focusing on lessons learned that may help to inform the Moolap Coastal Strategic Framework Plan, as part of a broader suite of detailed, site specific investigations being conducted by DELWP.

## 1.6 Key Learnings and Recommendations

The key lessons from the examination of the 12 case studies examined include:

- A key priority in exploring development options should be to manage environmental risks including acid sulphate soils and climate change.
- Renewal should seek to respond to a site's surrounds and sense of place, including the natural landscape and history of the area. The most effective urban renewal projects demonstrate a sophisticated response to place and site characteristics.
- Sensitive development has the potential to expand and improve the natural function of the saltpans as a significant wetland area and part of an internationally significant bird migration route.
- The Moolap project presents an opportunity to consider how the site might contribute to Geelong's climate resilience.
- Best practice urban renewal on sensitive waterfront sites involves building with nature. This means understanding, working with, and where possible, enhancing the ecological function of these landscapes as a way of managing environmental risks including climate change. This is addressed in more detail in Chapter 3 of this report (Delta Commission).
- Urban renewal demands a whole-of-government approach, with authorities working together and making targeted upfront investments. Where private funding is involved, it must support upfront investments in necessary infrastructure and services including environmental works, open space and transport.
- Large-scale developments depend on the proximity of city centres and public transport infrastructure.
- Interface areas between different land uses and developments need to be managed carefully.
- Even in market-based developments, Government has a vital role in planning, delivering upfront infrastructure and managing environmental risks on brownfield sites.

## 2. INTRODUCTION

Brownfield or urban renewal developments on sensitive sites are becoming more common as cities around the world seek to leverage opportunities and make the most productive use of available land. These projects are also often required to address complex environmental management issues such as contamination or other land management constraints.

The study area of more than 1,200 hectares encompasses two key urban renewal sites, located on low-lying waterfront land some 8km east of the city centre. The Alcoa Point Henry site has been used for aluminium production and will require extensive rehabilitation works, while the Cheetham Saltworks site includes significant wetlands and natural and man-made lagoons. Both sites are not only strategically important, but of environmental significance and have a critical role to play in defining Geelong's future identity.

This report seeks to inform the consideration of options for this significant area by exploring case studies from around the world that include former saltworks sites, urban renewal developments and sensitive waterfront sites. The case studies comprise a range of approaches from conservation and multi-functional environmental reserves, to high-density mixed-use developments and industrial parks. All cover complex sites and present interesting political, economic, social and environmental dimensions. None of the case studies provide a template for the study area, but all provide lessons and ideas that might inform planning for the Moolap site and what development options might be considered.

Alongside the case studies, the recommendations of the 2008 Delta Commission report commissioned by the Dutch Government are presented. This report aims to address water safety, water security and climate change issues in the Netherlands and can be considered to present a high-level best-practice approach to inform the management of climate change risks on low-lying land. The Delta Commission's recommendations, together with lessons identified from the 12 case studies in this report, present a range of issues that need to be considered as part of planning for the future of the Moolap site.



*Figure 2: Former Cheetham Saltworks site, Moolap. Photo: Donna Squire, Deakin University*



### 3. DELTA COMMISSION

The Dutch Government convened the Delta Commission in 2008 to provide recommendations on protecting the coastline and low-lying hinterland against rising sea-levels associated with climate change.

The commission's final report focuses on flood protection and securing fresh water supplies. The final recommendations present a best practice approach to managing development in low-lying areas that has the potential to inform planning for the Moolap site.

The commission's proposals focus on:

- Harmonizing as much as possible with natural processes
- Seeking multi-functional approaches that deliver social value
- Cost-effective, flexible approaches that can be implemented gradually and offer prospects for action in the short-term.

Among its recommendations, the Delta Commission found:

- Decisions on whether building should happen in low-lying areas must be based on a cost-benefit analysis. Costs must further be borne by those benefiting from development proposals rather than being passed on to other levels of government or society as a whole.
- Building should happen with nature. To this end, the Delta Commission outlines an ongoing program of beach restoration ("beach nourishments") and government sets clear building codes, educates residents and provides flood warnings. Beach nourishments are seen as providing multi-functional space for nature and recreation.
- Ongoing monitoring of sea levels would be required to guide future action.
- Any development outside areas protected by dykes must not impede the function of river systems.
- The function of specifically identified existing tidal systems including estuaries and wetlands must be maintained.
- A dedicated federal budget reserve/future fund and enabling legislation would be required to support investments including land acquisition and infrastructure works associated with climate protection.

The Delta Commission's recommendations focus on the short term, the long term up to 2050 and beyond 2050.

A copy of the Delta Commission's 12 recommendations for the future is provided in Appendix I. For further information the full report is available at: [http://www.deltacommissie.com/doc/deltareport\\_full.pdf](http://www.deltacommissie.com/doc/deltareport_full.pdf)

#### 3.1 Building with Nature

The Delta Commission's report raised the idea of "Building with Nature", which has since become an important focus in the Netherlands. Building with Nature is one of a number of contemporary approaches that seek to respond to environmental risks (such as climate change) by integrating nature in planning, engineering and urban design. Building with Nature is a design philosophy principally based in hydraulic engineering that seeks to integrate flora, fauna, natural materials, currents and weather conditions to manage complex environmental challenges in an ecological manner that supports nature and creates new recreational and economic assets.

In the Netherlands, Building with Nature has become an innovation program run by EcoShape; a consortium of government, research institutions and the private sector. Building with Nature re-envisages flood mitigation or coastal management works as opportunities for multi-functional spaces including recreational reserves, habitats, economic opportunities or other assets.

This approach shares similarities with "integrated coastal management" approaches such as Blue Urbanism, which proposes that planning and built environment disciplines consider land and water as seamless, with the two meeting in an increasingly dynamic and blurred edge. Many of the case studies in this report respond to climate change risks by deploying sophisticated approaches that recognise the increasing fluidity of the transitional zone between land and water and the unique environmental, social and economic opportunities that flow from successful management of these areas.

## 4. ADELAIDE INTERNATIONAL BIRD SANCTUARY, AUSTRALIA

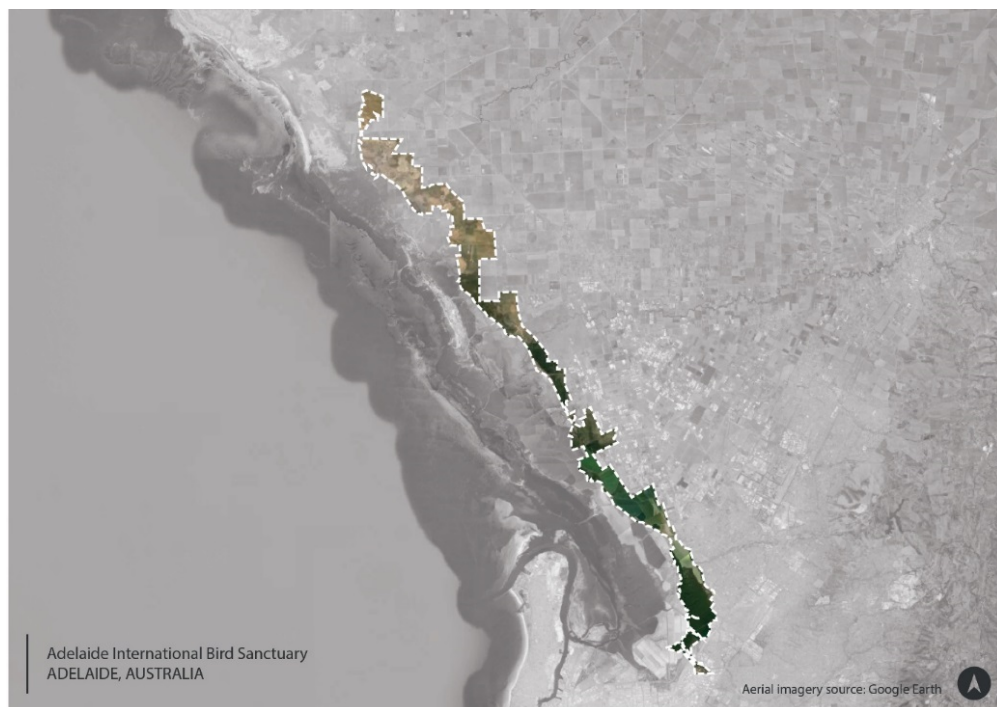
### 4.1 Introduction

The Adelaide International Bird Sanctuary proposes to renew around 10,000 hectares of land, once part of a mineral lease over the Dry Creek Saltfields that were constructed in the 1930s.

The Ridley Corporation, which had owned a large portion of the site as freehold land and had rights to the mining lease over Crown land, has worked with the State Government to close its operations. The Commonwealth Government has ruled that the site closure is to be a controlled action under the Environment Protection and Biodiversity Conservation Act (1998).

The South Australian Government's vision for the site is to "create an internationally important conservation area on the fringes of Adelaide that safeguards migratory birds, improves the health of the Gulf of St Vincent and supports sustainable urban development".

As well as a conservation reserve, the project presents a sophisticated, urban ecology-based response to climate change risks. It presents to manage risks associated with remediation of the site including the formation of coastal acid sulphate soils, provide habitat for internationally significant species, improve water quality and develop an internationally significant ecotourism asset for the city of Adelaide.



*Figure 3: Aerial map, Adelaide International Bird Sanctuary*



*Figure 4: Aerial view of saltfields. Photo: Govt. SA (2014)*



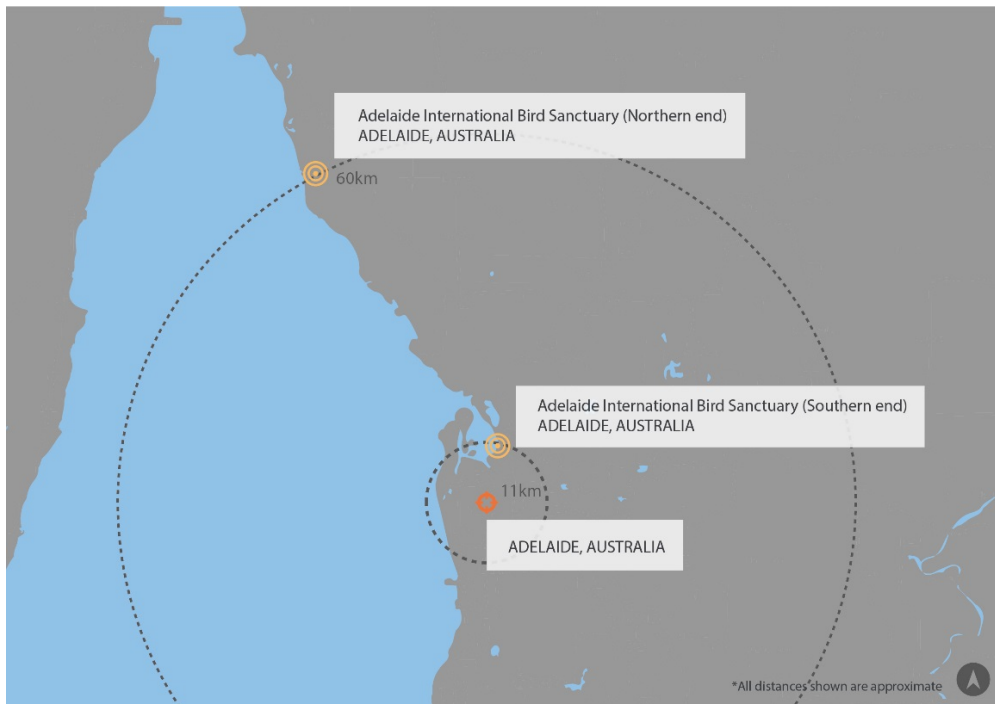


Figure 5: Proximity map of Adelaide International Bird Sanctuary and nearest city



Figure 6: Scale comparison map of Adelaide bird Sanctuary and Moolap site.

## 4.2 Site conditions

Before the 1930s, the site had supported wetlands including saltmarsh and mangroves. Of the 10,000 hectares covered under the mineral lease, 4,000 were developed as artificial saline ponds used to produce salt. The remainder of the site is undeveloped and has had limited access over the last 80 years, providing vital habitat for a range of species.

The Adelaide International Bird Sanctuary proposal includes all of the ponds apart from the southernmost area adjacent to the Port River Expressway and Port Wakefield Road, which have been identified in the 30 Year Plan for Greater Adelaide (published in 2010) as an urban growth area. These saltfields were indicated in the 30 Year Plan as having a lower conservation significance.

The Dry Creek Saltfields have been recognised internationally as a significant waterbird habitat for more than 50 years, supporting 25,000 waterbirds with 52 different species. Of these, 29 species are protected, 17 species are listed as rare and two are vulnerable.

The site includes the risk of acid sulphate soils forming on exposed areas, particularly the former salt ponds should they run dry.

The land identified as part of the sanctuary is likely to include most of the Crown Land in the area. It is envisaged that the reserve would be proclaimed as a conservation park under the National Parks and Wildlife Act (1972).



Figure 7: Land uses and facilities legend for Adelaide International Bird Sanctuary

### 4.3 Governance and planning frameworks

The land under the mining lease is either held by the Crown (including most of the coastal land seaward of the salt ponds) or freehold land which was sold by the Ridley Corporation in 2015. Most of the freehold land is on the landward side of the saltfields. In 2015, the Ridley Corporation sold its holding on the site to an entity associated with Adelaide Resource Recovery, a firm based near the Dry Creek site.

The South Australian Government's project plan has five main aims:

- Conserving the Adelaide hub of the international migratory bird flyway
- Enhancing water quality in the Gulf of St Vincent
- Creating a more liveable and sustainable city
- Offering exclusive eco-tourism experiences
- Facilitating indigenous involvement.

The project plan requires a whole-of-government approach across state government departments and agencies, consultation with local councils and work with research groups and non-government agencies.

The State Government committed to the proposal at the 2014 election, after which the Government bought 2300 hectares of undeveloped land from Ridley Corporation for \$2m to incorporate into the sanctuary. Another \$1.7m in funding has been committed over four years to produce a management plan, preparation works including pest control, rehabilitation and fencing, and build bird hides and visitor facilities such as boardwalks and interpretative signage.

### 4.4 Sustainability

The project is set to achieve an array of sustainability benefits for South Australia including improving biodiversity, providing opportunities to connect with nature, supporting Australia's treaty commitments relating to international birds and providing

significant opportunities to store carbon through the renewal of salt marsh wetlands, which are known for their carbon sequestration properties.

The proposal provides significant opportunities for the treatment of wastewater from SA Water’s treatment plants, as well as opportunities for regional local governments to capture, treat and possibly reuse stormwater by flushing it through rehabilitated tidal wetlands. This in turn would improve water quality at local beaches, safeguard commercial fisheries and nearby recreational fishing spots. It remains to be seen if or how the changed water regime affects the wetlands’ function and current plans provide for an ongoing monitoring regime.

Aside from its environmental credentials, the project contributes to Adelaide’s economic sustainability by mitigating risks posed by climate change and sea level rises, supporting local fishing and providing significant ecotourism potential.



Figure 8: Birdlife. Photo: Govt. SA (2014)

#### 4.5 Summary table

<b>Location and Context</b>	Northeast coastline in the Gulf St Vincent, South Australia, between Port Parham in the north and the southern end of Barker Inlet in the south.
<b>Existing Land use</b>	The area of coastline incorporates various uses including a saltworks that ceased production in June 2013, aquatic reserves and conservation parks and commercial fisheries.
<b>New Land use</b>	Proposed creation of a multi-functional conservation reserve that stretches 60km along the edge of the gulf that will consolidate a number of existing conservation areas on both land and sea.
<b>Size</b>	The saltfields cover around 10,000 hectares. Around 4000 hectares were developed as Salina Ponds (artificially controlled saline ponds used to produce salt). The rest of the land is undeveloped and well preserved due to limited access to the site for the past 80 years.
<b>Year of development</b>	2014-2018
<b>Issues, Benefits and Disbenefits</b>	<p>Infrastructure</p> <ul style="list-style-type: none"> <li>• Provides a means to treat and improve the quality of stormwater flowing into the Gulf of St Vincent.</li> <li>• Protects existing development against sea level rise and storm surges.</li> <li>• Increases local climate change resilience.</li> </ul> <p>Economy</p> <ul style="list-style-type: none"> <li>• Potential to be a world-class eco-tourism and bird-watching destination as part of an internationally-significant migration path.</li> </ul>

	<ul style="list-style-type: none"> <li>• Raise South Australia's international reputation as a tourism destination.</li> <li>• Potentially reduces the requirement for future coast protection works across a substantial area of Adelaide's coastline.</li> </ul> <p>Environment</p> <ul style="list-style-type: none"> <li>• Provides internationally significant habitat for migratory bird species.</li> <li>• Integrated water management required to ensure the sanctuary reduces risks of acid sulphate soils forming in decommissioned salt ponds.</li> <li>• Saltmarsh is one of the most effective known landscapes for carbon sequestration.</li> <li>• Some existing salt ponds to be used to treat stormwater from surrounding urban areas, while others may be re-opened to tidal flows through further wetland regeneration. Potential for the wetlands to treat wastewater from nearby treatment plants has also been explored. Stormwater, wastewater and tidal flows to largely replace pumping associated with saltworks.</li> </ul> <p>Heritage</p> <ul style="list-style-type: none"> <li>• Recognises the history of mangrove and saltmarsh wetlands that predated salt production.</li> </ul> <p>Community</p> <ul style="list-style-type: none"> <li>• Supports Australia's international treaty obligations to protect migratory bird flight paths.</li> <li>• Provides potential opportunities for people to connect with nature.</li> </ul>
<b>Staging of the project</b>	<p>The condenser ponds are currently in a Holding Pattern, whereby water is still being pumped through the fields to maintain salinity and water levels.</p> <p>The northern section of the Sanctuary is expected to be proclaimed a National Park by mid-2016. Sanctuary Management Plan expected mid 2017.</p> <p>Establishment of the park is expected to be complete in 2018.</p>
<b>Cost and funding mechanism</b>	<p>The South Australian Government committed to the proposal at the state election held in March 2014. The 2014-15 State Budget included expenditure of \$300,000 for the purpose of commencing work. \$2 million was committed in August 2014, which included the purchase of 2,300 hectares of land formerly held by the saltworks operators.</p> <p>The South Australian government has also committed to an expenditure of \$1.7 million over a period of 4 years for the sanctuary's establishment and ongoing maintenance.</p>

#### 4.6 Potential lessons for the Moolap Plan

- Remediation of saltworks and associated wetlands can create a significant eco-tourism asset.
- A conservation reserve on former saltworks can form a multi-functional space with an array of ecological and social benefits including conservation, climate change mitigation, climate change adaptation, stormwater treatment, flood mitigation, reduced risk of coastal acid sulphate soil formation and facilitating community connection with nature.
- The Moolap saltworks presents an opportunity to further Australia's international treaty commitments to protect migratory birds along the East Asian Australasian Flyway, and the protection of species listed under the Environmental Protection and Biodiversity Conservation Act (1998).

#### 4.7 Further information

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## 5. BORNEO SPORENBURG, AMSTERDAM, NETHERLANDS

### 5.1 Introduction

Borneo Sporenburg is an urban renewal project based on the former Amsterdam eastern docklands that sought to create a high-density residential development on the edge of the city. Amsterdam has an urban population of more than 1.3 million. Its urban centre includes more than 880,000 bicycles and 216 trams. The city aims to reduce carbon emissions by 40% by 2025 compared to 1990 levels.

The development is the first Dutch high-density residential development with individual ground level access to every unit, and the first post-industrial urban renewal development of its size and scale in the Netherlands. Planning was completed between 1993-1996 and construction began in 1992 and finished in 2000.

The neighbourhood is mostly residential, with 2,500 housing units at a density of 100 units per hectare. Historical Dutch housing forms inspired the precinct's design and planning codes required a diversity of housing choices catering for a mix of residents including families.

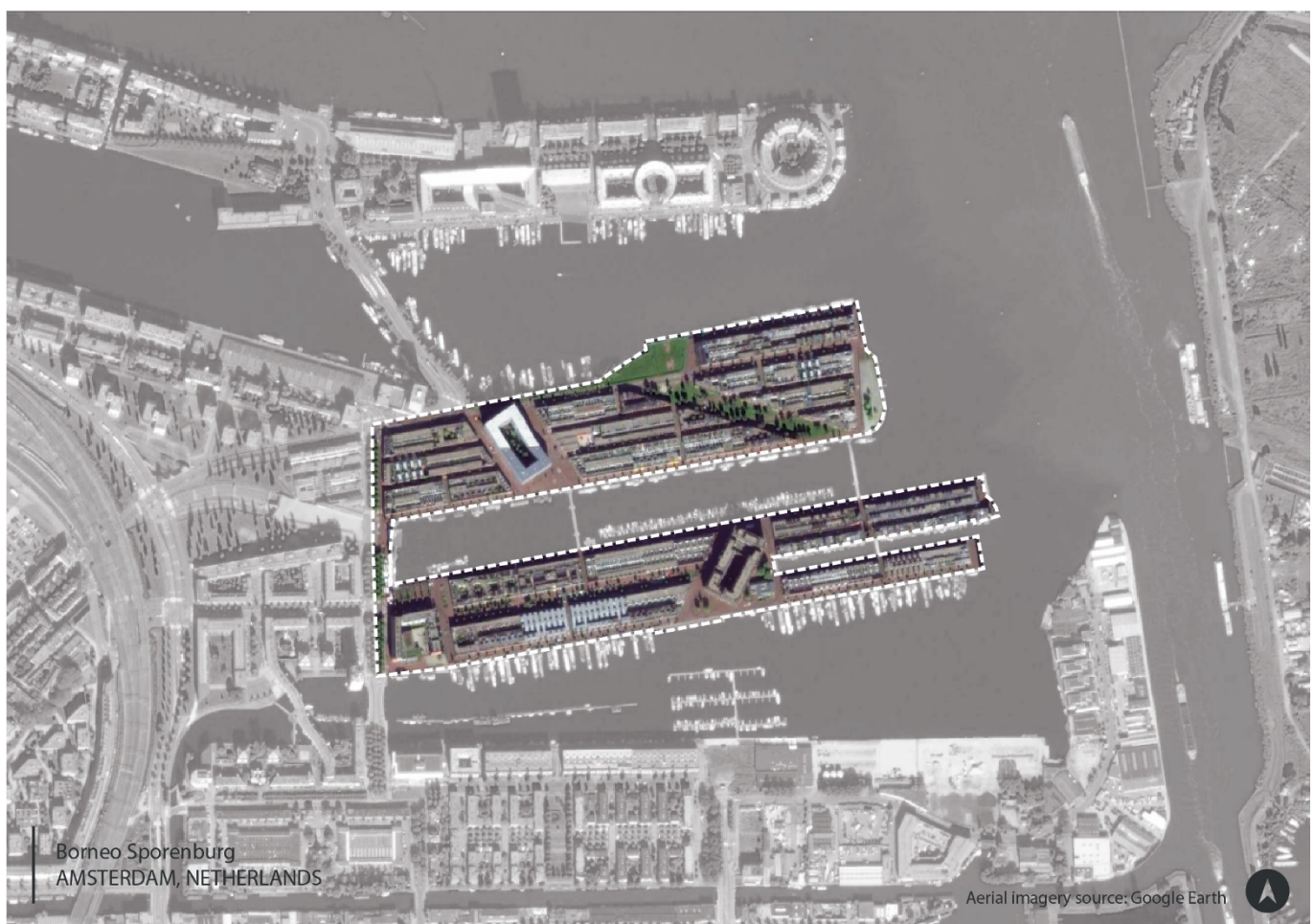


Figure 9: Aerial map, Borneo Sporenburg



Figure 10: Proximity map of Borneo Sporenburg and nearest city

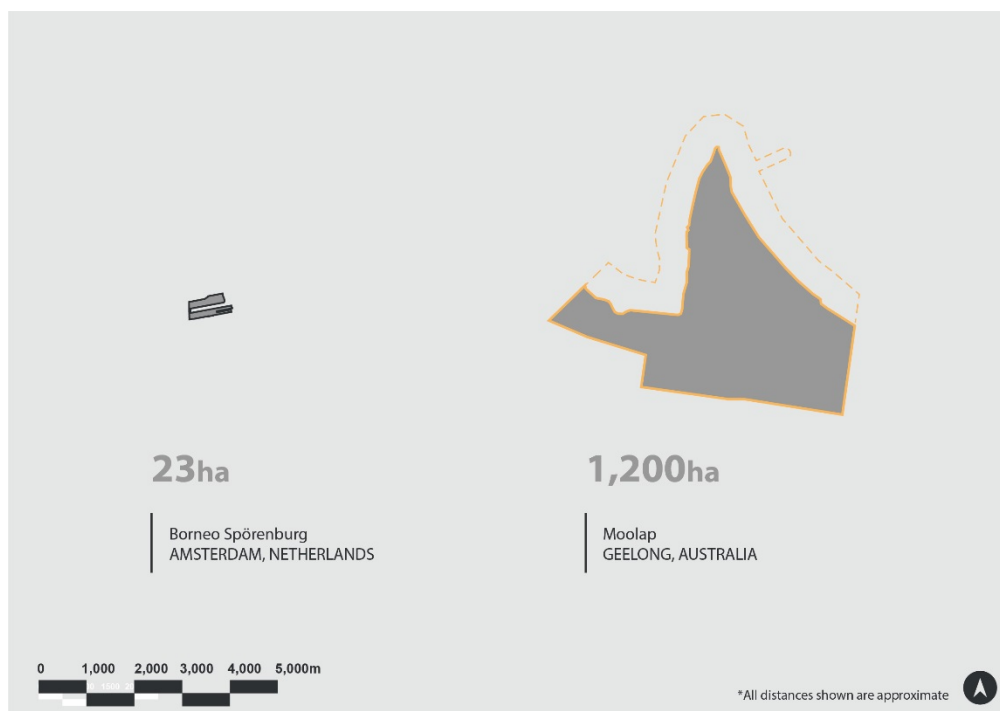


Figure 11: Scale comparison map of Borneo Sporenburg and Moolap site

## 5.2 Site conditions

The 250,000m<sup>2</sup> site in the Eastern Docklands neighbourhood of Amsterdam was once used for shipping to support trade with the Netherlands' eastern colonies. The site encompasses two peninsulas (Borneo and Sporenburg) surrounded by a harbour and canals. The area is exposed to harsh easterly winds from the docks.

The area grew rapidly after a deep water harbour was developed in 1876. After World War II, the harbour moved to the city's western docklands and the eastern docklands fell into complete disuse by the 1970s.

### 5.3 Governance and planning frameworks

Borneo Sporenburg was part of an urban renewal push to develop new housing areas in the Netherlands from the late 1980s. In 1989 Borneo Sporenburg was designated as a “pre-Vinex” location, which meant the City of Amsterdam was entitled to significant financial support from the national government to spearhead development in the area, provided construction started before 1996.

The strict masterplan, developed by Rotterdam-based West 8, focused on creating unique structures within a unified whole. The masterplan set design codes and criteria that dictated access arrangements, parking, private open space, storey and building heights, plot widths and building materials. The codes also required that dwellings should be designed by a variety of architects to promote diverse facades, particularly among the narrow façade rhythms of terrace houses.

As the precinct is predominantly residential, housing design is a vital characteristic. Housing design is inspired primarily by traditional Dutch canal or patio houses, and the former Zuiderzee villages where small houses descended straight to the water. The blocks of terrace housing are broken up by three large apartment blocks which are oriented diagonally to maximise waterfront views.

### 5.4 Sustainability

Borneo Sporenburg provided alternatives to further densification of Amsterdam’s inner core and sprawl by providing a diverse range of housing options on a brownfield site. The terrace house design has proven adaptable, catering for a range of dwellings from social housing to executive apartment-style houses.

High density development is achieved by arranging dwellings in a compact system of plots and small streets that also promotes walkability. This is further enhanced by the variety of distinctive housing facades, apartment blocks and the waterfront which add character and make the area easy to navigate.

Two sculptural stainless steel bridges connecting the peninsulas are for pedestrian use only, emphasising cycling and walking activity. The bridges provide landmarks and focal points. Car parking is internal or underground with little on street parking. The precinct is a 15-minute bike ride from the city centre.

The housing design reacts to the exposed dockside location by taking public space into private voids within houses. The masterplan requires that 30%-50% of each dwelling should be void (for example, a patio courtyard), meaning houses directly front the street without front or rear gardens, that natural light permeates terrace houses and that minimal open space in the precinct is exposed to the easterly winds from the docks. The area includes little open space apart from the pedestrian bridges, which come alive during summer, and the water, which serves as the dominant public space reflecting Amsterdam’s boating culture.

The other effect of the lack of front gardens has been the direct relationship between the house and street, providing greater interaction with the street front and further potential for passive surveillance of the public domain.

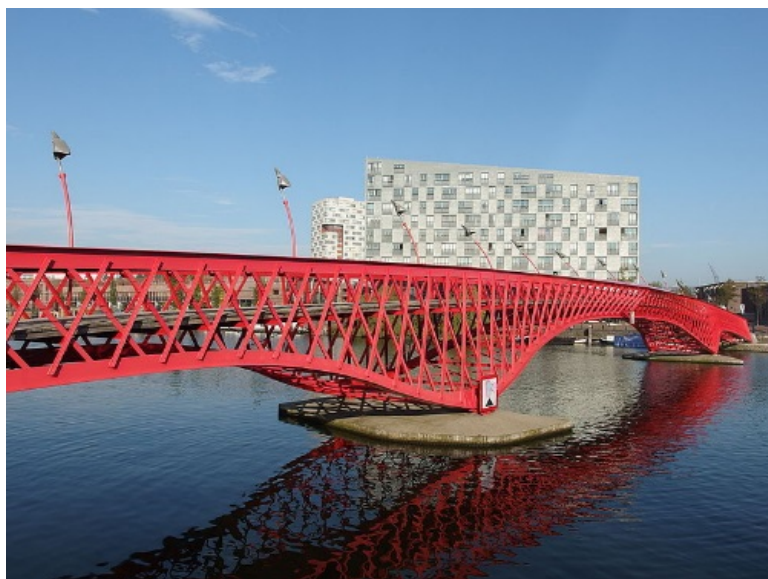


Figure 12: Red bicycle bridge. Photo: Guilhem Vellut, Creative Commons Licence





Figure 13: Waterfront housing. Photo: Courtesy of MGS Architects



Figure 14: NEMO Science Centre. Photo: Courtesy of MGS Architects

### 5.5 Land use and facilities

Borneo Sporenburg is overwhelmingly residential, without shops and limited local facilities. The mosaic of terrace houses is broken up by three large apartment buildings, the largest of which is dubbed the Whale because of the shape of its roof, likened to a whale diving under the water and resurfacing.

The Whale's design allows the building to maximise viewlines of the surrounding environment. The building's raised design on two sides creates a central fold that allows natural light to reach the lowest floors and inner courtyard of the building. All apartment blocks contain courtyards or collective gardens.

Other features in the community include two schools, a small number of offices and shops, restaurants, a sports centre, medical institutions and a yacht club.

Only 30 percent of Borneo Sporenburg's units are social housing, rather than the 70 percent figure that has been typical of similar developments in the Netherlands.



Figure 15: Land uses and facilities legend for Borneo Sporenburg



## 5.6 Summary table

<b>Location and Context</b>	Borneo Sporenburg consists of two peninsulas on Amsterdam's eastern harbour.
<b>Existing Land use</b>	Docklands and associated industry.
<b>New Land use</b>	Borneo Sporenburg forms a high-density housing area that accommodates terrace housing as well as three large apartment buildings.
<b>Size</b>	Approximately 25 hectares.
<b>Year of development</b>	1992-2000
<b>Issues, Benefits and Disbenefits</b>	<p>Infrastructure</p> <ul style="list-style-type: none"> <li>• More than 100 architects designed buildings, leading to diverse interpretations within the rigid masterplan. This provided a variety of house types and a navigable streetscape.</li> <li>• Two pedestrian bridges linking the peninsulas form the main public spaces.</li> <li>• Blocks of terrace/canal houses broken up by three large apartment blocks.</li> <li>• The development is considered a highly innovative and successful urban renewal project notable for its master planned approach and cooperation across multiple levels of government. The project won the Victoria Rudge Green Prize in Urban Design from Harvard University in 2002.</li> </ul> <p>Economy</p> <ul style="list-style-type: none"> <li>• Few local shops and facilities – precinct very much residential.</li> <li>• Good housing diversity catering for wide range of ages and demographics, 30% is subsidized social housing (below Dutch average).</li> </ul> <p>Environment</p> <ul style="list-style-type: none"> <li>• Pedestrians and cyclists are well-catered for, with limited on-street car parking available.</li> <li>• Courtyard designs allow for natural light in houses.</li> <li>• Little green space, apart from internal courtyard gardens in buildings.</li> <li>• Development benefits from nation-wide strategies to protect the low-lying Dutch coastline from climate change-related inundation. These include ongoing beach restoration, dyke maintenance, historical land reclamation and level raising, maintenance of Amsterdam's canal network and constant government investment in flood mitigation.</li> </ul> <p>Heritage</p> <ul style="list-style-type: none"> <li>• The housing design draws its inspiration from Dutch seaside villages.</li> </ul> <p>Community</p> <ul style="list-style-type: none"> <li>• Organising dwellings in a compact system of plots and small streets has allowed for high densities and good surveillance of public areas.</li> <li>• Little green space – waterfront and pedestrian bridges are main public areas, with green spaces provided within building courtyards. This design has proved contentious in some quarters.</li> <li>• No front gardens means houses have very strong direct relationship with the street. This has engendered a feeling of community safety.</li> <li>• Inspiration from historical Dutch housing types promotes greater sense of identity and place.</li> </ul>
<b>Staging of the project</b>	<p>1992: Master planning process started.</p> <p>1996: Planning complete, development began.</p> <p>2000: Development of peninsula completed with more than 2500 housing units.</p>
<b>Cost and funding mechanism</b>	Public investment from local and national governments, with some private investment in buildings.

## 5.7 Potential lessons for the Moolap Plan

- Borneo Sporenburg presents an option for higher density development that is predominantly low-medium rise and can cater for families.
- Higher density development does not have to mean high rise development.
- A strict master planned approach can still achieve imaginative, interesting design.
- Courtyard style housing can provide an alternative means of providing open space to exposed sites but it can be contentious when it comes at the expense of public open space.
- Housing can be designed to impart a unique sense of place by drawing on local history.
- Narrow and frequently changing building facades are important in building a walkable urban fabric.
- A whole-of-government approach that potentially includes seed funding is vital in providing a catalyst for urban renewal projects.

## 5.8 Further information

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## 6. CAMARGUE REGIONAL NATURE PARK, FRANCE

### 6.1 Introduction

A wilderness constantly built and reformed, La Camargue is a place of paradoxes. The largest wetland in France, it was declared a UNESCO Biosphere reserve in 1977. Yet the reserve has an extensive history of human modification stretching beyond Roman times. It has a rich history and local culture based on farming, grazing and interaction with the harsh landscape. The area is famous for its eponymous white horse breed, fighting bulls, livestock that roam parts of the reserve and the horsemen that herd them.

Today, La Camargue is recognised as an internationally significant environmental, eco-tourism, agricultural and social asset. The Natural Regional Park of Camargue (NPRC) sits at the Rhine River's delta, covering 101,000 hectares including freshwater, brackish and saline wetlands interspersed with grazing and intensive agriculture.

The wetland is home to two-thirds of Europe's bird species and is the Greater Flamingo's only nesting site in France. Yet it remains a unique example of human and environmental interaction.

Tourism has become a major economic activity in the area, along with agriculture and conservation. More than one million visitors travel to the area annually.



Figure 16: Aerial map, Camargue Regional Nature Park



Figure 17: Proximity map of Camargue and nearest city

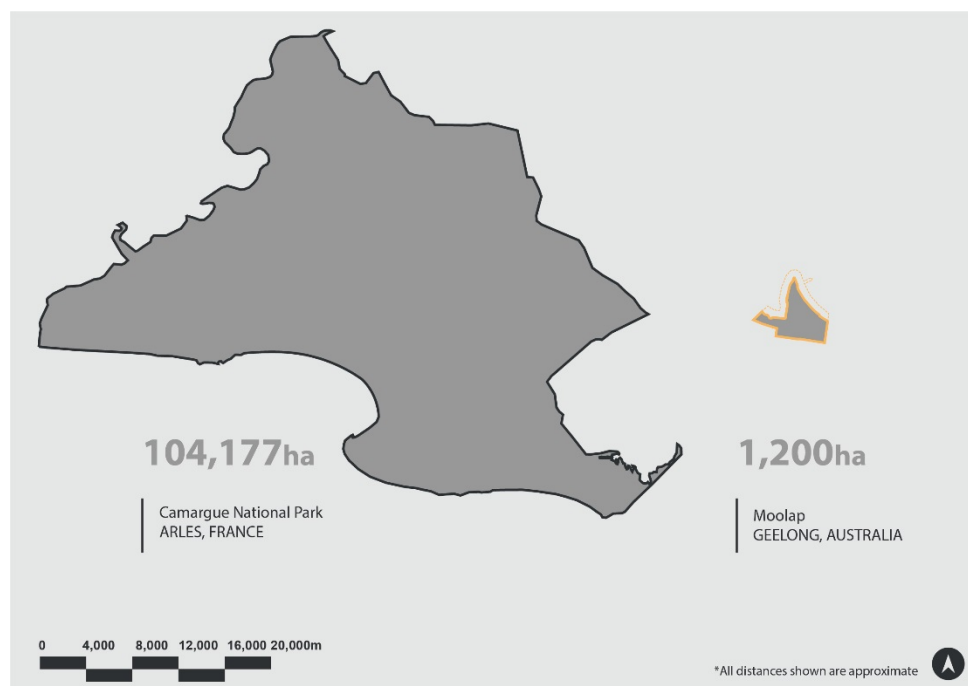


Figure 18: Scale comparison map of Camargue and Moolap site

## 6.2 Site conditions

La Camargue is a complex and highly dynamic landscape. Constantly shaped by the Rhine, it has been extensively modified by people for many hundreds of years through drainage schemes, dykes, continued agricultural activity including rice growing and grazing, recreation and salt production. The Rhine's dumping of mud at the delta has pushed the coastline further north over time. Water levels are constantly managed in the reserve, a process which supports its biodiversity.

The Camargue Wildlife Reserve was established in 1927 with the initial aims of conservation and promoting scientific study. Despite human attempts to "tame" the landscape over hundreds of years, La Camargue remains inhospitable with development constraints including saline soils, flooding and high winds.





Figure 19: Landscape of the Camargue Regional Nature Park. Photo: Creative Commons License.

### 6.3 Governance and planning frameworks

Governance of the region is complex. The site is one of Europe's most protected areas, owing to its designation as a Ramsar site, a UNESCO Biosphere reserve and UNESCO World Heritage site. Much of the Camargue delta is administratively part of the commune of Arles (population 50,000), centred on the city of Arles which is just outside the park.

Different organisations also administer beaches in the surrounding area, with different approaches to land management. Management of the reserve is led by the association *Gestionnaire de la reserve naturelle*, a non-profit conservation organisation registered as a charity in 1855. The association is now completing a new management plan for the reserve, which will run from 2016-2020.

Management of the reserve has in recent years focused on a policy of facilitating managed human interaction with nature. This includes producing a three-level hierarchy of birdwatching trails: those with free access to the landscape in areas of low-sensitivity, trails with purpose-built hides and guided tours of highly sensitive and protected sites.

An eco-tourism and development project, "Ecotourisme et développement en Camargue", started in 2003 with the aim of drawing on tourism to create employment while recognising the limited carrying capacity of sensitive areas. The project involved a feasibility study that identified fauna and natural assets, measures to reduce the impacts of human activities and working with the local population to develop tourism. The project was funded with a €2.6 million budget (AU\$3.97 million) from the European Union, World Wildlife Fund and Gaz de France and incorporated a range of sustainability initiatives including solar power, waste recycling and rainwater collection. Since 2008 park management and local communities have been working to implement the principles of the European Charter for Sustainable Tourism, which has included a travelogue-style blog covering attractions across five European parks including organic farms, natural heritage sites and local culture.

Studies of the management of the Camargue have suggested that ecosystem conservation has been furthered and ensured when it is understood that the main activities conducted on the land depend directly on the ecosystem. This has particularly been evident across protected wildlife areas and pastures.

### 6.4 Sustainability

Management of the landscape has recognised the need to limit human impacts on fragile areas while facilitating encounters between people, productive agriculture and nature. Community development programs have focused on drawing local economic benefits from tourism in the area. Research has found that local farmers' stewardship of pasture in the reserve has

been important in maintaining the natural environment. Limits on visitor numbers have been put in place, including a 100,000 annual cap on visitation to the Marshlands of Vigueirat.



Figure 20: Livestock. Photo: Michelle Osmenda, Creative Commons Licence



Figure 21: Flamingoes. Photo: Courtesy of DELWP

## 6.5 Land use and facilities

La Camargue remains a complex mosaic of often-conflicting land uses. Yet the focus on conservation has been renewed and strengthened as tourism has become increasingly important to the local economy. The park itself includes a number of private and public estates, not all of which are always open. Many of these estates and farms are promoted as tourism destinations in their own right. This has led to the region having a rich, multi-dimensional tourism offering.

Significant facilities around the park include Pont de Gau, a bird sanctuary that includes an educational centre, 15km of nature trails and access to scenic viewlines. The area has become an internationally renowned destination for birdwatching. The area has a rich and continuing history of infrastructure works that have supported biodiversity and in 2016 a new island was completed to provide further nesting area for the Greater Flamingo.



Figure 22: Land use and facilities legend for Camargue Regional Nature Park

## 6.6 Summary table

<b>Location and Context</b>	Located in the Rhone delta, south of Arles in France.
<b>Existing Land use</b>	Saltfields, agriculture (including rice paddies and grazing) and wetlands developed through river flows and extensive human intervention.
<b>New Land use</b>	Nature reserve and designated Ramsar wetlands alongside continued agricultural use and tourism development. Some private estates remain within the park. The site includes Visitors' Centres, renewed bird habitat and salt works observatory.
<b>Size</b>	The reserve's 13,000 hectares of ponds, lagoons and salt plains comprise one of Europe's largest wetland areas.
<b>Year of development</b>	Officially established and protected by the National Society for the Protection of Nature in 1927, recognised as a nature reserve in 1975 and designated as a UNESCO Biosphere area in 1977. Ongoing infrastructure works have been conducted in the reserve.
<b>Issues, Benefits and Disbenefits</b>	<p><b>Economy</b></p> <ul style="list-style-type: none"> <li>• Awarded tourist destination – equestrian and nature tourism.</li> <li>• The region attracts 1 million visitors each year.</li> </ul> <p><b>Environment</b></p> <ul style="list-style-type: none"> <li>• While flooding is managed via the construction of dykes along the coastline, it remains a problem in the region.</li> <li>• One of the most biologically diverse regions in Europe.</li> <li>• Visitation is managed to prevent damage to the ecologically sensitive environment.</li> <li>• Tourist management required to limit damage to ecologically sensitive environment.</li> <li>• Accredited as a Biosphere reserve under UNESCO's Man and the Biosphere Programme (MAB), an Intergovernmental Scientific Programme that aims to establish a scientific basis for the improvement of relationships between people and their environments.</li> </ul> <p><b>Infrastructure</b></p> <ul style="list-style-type: none"> <li>• Network of irrigation and drainage channels for supply of water for agriculture (stock breeding, rice, wheat and salt).</li> <li>• Dykes have been constructed to channel water across many centuries.</li> <li>• Several kilometres of walking trails have been built across the park.</li> </ul> <p><b>Heritage</b></p> <ul style="list-style-type: none"> <li>• Visitor Centres provide information on the area's rich natural environment, culture and traditions. The main visitor centre, Capilere, includes on-site accommodation facilities while the Pond de Gau bird sanctuary includes an educational centre.</li> <li>• The park includes a number of farms and some private estates. The area's grazing history has been maintained.</li> <li>• Distinct, prized local breeds of horses and cattle.</li> </ul>
<b>Staging of the project</b>	Not known.
<b>Cost and funding mechanism</b>	<p>Jointly administered by authorities, the National Society for the Protection of Nature and local people.</p> <p>Funding for tourism-based developments and maintenance within the park comes from various sources including the National Society for the Protection of Nature, government authorities and the European Union.</p>

## 6.7 Potential lessons for the Moolap Plan

- A range of activities can successfully co-exist in sensitive landscapes if their operation recognises their fundamental dependence on the overall ecosystem.
- Human intervention in sensitive environments can improve biodiversity.
- Wetlands can be managed and developed as internationally significant tourism attractions.

- Sustainability can be understood as an environmental, economic and social concept – and managed accordingly, even in sensitive landscapes.

## 6.8 Further information

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## 7. EAST TRINITY INLET, CAIRNS, AUSTRALIA

### 7.1 Introduction

East Trinity Inlet is located on the opposite bank of the Trinity Inlet to the Cairns CBD. While Cairns has a population of around 142,000 people, around 120 people live around East Trinity. The area was originally a natural estuarine floodplain including mangroves and saltmarsh, rising to the hills of the Grey Peaks National Park further east. Attempts to cultivate sugar on the eastern bank in the 1970s exposed acid sulphate soils, which have caused significant environmental damage.

Following purchase of 990 hectares of land in the area by the Queensland Government in 2000, the area has become one of the world's most significant and successful acid sulphate soil remediation projects, with 774 hectares renewed as an environmental reserve using technology developed in Queensland.

While the success of the remediation project is undisputed, potential development in the area has long been contentious. Over the 1980s and 1990s, various developments were unsuccessfully proposed.

In 2014, state-government owned Ports North Corporation proposed three options for development of a 518-hectare site on East Trinity that would potentially have been a dumping ground for spoil associated with proposed dredging of the estuary mouth. The dredging sought to allow large cruise liners to enter the port, with an alternative option of dumping spoil in the ocean.

After the 2015 Queensland election, the newly-elected state Labor Government denied permission to dredge the estuary on economic and environmental grounds, putting further development plans in doubt.



Figure 23: Aerial map, East Trinity Inlet site, Cairns.

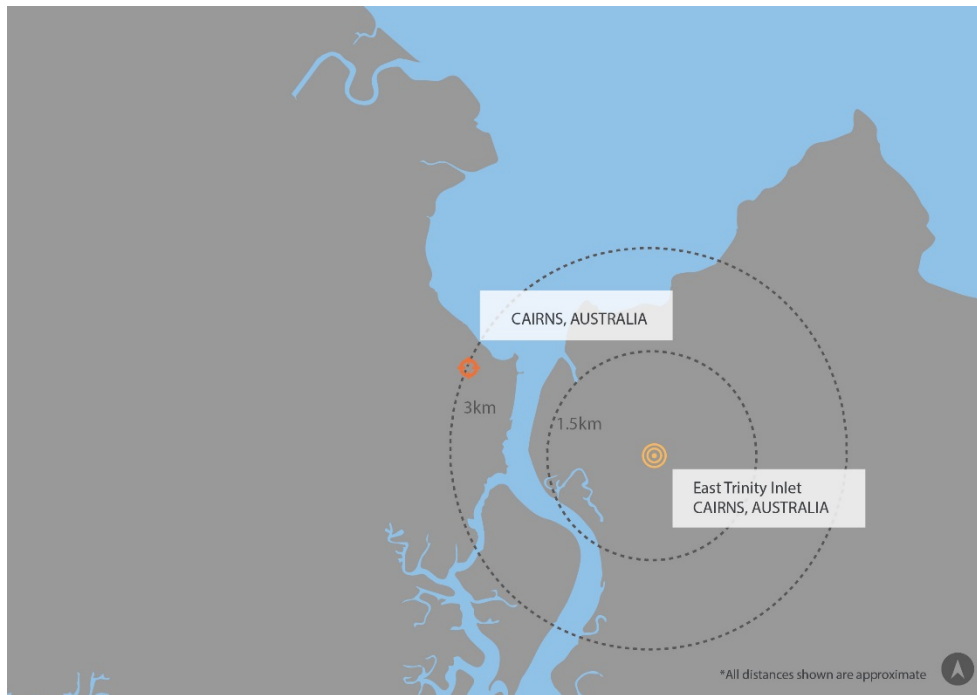


Figure 24: Proximity map of East Trinity Inlet and nearest city



Figure 25: Scale comparison map of East Trinity Inlet and Moolap site.

## 7.2 Site conditions

East Trinity has long been a tidal wetland. During the 1970s, the Colonial Sugar Refining Company sought to reclaim the land to grow sugar, building a 7km earth bund wall to prevent tidal flows over the site. These works exposed acid sulphate soils, causing significant environmental damage.

In 2014, Queensland Government investigations found remediation work had substantially improved water, soil, vegetation and biodiversity in the area.

Queensland Parks and Wildlife Service continues to manage the East Trinity Reserve, with a program covering infrastructure maintenance including internal roads and drains, management of pests like wild dogs and pigs, weed control including controlled burns and crocodile monitoring.



*Figure 26: Aerial view of Cairns in foreground, East Trinity Inlet site in middle ground, and Grey Peaks National Park in background. Photo: Brad Newton.*

### **7.3 Governance and planning frameworks**

Since the 1980s a variety of development proposals have been put forward for the East Trinity area including plans for a residential development in 1995 that included a golf course, hotel and marina. The Ports North proposal, put forward as part of an Environmental Impact Statement for the proposed dredging of the estuary, proposed three scenarios for development:

- Development for rural use, likely involving sugar cane production.
- Urban development with access via existing road connections with a population of around 14,500 on 5,180 lots (10 lots per hectare) using 5.26 million cubic metres of fill to raise the site for flood protection.
- Urban development with access via a bridge over Trinity Inlet, catering for a population of around 21,500 on 7,700 lots (at 15 lots per hectare). This option also required 5.26 million cubic metres of fill.

These proposals were knocked back along with the port dredging proposal. East Trinity area remains zoned for Rural use under the Cairns Region Plan (2016) with areas closer to the waterfront zoned for Conservation (2016).

### **7.4 Sustainability**

Management of coastal acid sulphate soils around East Trinity has been an outstanding environmental remediation success. East Trinity's recent history shows the scale of potential economic and environmental impacts associated with exposed acid sulphate soils.

Proposals for development in the area have been contentious, not least because of the site's environmental history. The most recent proposal to use dredge spoil to raise land levels to support development raised further concerns regarding impacts on ecosystem function, water quality, groundwater and the potential further release of acid sulphate soil.

The costs of dumping dredge spoil on the site were also deemed not economically viable.





Figure 27: Area of dead melaleuca. Photo: Peter Senior

## 7.5 Land use and facilities

East Trinity remains zoned for rural use with limited development. Queensland Parks and Wildlife Service continues to manage the nature reserve.

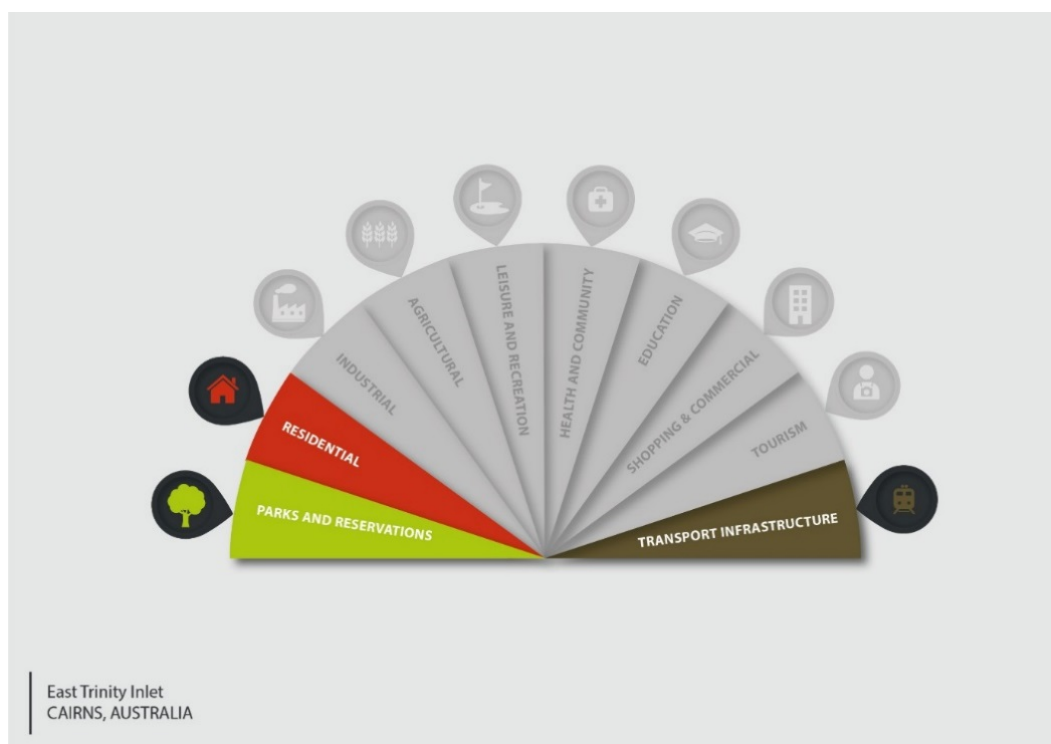


Figure 28: Land use and facilities legend, East Trinity Inlet, Cairns

## 7.6 Summary table

<b>Location and Context</b>	<p>Located 37km south-east of Cairns. The site is situated on a relatively flat coastal plain, but rises steeply to the hills of the Grey Peaks National Park to the east. The site is bordered by:</p> <ul style="list-style-type: none"> <li>• Tidal mangrove over which the Mandingalbay Yidinji people have been granted exclusive Native Title.</li> <li>• Melaleuca forest, held in reserve by Cairns Regional Council (CRC).</li> <li>• Freehold agricultural properties.</li> <li>• A small residential area.</li> </ul>
<b>Existing Land use</b>	Tidal wetland dominated by mangroves and samphire flats with fringing melaleucas.
<b>Proposed Land use</b>	<p>Development proposal to dredge Cairns Trinity Inlet channel and dump spoil in East Trinity. Associated with the dredging proposal, Ports North (owned by the Queensland Government) proposed three options to redevelop a section of land 400m back from the waterfront. The area of 518 hectares was estimated in line with the area of dredge spoil that would have been dumped on the prospective development site.</p> <p>The Queensland Government rejected the proposal to dredge the inlet in 2015, putting plans on hold.</p>
<b>Size</b>	939 hectares, including 168 hectares raised area and 775 hectares lowland area. The 2014 redevelopment proposal covered 518 hectares.
<b>Year of development</b>	In 2001, the Queensland Government purchased the land to remediate the acid sulphate soils. Several plans have been proposed for the area, with Ports North proposing new developments associated with dredging of the estuary in 2014.
<b>Issues, Benefits and Disbenefits</b>	<p><b>Infrastructure</b></p> <ul style="list-style-type: none"> <li>• The site has limited existing infrastructure. There is an internal road network consisting of unsealed roads, drainage channels and causeways. Site access is via the sealed Yarrabah Road, with the Cairns CBD being a 40 minute drive away.</li> <li>• Currently Cairns has limited land and waterway resources for urban development due to fast growing tourism and demand for infrastructure.</li> <li>• Proposed ferry service would provide transport into Cairns.</li> </ul> <p><b>Economy</b></p> <ul style="list-style-type: none"> <li>• Testing, reducing acid sulphate run-off into the Trinity Inlet, and maintenance of existing site is an ongoing drain on State funds.</li> <li>• Redevelopment has the potential to increase tourism and provide employment opportunities for nearby Yarrabah Aboriginal people and others living in Cairns' southern corridor.</li> <li>• Development scenarios canvassed in 2014 proposed intensified agriculture or housing for up to 20,000 people. This depended on dredging of Trinity Inlet to cater for larger cargo and cruise ships.</li> </ul> <p><b>Environment</b></p> <ul style="list-style-type: none"> <li>• Agricultural development in the 1970s exposed extensive areas of acid sulphate soils. The area has been slowly rehabilitated through a number of measures including active floodgate management, which has reinstated tidal inundation. Draining low-lying areas again and preventing regular tidal inundation would allow oxidation of the reformed sulfides, causing loss of important habitat to fisheries, waterbirds, saltwater crocodiles and other marine life.</li> <li>• Acid sulphate soils will require ongoing management. Dumping of dredge spoil on land around East Trinity may have imported further acid sulphate soil.</li> <li>• Weeds, feral pigs and vermin pose constant management challenges.</li> <li>• Stagnant water provides breeding ground for mosquitoes.</li> <li>• Crocodile habitat in the area.</li> </ul>

	<ul style="list-style-type: none"> <li>World-leading remediation of acid sulphate soils has improved water quality around wetlands to the point where they provide habitat for large populations of birds, fish and aquatic species.</li> <li>Development proposal from 2014 would have involved removal of more than 500 hectares of remnant and regenerating native vegetation communities with loss of habitat for migratory shorebirds, waders and threatened bird species.</li> <li>Trinity Inlet is mapped as a High Ecological Value (HEV) wetland on the basis of its location in the Great Barrier Reef catchment.</li> <li>Much of the site comprises low lying land below 1.5 m AHD, therefore the site is subject to active coastal processes in the form of an erosion prone area, storm tide hazard area and coastal management district.</li> <li>Increased boating and shipping activity has potential to release petroleum-based pollutants, anti-fouling leachates, litter and organic waste.</li> <li>Dredging and redevelopment proposals overturned after preparation of Environmental Impact Statements.</li> </ul> <p>Community</p> <ul style="list-style-type: none"> <li>Potential urban growth at East Trinity is not supported by regional planning exercises including the Far North Queensland Regional Plan or Cairns Plan 2016.</li> <li>Significant opposition from environmental groups.</li> <li>Future of the area is highly political.</li> </ul> <p>Heritage</p> <ul style="list-style-type: none"> <li>Consideration of local indigenous culture and integration with adjacent Native Title lands.</li> </ul>
<b>Staging of the project</b>	Development proposed to be completed in a single stage or to be divided into 2 phases.
<b>Cost and funding mechanism</b>	Queensland Government has anticipated initial costs of remediating acid sulphate soils using techniques such as tidal exchange and lime treatment of acidified areas at \$55m-\$70m over 25 years. More traditional methods may have cost up to \$300m. The 2014 redevelopment proposals were led by Ports North, a government-owned body.

## 7.7 Potential lessons for the Moolap Plan

- The environmental and economic risks associated with exposure of coastal acid sulphate soils are significant.
- Sites with complex histories and environmental factors will often be politically sensitive.
- Environmental protection needs to be prioritised in areas with potentially volatile coastal acid sulphate soils.
- Environmental restoration strategies used at East Trinity present precedents for effective remediation of acid sulphate soils.

## 7.8 Further Information

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## 8. GARDENS BY THE BAY, SINGAPORE

### 8.1 Introduction

Built on reclaimed land, Gardens by the Bay covers more than 100 hectares. The facility is a blend between a landmark infrastructure project, green open space and a conservation installation.

Gardens by the Bay is a significant part of Singapore's mission to transform itself from "garden city" to "city in a garden". The project challenges more traditional notions of public space, urban planning, landscape design and leisure. Gardens by the Bay is notable for its planning approach, management model and landmark design, with dazzling infrastructure including glass conservatories and man-made "supertrees". The gardens host more than 1700 species of plants from around the world.

While describing its vision as a "world of gardens for all to own, cherish and enjoy", the gardens are run and maintained by a company limited by guarantee that also has charity status. Ticketing forms more than two-thirds of the gardens' income. The gardens are effectively a semi-private realm.



Figure 29: Aerial map, Gardens by the Bay, Singapore



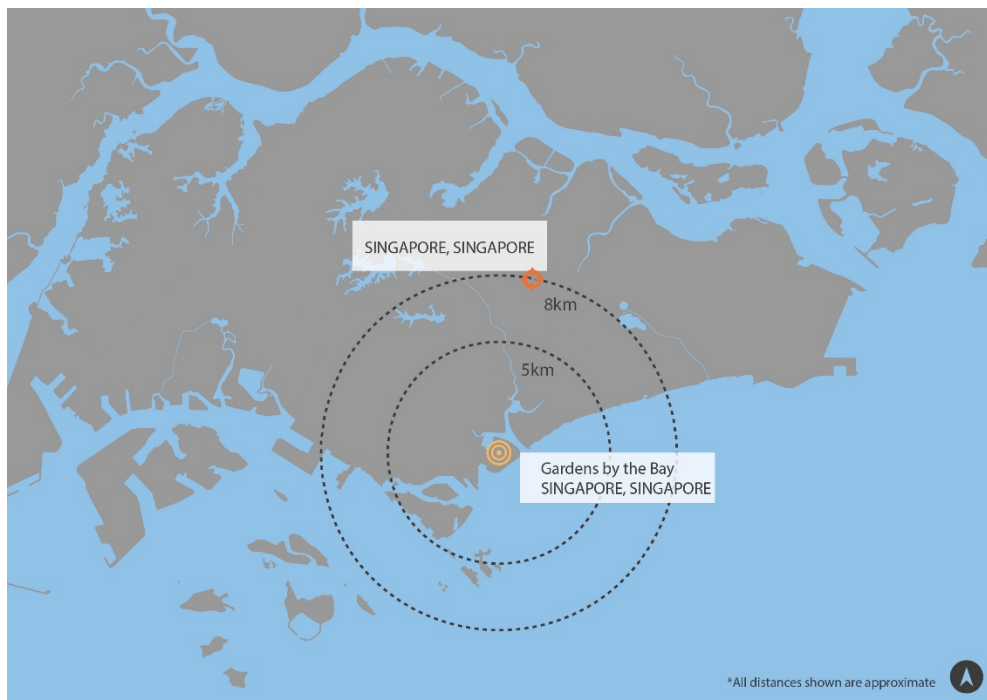


Figure 30: Proximity map of Gardens by the Bay and nearest city.

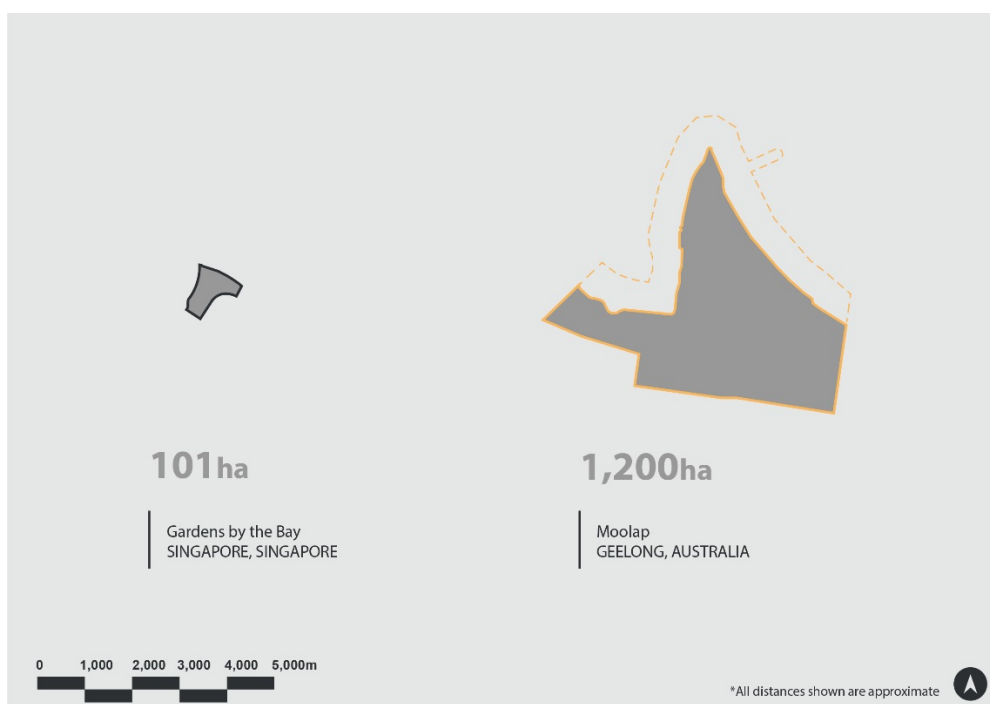


Figure 31: Scale comparison map of Gardens by the Bay and Moolap site

## 8.2 Site considerations

The site sits at a prominent location in Marina Bay, in the island's south near the mouth of the Singapore River and the city-state's Downtown Core. The area sits on reclaimed land and extensive drainage and soil preparation work was required. Initial construction and preparation works, excluding land reclamation, cost more than SG\$1.05bn (Note: the Singaporean and Australian dollar are currently at parity).

Land reclamation continues in Singapore with the island's area increasing by 22% between 1965 and 2015 and another 100km<sup>2</sup> of land proposed to be formed through reclamation work by 2030. Singapore's sand importing and the creation of land in sensitive border areas has caused some friction with its south-east Asian neighbours.



Figure 32: Aerial view of Gardens by the Bay. Photo: Wilkinson Eyre Architects

### 8.3 Governance and planning frameworks

The planning process and governance framework for Gardens by the Bay are notable. The planning process started in 2006 with a design competition that drew 70 entries from 170 firms. From these entries, a jury consisting of 11 local and international experts shortlisted eight teams. Masterplan concepts from the two final winning teams were publicly exhibited in 2006, with more than 10,000 people visiting and more than 700 providing feedback, which informed the final plans.

Gardens by the Bay was developed by a multi-disciplinary team with construction starting in 2007. Today Gardens by the Bay is a company limited by guarantee, which also has charity status. The company has a board of 14 Directors. In 2013/14, 68 percent of the company's income came from ticketing, with only 7 percent coming from donations and sponsorships. Another 14 percent of income comes from facility rental. Adult ticket prices are \$20 for Singapore residents and \$28 for non-residents.

The gardens' income in 2013/14 was SG\$49.198m, with expenses of SG\$63.927m. The gardens received almost SG\$27m further revenue in government grants over 2013/14.

The park seeks to promote a sense of local ownership through its volunteering program where more than 740 volunteers provide services ranging from visitor information to maintenance, participate in educational programs and biodiversity surveys.

Gardens by the Bay has a strong marketing presence including social media campaigns and a website geared to ticketing, public relations and promoting various value-adds like educational programs and publications for sale. In 2013/14, Gardens by the Bay spent around SG\$3.5m on marketing, communications and community programs.

### 8.4 Sustainability

While land reclamation is a resource intensive activity, the Gardens by the Bay project takes a broad approach to sustainability focusing on energy and water cycles, promoting a sense of ownership of Singapore's gardens through activities like volunteering programs and promoting connections to nature through educational programs.

The two landmark conservatory buildings are particularly notable for their design approach to energy. The exterior uses a specialised glass that allows optimal light for plants but minimises heat gain, while the rooflines feature sails that open automatically to provide shade when temperatures rise. Lower levels are cooled by air that is dehumidified. Energy is also generated on-site by a steam turbine that runs on horticultural waste.

The water cycles involve filtering run-off through wetlands and islands of aquatic plants. The gardens include two main lakes that capture run-off from the gardens before it is discharged to the nearby Marina Reservoir or used for garden irrigation. The lake system also includes habitats for aquatic animals while constant circulation of water keeps mosquito breeding in check.



Figure 33: Interior garden tower: Photo: Wilkinson Eyre Architects



Figure 34: View of the 'supertrees'. Photo: Wilkinson Eyre Architects

## 8.5 Land use and facilities

Home to around 600,000 individual plants, the gardens are notable for their landmark buildings. The two conservatories alone (Flower Dome and Cloud Forest) hold more than 100,000 plants of 1700 species between them. Both conservatories host special displays and events. From the outside, the buildings are notable for their distinctive appearance, described as being akin to “armoured hunchbacks” that rise from the landscape.

Also particularly notable are the “supertrees” – concrete and steel structures developed in the form of multi-functional forest trees that provide shelter and play host to vertical gardens, solar panels, lighting installations and even advertising displays. In 2013/14, the supertrees hosted around 154,000 individual plants of 675 species including tropical climbers, orchids, bromeliads, epiphytes and ferns. An aerial walkway between supertrees promotes the “amusement park” feel of the gardens and provides panoramic views.



Figure 35: Land use and facilities legend for Gardens by the Bay

## 8.6 Summary Table

<b>Location and Context</b>	The site is located on reclaimed land in central Singapore, adjacent to the Marina Reservoir.
<b>Existing Land use</b>	Reclaimed waterfront area.
<b>New Land use</b>	<p>An iconic green recreation space in the heart of the city, designed to raise the profile of the city globally whilst showcasing the best of horticulture and garden artistry. The complex includes:</p> <ul style="list-style-type: none"> <li>• Cooled plant conservatories – the Flower Dome and the Cloud Forest.</li> <li>• Individual gardens.</li> <li>• Event and dining spaces.</li> <li>• Inter-connected waterways around Marina Bay, lakes and aerial bridges.</li> <li>• Showpiece Supertrees – built structures up to 50 m high that perform multiple functions including planting, shading, harnessing solar energy, collecting rainwater, exchanging air and providing a night time music and light show.</li> </ul>
<b>Size</b>	<p>101 hectares comprising three distinct waterfront gardens:</p> <ul style="list-style-type: none"> <li>• Bay Central Garden – 15 hectares, 3kms waterfront promenade.</li> <li>• Bay East Garden – 32 hectares, 2kms waterfront promenade.</li> <li>• Bay South Garden – 54 hectares.</li> </ul>
<b>Year of development</b>	2006 – ongoing.
<b>Issues, Benefits and Disbenefits</b>	<p><b>Infrastructure</b></p> <ul style="list-style-type: none"> <li>• The Gardens by the Bay Mass Rapid Transit station, under construction, will open in 2021.</li> <li>• A bus service also serves the Gardens.</li> </ul> <p><b>Economy</b></p> <ul style="list-style-type: none"> <li>• Tourism - in 2012 the facility was voted the 4th most visited attraction in the world. In November 2015 the gardens welcomed their 20 millionth visitor.</li> </ul> <p><b>Environment</b></p> <ul style="list-style-type: none"> <li>• Significant urban greening.</li> <li>• Use of green power - electricity generated from burning of horticultural waste, advanced cooling technologies for conservatories.</li> <li>• Water recycling - 95% of rainwater captured and filtered by aquatic plants for irrigation and return to Marina Reservoir.</li> <li>• Biodiversity - creation and enhancement of habitats.</li> </ul> <p><b>Community</b></p> <ul style="list-style-type: none"> <li>• Improved public amenity and open space.</li> <li>• Improved thermal comfort in hot humid climate, via increased vegetation and shade from canopy coverage and designing for enhanced natural ventilation.</li> <li>• Improved public amenity via creation of a range of programmable event spaces including outdoor area accommodating 20,000 people, convention centre accommodating 700 people and informal gathering spaces.</li> <li>• The Gardens were awarded the World Building of the Year Award at the World Architecture Festival in October 2012.</li> </ul>
<b>Staging of the project</b>	<p>An international master plan design competition was launched in January 2006.</p> <p>Bay East Garden was opened to the public in October 2011.</p> <p>Bay South Garden opened to the public in June 2012.</p> <p>More developments of Bay Central Garden are coming in the next few years.</p>
<b>Cost and funding mechanism</b>	<p>The cost of the project was \$1.035 billion.</p> <p>The three gardens started out as project of the National Parks Board. Gardens by the Bay now operates as a company limited by guarantee. The company is also a registered charity.</p> <p>The gardens' income in 2013/14 was SG\$49.198m, with expenses of SG\$63.927m. The gardens received almost SG\$27m further revenue in government grants over 2013/14.</p>



## 8.7 Potential lessons for the Moolap Plan

- Gardens by the Bay's stunning landmark infrastructure has required significant upfront capital investment and ongoing maintenance, with funding from public and private sources.
- The model allows for revenue from ticketing but has attracted criticism for its neo-liberal focus. While ticketing revenue has been high, significant government support through grant programs has also been required.
- The project has furthered Singapore's international profile through its distinctive design and super scale, attracting millions of visitors from around the world.
- The gardens' educational programs provide much-needed opportunities for schools and residents to reconnect with nature, while improving local community engagement.
- The management of water and energy cycles at Gardens by the Bay shows significant buildings can operate in a sustainable way.
- Facilities such as this require significant investment in marketing, communications and engagement.

## 8.8 Further information

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## 9. HAFENCITY, HAMBURG, GERMANY

### 9.1 Introduction

Europe's largest urban renewal project, HafenCity, is centred on 157 hectares of mostly state-owned land in the centre of Hamburg at the meeting point of the Alster and Elbe Rivers.

The site once included port facilities located close to the city centre. This area of waterfront along the northern shore of the Elbe River has always been significant for its viewlines towards shipyards and ocean liners. From the 1980s technological advances and the building of new shipyards to the south west meant older port facilities, such as those on the HafenCity site, became derelict.

HafenCity is a strategically significant inner city location in Hamburg. It increases the size of the city centre by 40%, seeking to provide much-needed housing to cater for a growing population, particularly of younger residents and older residents downsizing and seeking quality. HafenCity re-establishes the connection between the River Elbe and the city centre, focusing Hamburg's future growth along the river.



Figure 36: Aerial map, HafenCity, Hamburg



Figure 37: Proximity map of HafenCity and nearest city



Figure 38: Scale comparison map of HafenCity and Moolap site.

## 9.2 Site conditions

The development faces challenging natural conditions. The area lies below the main Hamburg dyke. All buildings are to be built on plinths of compacted fill, which developers are required to construct, with promenades at lower levels. This approach was preferred to the construction of further dykes because it preserves opportunities for waterfront viewlines. Providing underground car parking inside the plinths also reduces at-grade car parking and provides for more efficient use of space. Some of these car parking areas inside plinths include floodgates.

The design seeks to address climate change risks by providing a “blue microclimate” which recognises that areas of the promenade may be flooded by storm surges as sea levels rise.



A strong tree canopy is proposed for HafenCity, with species selected according to a Tree Masterplan for their ability to survive in harsh waterfront conditions. Planting guidelines include the importing of organic matter and piped supply of oxygen to tree root systems.



Figure 39: Aerial view, HafenCity. Photo: Courtesy of MGS Architects

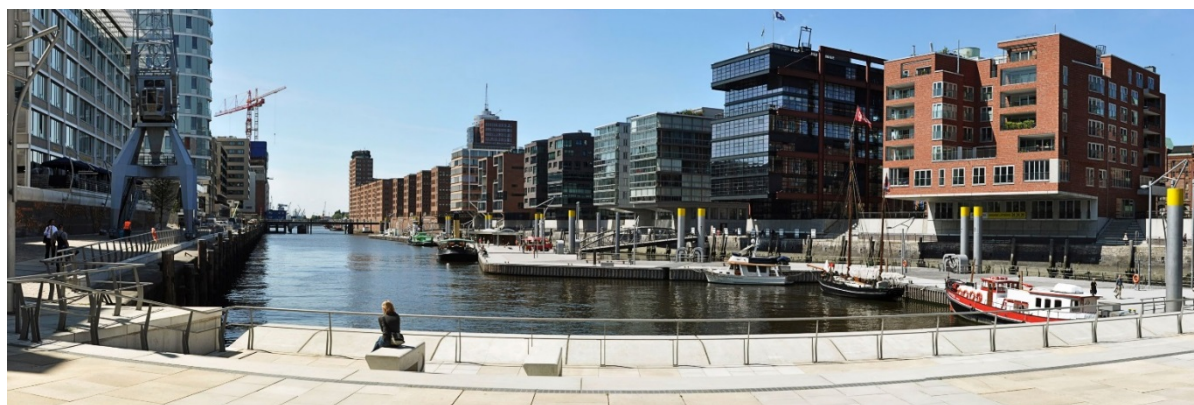


Figure 40: Waterfront development, HafenCity. Photo: Courtesy of MGS architects.

### 9.3 Governance and planning frameworks

HafenCity's planning and development has been led by HafenCity Hamburg GmbH, a corporation fully owned by the Free Hanseatic City of Hamburg. The corporation takes the role of development manager, property owner and infrastructure body.

Proceeds from the sale of HafenCity land finances infrastructure like roads, bridges, squares, parks, quays and promenades. Prospective developers have the ability to take up options on sites, which come with an obligation to develop plans which are key to the approval of land sales. Land sales and the purchase of options have to be approved by a Land Commission. This process means that while the private sector builds on lots, HafenCity Hamburg GmbH retains substantial influence over development projects.

Under this model, the government takes on the risk associated with early development and infrastructure provision, receiving higher land prices as infrastructure is developed.

Planning for the precinct started in the 1990s with a competition that led to the development of the first Masterplan in the year 2000. The area is based on a mixed use, planning-led approach.

The late 2000s Global Financial Crisis, which slowed down commercial development, and the rising demand for affordable housing ushered in a review of planning frameworks. An updated Masterplan for the eastern section of HafenCity was developed in 2010.

## 9.4 Sustainability

HafenCity is underpinned by a five-level sustainable development strategy, covering:

- Reuse of an old port and industrial area
- High urban density and high degree of mixed use in the core of HafenCity
- Sustainable transport that includes connecting the underground railway in HafenCity with the existing town centre, hydrogen-fuelled buses and promoting walkability
- A localized heating network based on low carbon limits and renewable energy sources; and
- A unique local certification system for buildings, the HafenCity Ecolabel.

The heating system draws on biomethane, solar heating, low temperature boilers and heat pumps. Under the certification system, at least 50% of buildings across central and eastern HafenCity are required to meet the Gold HafenCity Ecolabel, a precinct-specific sustainability accreditation.



Figure 41: Public open space, HafenCity. Photo: Courtesy of MGS architects

## 9.5 Land use and facilities

Of the 157ha area of HafenCity, 126ha is considered developable land. Of this portion, 25% is dedicated to transport infrastructure, 24% to public open space and 31% to the imprint of buildings. The building area includes 700,000m<sup>2</sup> of residential floorspace, 215,000m<sup>2</sup> commercial/retail/exhibition/hospitality space, 1.1mil m<sup>2</sup> office space and 310,000m<sup>2</sup> devoted to education, culture, leisure and hotels.

The main landmark building in HafenCity is the Elbphilharmonie concert hall located on top of Speicher (Warehouse) A. The hall has become a distinctive city landmark that has attracted international attention because of its spectacular architecture, but also because of its increasing cost and construction delays. HafenCity's community, cultural and civic facilities also include a maritime museum, science centre with theatre, automotive museum, primary school with day care and sports hall, secondary school, two universities and two other tertiary education campuses.





Figure 42: Land uses and facilities legend, HafenCity.

## 9.6 Summary table

<b>Location and Context</b>	HafenCity is a quarter in the district of Hamburg-Mitte, Hamburg, Germany. It is located on the Elbe river islands that were formerly called Kehrwieider and Wandrahm.
<b>Existing Land use</b>	Former harbor of Großen Grasbrooks and warehouse district.
<b>New Land use</b>	HafenCity Hamburg is an urban regeneration project where the old port warehouses of Hamburg are being replaced with offices, hotels, shops, government buildings, and residential areas. HafenCity will enlarge Hamburg's city centre by 40 percent. A total of 1.8 mil m <sup>2</sup> of new construction is being planned and much of it is being designed by a constellation of international 'starchitects'.
<b>Size</b>	Approximately 2.2 km <sup>2</sup> . The project is the one of the largest rebuilding projects in Europe by landmass.
<b>Year of development</b>	2001-2025
<b>Issues, Benefits and Disbenefits</b>	<p>Infrastructure</p> <ul style="list-style-type: none"> <li>• The area is served by a newly constructed underground train line, the U4, completed in 2012.</li> <li>• Fuel cell buses.</li> <li>• Cruise ships can berth at Hamburg Cruise Centre, HafenCity.</li> </ul> <p>Economy</p> <ul style="list-style-type: none"> <li>• 6,500–7,000 homes (approx. 1,500–2,000 subsidized) for approx. 13,000–14,000 residents.</li> <li>• 60,000 – 80,000 visitors per day.</li> <li>• Ballooning construction costs despite cuts in public expenditure in other areas.</li> <li>• Uneven investment – High level investment in HafenCity and insufficient funds for other areas that are less visible and "attractive" for target investment groups.</li> <li>• Area has become home to more than 500 companies to date, of which approx. 40 are larger firms.</li> <li>• Creation of up to 45,000 jobs (of which 35,000 are office jobs).</li> </ul>



	<p>Environment</p> <ul style="list-style-type: none"> <li>• Noise, compatibility of operating harbor with inner-city waterfront.</li> <li>• Periodic flooding from storm surges has necessitated innovative flood technologies including: <ul style="list-style-type: none"> <li>○ New roads and public spaces to be built on sand terraces over almost 8m above the normal high-tide line.</li> <li>○ Waterproofing of buildings along the shore up to the elevated-road level.</li> <li>○ Buildings adjacent to the shore required to have an entryway allowing access to the 8m high road.</li> </ul> </li> <li>• Reduction of CO<sup>2</sup> emissions by 27% compared to natural gas use via district heating, solar heating and fuel cells.</li> <li>• Model projects for sustainable buildings such as the Greenpeace headquarters opened in 2011.</li> </ul> <p>Community</p> <ul style="list-style-type: none"> <li>• Investment in prestigious landmark projects including the Elphilarmonie concert hall.</li> <li>• Social polarization due to government encouragement of high value housing in HafenCity while simultaneously cutting social housing budgets.</li> <li>• 22 hectares of green parks and urban water places.</li> <li>• Precinct design includes 5kms of road to 10kms of footpaths with only 30 percent of the footpaths next to the streets.</li> </ul>
<b>Staging of the project</b>	<ul style="list-style-type: none"> <li>• 1997: Announcement of HafenCity project</li> <li>• 1999: Masterplan competition</li> <li>• 2001: Construction of buildings begins</li> <li>• 2003: Completion of first building, construction of first neighbourhood</li> <li>• 2005: First occupants move in</li> <li>• 2009: Completion of construction of first neighbourhood</li> <li>• 2010: Revision of Masterplan for eastern HafenCity</li> <li>• 2012: U4 subway opens</li> <li>• 2014: Opening of HafenCity University</li> <li>• 2017: Opening of Elbphilharmonie</li> <li>• 2017: Construction of southern Überseequartier begins</li> <li>• 2025: Projected completion of HafenCity</li> </ul>
<b>Cost and funding mechanism</b>	<ul style="list-style-type: none"> <li>• Private investment – around €8.5bil (AU\$12.96b).</li> <li>• Public investment – €2.4bil (AU\$3.66b), mostly financed from special assets fund sales of plots in HafenCity (around €1.5bil or AU\$2.29b).</li> </ul>

## 9.7 Potential lessons for the Moolap Plan

- HafenCity's innovative approach to potential flooding associated with climate change seeks to protect buildings while designing promenades and public spaces to accommodate potential river surges.
- Risks associated with cost overruns on landmark projects need to be considered.
- The requirement for plans to be developed by prospective developers before land sales are finalised presents an innovative planning approach for individual sites that helps guide private investment.
- Providing public transport infrastructure up-front, particularly in large scale developments, is vital in ensuring new precincts are connected to the existing urban fabric.

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## 10. HAMMARBY SJÖSTAD, STOCKHOLM, SWEDEN

### 10.1 Introduction

Situated south of Stockholm's city centre, Hammarby has become renowned the world over as a model for eco-city developments. The so-called Hammarby Model defines a master planned approach that seeks to achieve what is described as "closed-loop urban metabolism", allowing for unified infrastructure of energy, water and waste. Similarly, planning has focused on managing flows of energy, water and waste in a manner that prioritises the area's aesthetics.

The Hammarby Model is described by ecological planning theorist Tim Beatley as an "effective demonstration that ecological and urban can go together". The model includes targets for land decontamination, use of brownfield land, public transport provision, energy efficiency and water and waste recycling.

The area includes mostly apartments, with around 11,000 units across 4-5 storey residential buildings and mostly ground-floor commercial use.

Stockholm, the capital of Sweden, is a city of around 900,000 people based on an archipelago of 14 islands in the Baltic Sea.



Figure 43: Aerial map of Hammarby Sjöstad

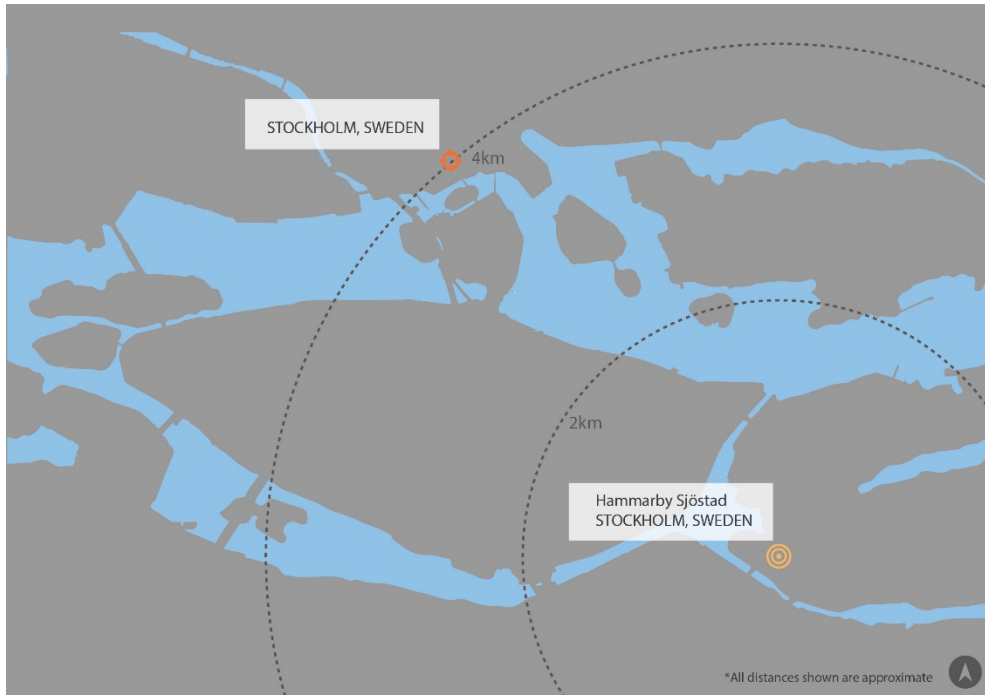


Figure 44: Proximity map of Hammarby Sjöstad and nearest city



Figure 45: Scale comparison map of Hammarby Sjöstad and Moolap site

## 10.2 Site conditions

Hammarby Sjöstad (Lake City) is surrounded by a lake (Hammarby Sjö) and canal (Sickla Kanal). These have provided for quays and waterfront walkways in the precinct.

The site is around 200 hectares in area. Before redevelopment, the area was mainly industrial with activity centred on the Lumafabriken Works – a functionalist building that now houses a library and offices. The proposal effectively extends Stockholm’s town centre to the south.





Figure 46: Aerial view of Hammarby Sjöstad. Photo: Courtesy of MGS Architects



Figure 47: Integration of water in the urban environment. Photo: Courtesy of MGS Architects

### 10.3 Governance and planning frameworks

Redevelopment was funded by local government, various government agencies and the national government through its Local Investment Program, dedicated to encouraging local government take up of environmentally sustainable technology and practice.

The design and planning process has had a high degree of local leadership. The city's planning department led an initial Strategic Masterplan that divided the area into 12 districts to be developed in phases. The City then selected up to four private sector architects or planners to test the strategic plan and draw up more detailed proposals for each sub-district in a process described as "parallel sketches" whereby the City chooses the best features from each plan to develop each detailed district Masterplan.



The City seeks to use different design teams across the districts. After district Masterplans are finalised, the city then develops distinct building codes for each district.

#### 10.4 Land use and facilities

The precinct is heavily based on residential buildings of 4-5 storeys with internalized green courtyards. The height of the buildings has been limited to lower wind speeds while allowing natural light into buildings and courtyards. Considerable emphasis is placed on planting out the courtyards, green roofs and other green infrastructure.

A notable feature of the area is the lack of green open spaces, parks and public squares – with the focus instead being on internal building courtyards and waterfront spaces. The southern shore of Hammarby Sjö (lake) has been rejuvenated as a wetland public space with boardwalks and reed plantings.

The Hammarby Model approach, while defined as compact urbanism, delivers an urban form that is similar to Stockholm's centre in block layout, density and street designs even though each district of Hammarby has its own guidelines.



Figure 48: Land use and facilities legend, Hammarby Sjöstad

#### 10.5 Summary table

<b>Location and Context</b>	Hammarby Sjöstad (Lake City) is an urban renewal area directly south of Stockholm's south island.
<b>Existing Land use</b>	From the 1800s the area was farmed, prior to industrialisation. The area was slated for an arena and Olympic Village as part of Stockholm's unsuccessful 2012 Olympic bid.
<b>New Land use</b>	Hammarby has been designed as a sustainable eco-city. Buildings are primarily 4-5 storey residential blocks, with some ground floor commercial use. When finished, the area is anticipated to include around 11,000 apartments.
<b>Size</b>	200 hectares
<b>Year of development</b>	Planning for redevelopment of the site started in 1996. Construction is expected to be completed around 2017.
<b>Issues, Benefits and Disbenefits</b>	<p>Infrastructure</p> <ul style="list-style-type: none"> <li>Infrastructure designed to achieve "closed-loop urban metabolism" – managing flows of energy, water and waste.</li> </ul>

	<ul style="list-style-type: none"> <li>• Stormwater retention and processing infrastructure designed to be aesthetically attractive.</li> <li>• Integrated approach to infrastructure planning takes in technical, transport, building and environmental infrastructure.</li> <li>• Traffic flow systems designed to minimise noise effects for residents.</li> </ul> <p>Economy</p> <ul style="list-style-type: none"> <li>• Housing has been less affordable in Hammarby than other parts of Stockholm.</li> <li>• Retail has taken time to develop in the area.</li> </ul> <p>Environment</p> <ul style="list-style-type: none"> <li>• Hammarby has become a renowned case study that has inspired other eco-city developments around the world, including projects in China and Brazil.</li> <li>• Interdisciplinary, sophisticated planning focused on managing flows of energy, water and waste.</li> <li>• Energy efficiency seeks to reduce heat consumption by 60%.</li> <li>• Large scale stormwater harvest and filtration systems.</li> <li>• Focus on co-generation of energy including local waste incineration, aided by unique waste collection process that sends bagged waste to substations.</li> <li>• Southern lake shore planted with reeds and developed with boardwalks.</li> </ul> <p>Community</p> <ul style="list-style-type: none"> <li>• Design approach has instituted a lack of public squares and green spaces (apart from those in apartment blocks) and community meeting space.</li> <li>• Cultural diversity is low, residents are mostly affluent.</li> <li>• Lower levels of subsidized housing compared to other areas of Sweden.</li> </ul>
<b>Staging of the project</b>	Incremental development over stages.
<b>Cost and funding mechanism</b>	Funding was obtained through multiple levels of government and the private sector. Government agencies included the City of Stockholm, Stockholm Transport, the National Road Administration and the national government through the Local Investment Program (LIP) which was designed to encourage local governments to take up environmentally sustainable technologies and practice.

## 10.6 Potential lessons for the Moolap Plan

- Functional high residential densities can be achieved at height limits of 4-5 storeys with improved microclimates.
- Substantial upfront infrastructure investment with government funding as a catalyst is required to achieve the Hammarby Model of eco-city development.
- A parallel process that uses a variety of architect teams can bring the best of many minds to bear on design of urban areas.
- The design of blocks to reflect existing layouts in Stockholm's city centre reflects the importance of place considerations and existing context in design.
- Careful consideration needs to be given to public squares and community meeting space to encourage a sense of encounter, even if buildings have large courtyard spaces.
- Eco-city level sustainability in a new settlement requires a highly integrated, multi-disciplinary planning approach.
- Consideration needs to be given to housing affordability at design stage so that cultural diversity can be achieved.

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## 11. ÎLE DE NANTES, FRANCE

### 11.1 Introduction

The Île de Nantes sits on the far side of the Loire River, opposite the city of Nantes' historical centre. The City of Nantes is France's sixth largest city with a population of 290,000. The broader metropolitan area has a population of more than 600,000 people across 24 municipalities that are represented by the Nantes Métropole.

The site (or conglomeration of sites) includes docklands that had become derelict after the last shipyard closed in 1987. During the 1980s, the demolition of the existing structures was proposed to make way for a new precinct focused on business and commerce. However, local lobbying led to the protection of the area's industrial heritage and a renewal project focused on bringing together the historic city and the Île de Nantes. The project has focused on a gentle form of urban revival based on upgrading existing public spaces to drive urban transformation, limiting destruction and preserving the history of the place.

This project has thus reorganised the city centre, with a view to providing families with an alternative to moving to the suburbs and re-invigorating Nantes' relationship with the Loire River.

The Île de Nantes has also become renowned for its creativity with public spaces reconfigured with a focus on sustainability and social inclusion with a new creative cluster developed over the 2000s.

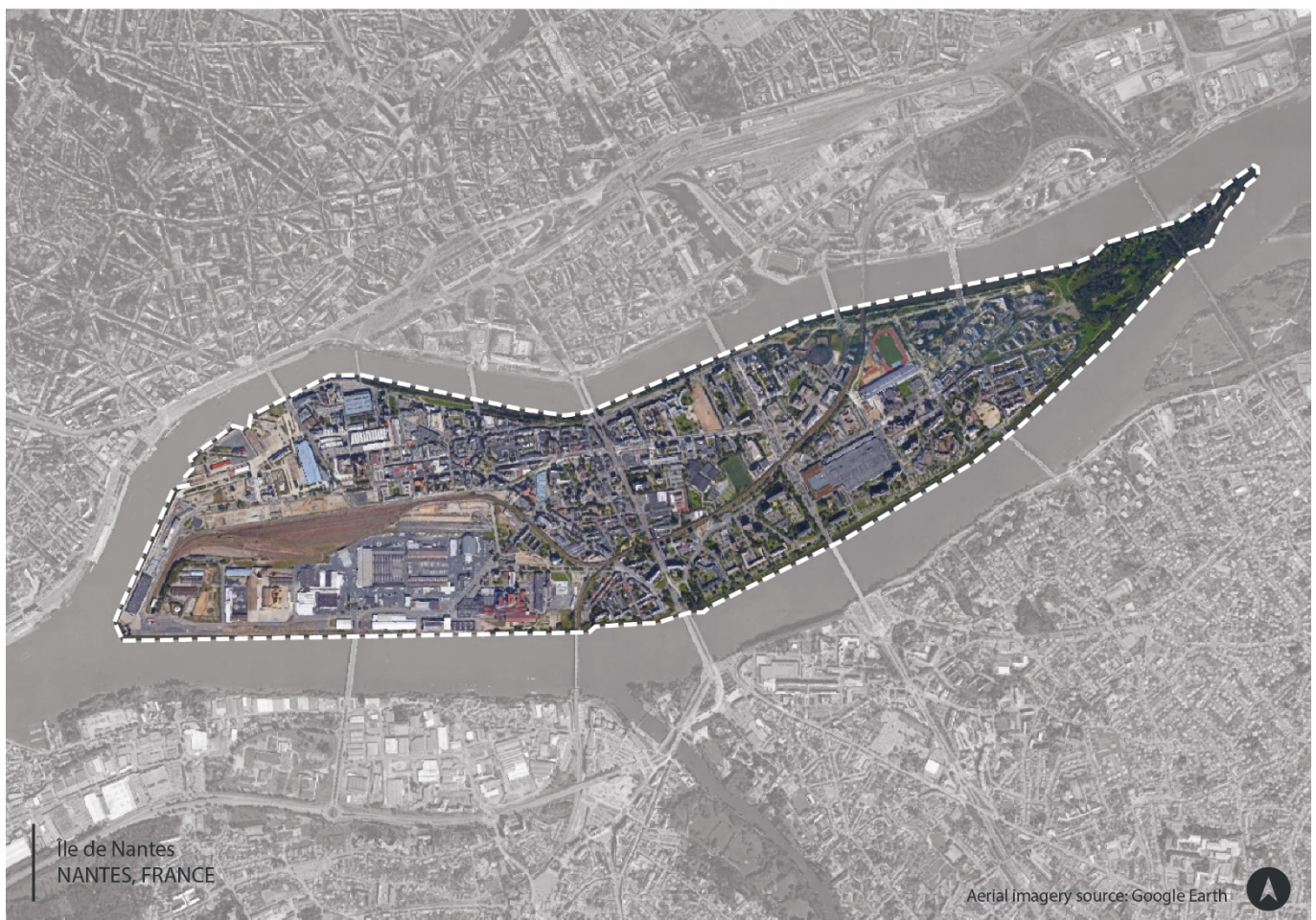


Figure 49: Aerial map, Île de Nantes

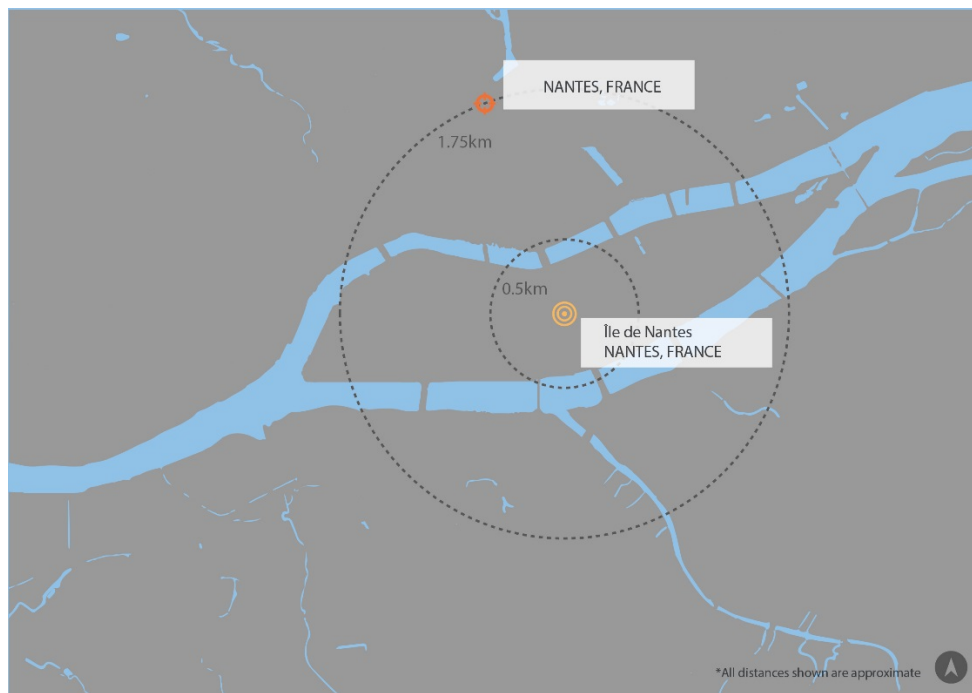


Figure 50: Proximity map of Île de Nantes and nearest city

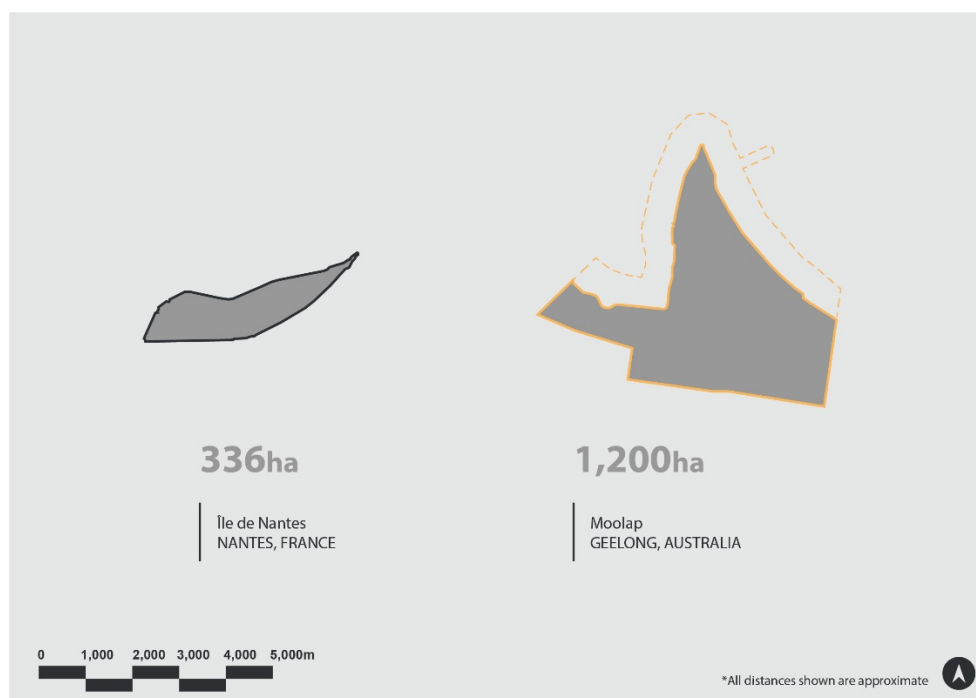


Figure 51: Scale comparison map of Île de Nantes and Moolap site.

## 11.2 Site conditions

The island is the result of land reclamation works including the construction of a seawall in 1753 that sought to unite an archipelago of small islands separated by branches of the Loire River. Much of the area was used as a shipyard and many warehouse structures have been retained and reused.

Following the deindustrialization of the shipyards, the island had poor connectivity to the city centre on the Loire River's opposite bank.





*Figure 52: Aerial view of Île de Nantes from upstream end. Photo: Creative Commons Licence*

### **11.3 Governance and planning frameworks**

The Île de Nantes has been developed through a “plan-guide”, a highly adaptable, light planning tool that differs from a conventional masterplan. The plan-guide seeks to involve the community and present broad design principles that are capable of evolving as new needs emerge.

This evolving plan is updated on a three-monthly cycle, meaning that projects become part of the planning framework as they are completed, while specific intervention points on the island are highlighted with a view to retaining the development’s overall coherence.

The plan-guide is based on a survey completed in 2003. The most rigid elements of the plan-guide focus on building height regulations, which are calculated for each lot according to the mass of existing buildings.

Since 2003, SAMOA (the West Atlantic Metropolitan Redevelopment Agency), a publicly owned company, has directed the Île de Nantes urban regeneration project. The Nantes Métropole is a majority shareholder in SAMOA with the City of Nantes. Other local government entities are also among its shareholders.

### **11.4 Sustainability**

The Île de Nantes approach to sustainability focuses on environmental and social sustainability through urban design and governance processes. Sustainability initiatives include district-based heating and cooling, neighbourhood composting facilities, an advanced waste management system, a cycling route around the island, and a photovoltaic power station.

The city of Nantes was a European Green Capital in 2013. In this year, the Green Island initiative began in Nantes as a way of engaging creative professionals to work with citizens and stakeholders on development areas. This process is seen as a way to build community ownership of planning and promote social cohesion between residents new and old, and the island’s creative sector.

Dialogue between government and community has been a hallmark of the project. This has included a workshop program run between November 2011 and January 2012 involving 24 residents from across the Nantes urban area, nine of which were drawn from the island. This group had a mandate to form questions and make recommendations for the construction of the island through until 2030. The recommendations focused on six themes: social life, transit, environment, housing, retail and employment.

## 11.5 Land use and facilities

The project aims to achieve 1,500,000m<sup>2</sup> of real estate development, 10,000 housing units (700,000m<sup>2</sup> of residential space), 160 hectares of new or reconfigured public space and three new public transit lines in dedicated lanes before 2030. Housing is diverse, with 25% subsidised to be affordable, another 25% moderately priced and the rest left to market.

Many enterprises like biotechnology firms, cultural enterprises and an institute of fine arts have been housed in renovated warehouses, while buildings on the city-site bank of the Loire have been developed to promote a dialogue with the existing city centre. New residential districts have been constructed alongside renovated social housing to promote diversity.

The island features many cultural attractions including the Les Machines theme park, located in a former shipyard. The park features mechanical creatures including a three-storey tall dragon, an elephant, squid, caterpillar, a heron with an 8m wingspan and a moving ant that can be operated by five visitors. The park also features a three-level, 25 metre tall carousel.

Other notable precincts include areas established to stimulate creativity and build a strong creative ecosystem. The Quartier de la Creation in the former industrial western part of the island has arisen as a focus for creative activity and a meeting point of artists, researchers, entrepreneurs and students.

SAMOA has taken a leading role in coordinating creative clusters, with a view to building bridges with higher education and research, and building a network of more than 280 businesses, traders and associations. SAMOA has also aided enterprises in finding office space and advising prospective start-ups, brokered collaboration across businesses and developed incubator spaces.



*Figure 53: Public space in the former shipyards with the nine-meter-high mechanical elephant.  
Photo: Jean-Dominique Billand*





Figure 54: Land use and facilities legend, Île de Nantes.

## 11.6 Summary table

<b>Location and Context</b>	The Île de Nantes (Island of Nantes) is an island located in the centre of the city of Nantes, France, surrounded by two branches of the Loire River. It is one of the eleven neighbourhoods of Nantes.
<b>Existing Land use</b>	Mostly shipyards with some urban use.
<b>New Land use</b>	<p>Île de Nantes has been developed as a culture-rich, creative neighbourhood that incorporates its industrial heritage. Development has been spearheaded by a government-owned development corporation, providing a mix of housing, commercial development and precincts tailored for creative operations. The redevelopment includes:</p> <ul style="list-style-type: none"> <li>• Eco-friendly accommodation.</li> <li>• Commercial and administrative activities.</li> <li>• Nightclubs, bars and restaurants.</li> <li>• Public open space.</li> </ul> <p>A notable element of the redevelopment is Les Machines de l'île, a theme park featuring a range of giant machines inspired by Jules Verne (born in Nantes) and Leonardo da Vinci.</p>
<b>Size</b>	The site is 336 hectares. The island is 4.9 km long and 1 km wide.
<b>Year of development</b>	Construction period 2000-2030.
<b>Issues, Benefits and Disbenefits</b>	<p>Infrastructure</p> <ul style="list-style-type: none"> <li>• The Île de Nantes is linked to the rest of the city by 13 bridges</li> </ul> <p>Economy</p> <ul style="list-style-type: none"> <li>• There has been a retaliation to the massive public investment in the island's cultural venues, claiming this is at the expense of others spread throughout the city, and who now suffer from the attendance-magnet that the island has become.</li> <li>• Strong driver of tourism.</li> <li>• Attracts creative and cultural entrepreneurs.</li> <li>• Land values range from 100 euro/m<sup>2</sup> (AU \$152) for social housing, 150 euro/m<sup>2</sup> (AU\$229) for offices &amp; businesses, and 200 euro/m<sup>2</sup> (AU\$304) for free housing.</li> </ul>

	<p>Environment</p> <ul style="list-style-type: none"> <li>• A sustainable alternative to urban sprawl.</li> <li>• Reuse of existing buildings.</li> <li>• Range of sustainability programs implemented from the neighbourhood level.</li> </ul> <p>Community</p> <ul style="list-style-type: none"> <li>• Features iconic artworks.</li> <li>• Strong community engagement embedded in the area's planning and development.</li> </ul> <p>Heritage</p> <ul style="list-style-type: none"> <li>• Redevelopment of the warehouses safeguards and showcases the history of the shipyards, a symbol of the industrial and maritime culture of Nantes. Until their closure in 1987, they were the mainstay of Nantes' shipbuilding industry.</li> </ul>
<b>Staging of the project</b>	<p>Phase 1 (2000-2010) - new residential complexes including an eco-district, new footpaths, access roads and bridges to connect with the river and the city.</p> <p>Phase 2 (2010-2030) - development of residential and commercial areas and creation of new public spaces and sustainable transport (bicycle and bus lines).</p>
<b>Cost and funding mechanism</b>	Mix of private investment and public funding (through SAMOA and various local and federal authorities).

### 11.7 Potential lessons for the Moolap Plan

- SAMOA shows the potential for an arm of government or a public company to act as a catalyst for creative urban renewal by supporting creative enterprises, developing incubator spaces and networks beyond the city itself.
- The Île de Nantes shows the potential that can be unlocked by respecting the history of a place in urban renewal work, with the retention of shipyard and quay infrastructure helping form its distinctive urban fabric.
- The Île de Nantes demonstrates the importance of a precinct aimed at providing an alternative housing choice to urban sprawl having a strong social/cultural life and integration with surrounding areas (including public transport links).
- Île de Nantes presents an interesting example of a flexible, dynamic and less-rigid approach to urban renewal planning that still channels and retains the essence of the place. This approach has produced an evolving plan that stays relevant as the precinct evolves.
- Culturally-focused adaptive reuse, strong local-level sustainability initiatives and community-based planning can develop strong social, environmental and economic sustainability.
- Urban sustainability initiatives can happen successfully at the small-scale, neighbourhood level.
- High levels of public investment focused on one precinct can create perceptions of unfair distribution of public monies and can have negative consequences on other areas of the city that may lose visitation to the newly regenerated area.

### 11.8 Further information

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## 12. REDWOOD CITY SALTWORKS, SAN FRANCISCO, USA

### 12.1 Introduction

The Redwood City Saltworks development is a proposed mixed-use development on a former saltworks site along the waterfront of Redwood City in San Francisco Bay. Redwood City is 43km south of San Francisco and has a population of around 81,000.

The development proposal presented to Redwood City in 2009 involved up to 12,000 housing units at varying densities and 250,000m<sup>2</sup> of commercial space, while leaving 56% of the site as wetlands and open space (including 176 hectares of restored wetlands and 149 hectares of parks and trails). The proposal stemmed from a partnership between agricultural firm Cargill (owner of the saltworks) and a luxury home builder (DMB Associates).

The development proponents have described the proposal as sustainable “smart growth” that would address the city’s lack of housing. However the plan proved contentious and has attracted strong community opposition including from conservation organisations that have expressed concern over its impact on the health of the bay.

Intervention from the US EPA, disputes over which government agency has jurisdiction over the proposal, and further planning issues have left the project in limbo. The proponents’ website states they are now working on a scaled back proposal for the site.



Figure 55: Aerial map, Redwood City Saltworks site.



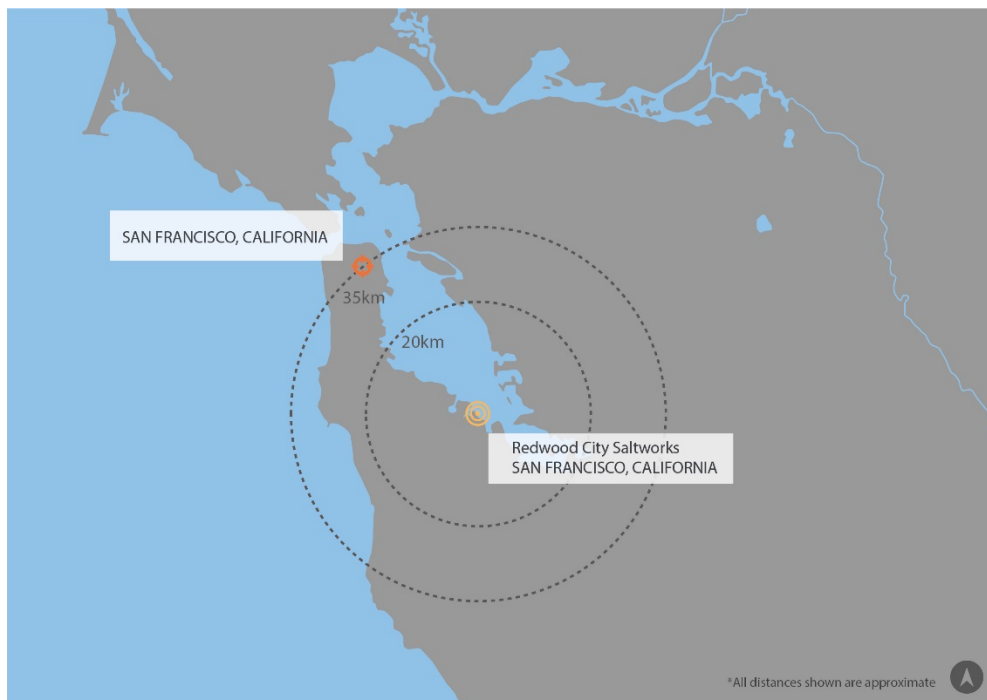


Figure 56: Proximity map of Redwood City Saltworks and nearest city.

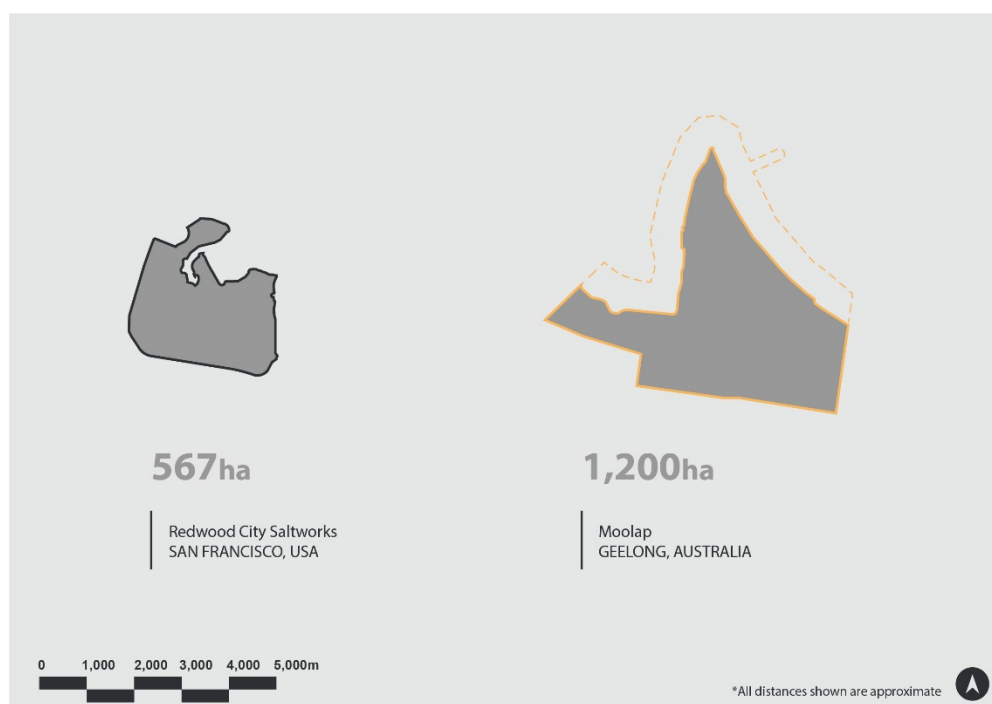


Figure 57: Scale comparison map of Redwood City Saltworks and Moolap site.

## 12.2 Site conditions

The 580 hectare site has an extensive history of salt harvesting. It is understood that Native Americans once used dyked ponds to harvest salt in the area. The planned development has been presented as an alternative to continued industrial-scale salt production on the site.

The area is part of an industrialised waterfront in a city that draws in a large number of commuting workers.

The site's owner, agricultural company Cargill, had sold 6,677 hectare of land involved in salt production to public agencies across the US in 2003 for wetland restoration. Redwood City is one of two sites Cargill retained.



Figure 58: Artemia breeding ponds, Redwood City Saltworks. Photo: Creative Commons Licence

### 12.3 Governance and planning frameworks

A design team appointed by the saltworks' owners presented a development proposal for the site to local authorities in 2009. The proposal has since been the subject of intergovernmental wrangling and jurisdictional confusion largely owing to the site's bayside location.

In 2015, the US Environmental Protection Authority deemed it would have a lead role in planning assessment as the site fell under its jurisdiction through the federal Clean Water Act (1977). While any development on the site would ultimately be decided by the Redwood City, permits would need to be granted from an array of federal and regional authorities.

### 12.4 Sustainability

While the proponents have claimed the project is an example of smart, sustainable infill growth that would fund some wetland restoration works, the initial proposal attracted substantial criticism for its potential impacts on wildlife habitat (including existing salt ponds), water quality and the health of the bay. Some of this discourse has also focused on the cumulative effect of waterfront infill development along the bay. The proposal has also attracted criticism from environmentalists for its apparent susceptibility to rising sea levels associated with climate change.

This proposal demonstrates that sustainability is not a straightforward concept, particularly in an environmentally sensitive area, and that considerations of place and perception need to be embedded in the design process.

### 12.5 Land use and facilities

The proposal involved mixed-use development with a range of residential densities, commercial space and recreational areas. Seven years after the initial development proposal, the salt works infrastructure and salt production areas remain.



Figure 59: Land use and facilities legend, Redwood City Saltworks

## 12.6 Summary table

<b>Location and Context</b>	<p>Redwood City Saltworks is located on the south San Francisco Peninsular. Surrounding areas include:</p> <ul style="list-style-type: none"> <li>• Office park and light industry.</li> <li>• Bay national wildlife refuge.</li> <li>• Industry/mobile home park.</li> </ul>
<b>Existing Land use</b>	Saltworks
<b>New Land use</b>	Development proposed 50% wetland restoration, recreation and open space, and 50% housing/mixed use development and community uses.
<b>Size</b>	567 hectares.
<b>Year of development</b>	The most recent development proposals were first put forward in 2009.
<b>Issues, Benefits and Disbenefits</b>	<p>Infrastructure</p> <ul style="list-style-type: none"> <li>• Traffic problems for existing highway - the development proposal would create up to 70,000 new daily vehicle trips.</li> <li>• Idea mooted for a battery-driven elevated personal rapid transit (PRT) system with many four-person vehicles.</li> </ul> <p>Economy</p> <ul style="list-style-type: none"> <li>• Housing – The plan includes enough housing for 25,000 people which would expand Redwood City's population of 79,000, by more than a third.</li> <li>• Job creation.</li> <li>• Redwood City has a significant influx of working commuters.</li> </ul> <p>Environment</p> <ul style="list-style-type: none"> <li>• Sea level rise – mitigation via a proposed levee.</li> <li>• Concern that proposal would have undermined shorebird and waterfowl habitat on existing saltworks site.</li> <li>• Water supply - difficulty in transferring water from agricultural to urban environment.</li> </ul>

	<ul style="list-style-type: none"> <li>• The development proposal has drawn strong opposition from environmental groups and some officials in the region are concerned about the scope and environmental impact of the project and incremental development around San Francisco Bay.</li> <li>• Water quality - pollutants from construction activities and storm water runoff affecting sensitive aquatic and tidal marsh habitats.</li> <li>• Air quality impacts and GHG emissions caused by development and increased traffic.</li> <li>• Earthquake risk – risk of liquefaction and levee failure.</li> <li>• Debate over sustainability of project as “smart” growth in a potential infill area, versus urban sprawl on the edge of Redwood City.</li> </ul> <p>Community</p> <ul style="list-style-type: none"> <li>• Zoning - Incompatibility between industrial uses and housing.</li> <li>• Noise pollution affecting surrounding residents and businesses.</li> <li>• Provision of new public amenities including parks, sports fields, and bayside biking and hiking trails.</li> </ul>
<b>Staging of the project</b>	Development proposal has not proceeded. Proponent has flagged intention to present revised, scaled down development plans in future.
<b>Cost and funding mechanism</b>	Privately funded.

## 12.7 Potential lessons for the Moolap Plan

- The Redwood City saltworks redevelopment proposal shows the importance of the scale and nature of proposed development being in tune with community expectations, especially on sensitive sites.
- New-urbanist style growth isn’t necessarily smart growth if it does not adequately consider place.
- Growth described as “smart growth” will not necessarily be seen as “sustainable”, particularly in a potentially sensitive environment – and the definition of sustainability is multi-faceted.
- New development proposals should be seen to start from place considerations, including upfront stakeholder and community engagement.
- All relevant authorities should be engaged in the development process from the beginning where possible, with clarity as to each authority’s role and legislative responsibilities.

## 12.8 Further information

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## 13. SANCTUARY LAKES, POINT COOK, AUSTRALIA

### 13.1 Introduction

Sanctuary Lakes, located 20km south-west of Melbourne's CBD, was developed on the site of a saltworks that operated for around 100 years. After the closure of the Cheetham Saltworks in the 1980s, the site posed a range of environmental and engineering challenges.

The eastern part of the Cheetham Saltworks site became an extension of the Point Cook Regional Park known as Cheetham Wetlands managed by Parks Victoria, while the western part was cleared and became Sanctuary Lakes Resort, a centrally administered residential and leisure community accommodating more than 2,700 lots developed around a lake and an 18-hole golf course. The final population is estimated to be around 7,000.

From the mid-1990s, Sanctuary Lakes acted as a catalyst for the broader development of Point Cook. The lake and residential estate are formed around two boulevards that skirt the north and south of the lake. The area includes "gated communities" and more suburban-style housing, with all lots paying the Owners' Corporation levy.

The development is aimed at the second or third home buyer market, a trend that remains evident today with median house prices steadily increasing from \$519,000 since 2011 to \$622,750 as of March 2016. The average lot size over that time has increased from 602m<sup>2</sup> to 719m<sup>2</sup> although some areas are set aside for lots smaller than 450m<sup>2</sup>.



Figure 60: Aerial map, Sanctuary Lakes.

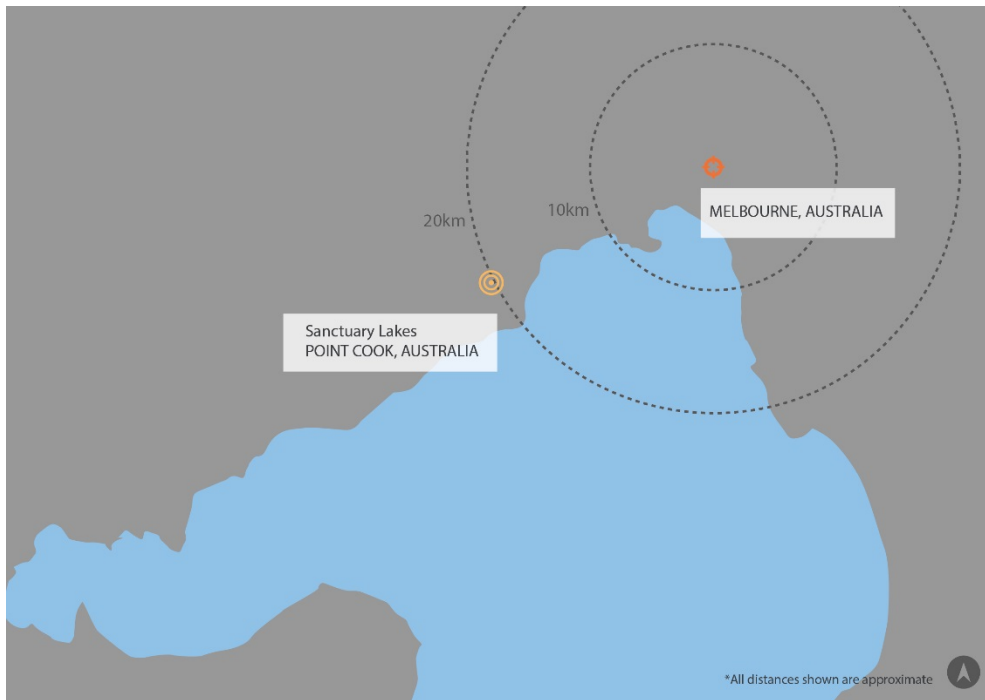


Figure 61: Proximity map of Sanctuary Lakes and nearest city.

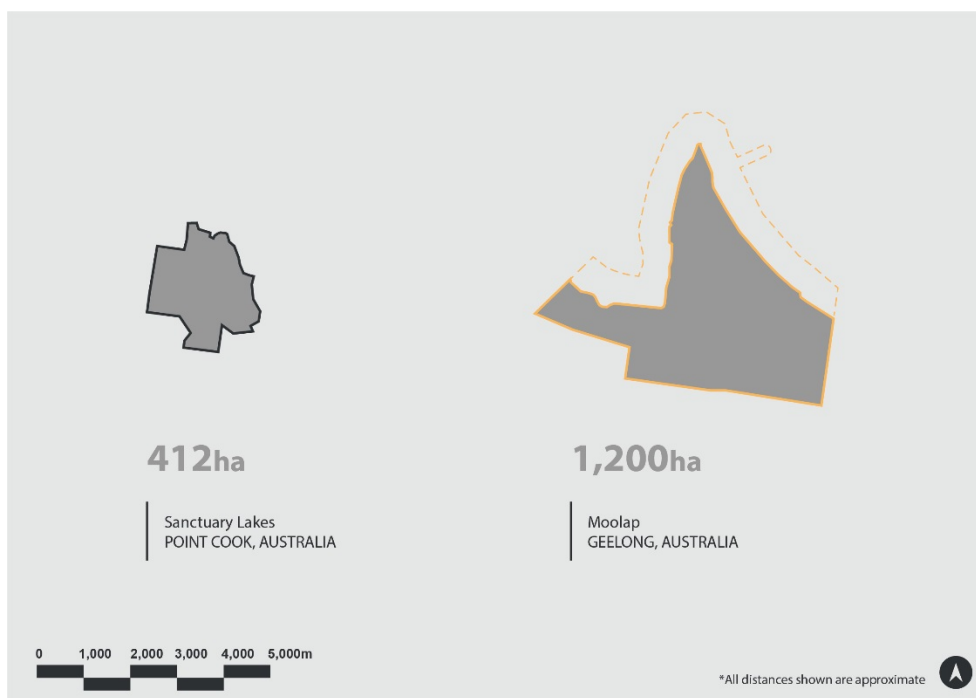


Figure 62: Scale comparison map of Sanctuary Lakes and Moolap site

### 13.2 Site conditions

The site had been altered and influenced by salt production dating from the 1920s, and the natural wetland systems along Port Phillip Bay.

As part of the initial development agreement the 405ha of wetlands now forming Cheetham Wetlands were gifted to the Victorian Government as Crown land reserved for conservation. These areas are now managed by Parks Victoria. The wetlands largely comprise artificial ponds and lagoons originally constructed for salt harvesting. The wetlands are of outstanding conservation value as migratory shorebird habitat. The southern section, south of Skeleton Creek, is protected as an internationally significant wetland under the Ramsar Convention. It is part of a network of significant wetlands along the west of Port Phillip Bay.



The western half, including the lake, was cleared for development. The 60ha man-made lake is owned and maintained by Sanctuary Lakes Resort Services (SLRS), a company jointly owned by all lot owners through the owners' corporation. The lake, twice the size of Albert Park Lake, is intended to operate as a carefully balanced eco-system that is subject to external influences such as the characteristics of inflowing water and prevailing weather. The nutrients in stormwater inflows however have caused excessive seagrass growth, which presents an ongoing management challenge.



*Figure 63: Aerial Image of Cheetham Saltworks before development of Sanctuary Lakes c.1995.  
Photo: @Sanctuary Living*



*Figure 64: Sanctuary Lakes Resort, c.2000 Golf Course and Housing construction underway.  
Photo: @Sanctuary Living*

### **13.3 Governance and planning frameworks**

The resort and estate are managed through an owners' corporation and two subsidiary entities: SLRS, which manages the estate and lake, and Sanctuary Lakes Club which manages the golf course. The Sanctuary Lakes Residents Association Advisory

Council, formed in 2007, includes a representative from each owners' corporation. All lots created since 2002 are part of the owners' corporation structure, while all lots pay the owners' corporation levy. This board of resident representatives assumed control of the operations of SLRS from November 2010.

Both companies draw their revenue from owners' corporation fees, while the golf club is funded through memberships and user fees. All roads and parks, except those in gated community areas, are owned by Wyndham City Council and maintained by SLRS under contract from Council. Under this contract, Council pays a flat rebate to each rateable property that is calculated annually. In 2015-16, the rebate was \$192.55 per property. All areas in gated communities are maintained and owned by SLRS.

Development on the site is subject to a series of codes and policies that govern a range of elements including fencing, house design, renovations and privacy. These requirements are enforced in addition to ResCode. There is also a requirement that houses are constructed on lots within 12 months of purchase.

### 13.4 Sustainability

Sanctuary Lakes is primarily designed as a high-end residential and resort area. It is mostly car dependent with limited alternative transport links. While the development is only 20km south-west of Melbourne's CBD, traffic congestion on the M1 highway can cause long travel times to the CBD.

The primary sustainability credentials of the precinct relate to the management of the wetlands. Access to the wetlands is restricted to reduce disturbance to waterbirds and for security. A sealed bicycle path now forms the separation between the Cheetham Wetlands and the Sanctuary Lakes development.

As a manipulated system, Cheetham Wetlands has achieved a seasonal, hydrological regime. The system of pumping involves water from a tidal creek, circulated through two looped systems and released back into Port Phillip Bay as hyper saline water. Management focuses on maintaining appropriate water levels for the shorebird population.



*Figure 65: View of Sanctuary Lakes Resort from Cheetham Wetlands. Photo: ©Sanctuary Living*

### 13.5 Land use and facilities

The development is mostly residential, with an 18-hole golf course and some connecting trails to the Cheetham Wetlands, as well as the Bay Trail for cycling and pedestrian use. Resort facilities including tennis courts and a childcare centre are also provided.





Figure 66: Land use and facilities legend, Sanctuary Lakes.

### 13.6 Summary table

<b>Location and Context</b>	Located in Point Cook, approximately 20km west of Melbourne CBD.
<b>Existing Land use</b>	Former Cheetham salt works site.
<b>New Land use</b>	Residential development including: <ul style="list-style-type: none"> <li>• 3000 houses.</li> <li>• 10% gated community.</li> <li>• 50% open space.</li> <li>• Planting of more than 10,000 trees. All introduced.</li> <li>• Protected wetland that provides an important bird habitat.</li> <li>• 60 hectares of artificial lakes.</li> <li>• 75 hectares 18 hole golf course.</li> <li>• Health club.</li> <li>• Shopping Centre.</li> </ul>
<b>Size</b>	410 hectares.
<b>Year of development</b>	Commenced development in 1995. Development completed in 2013. New shopping complex to be completed in 2017.
<b>Issues, Benefits and Disbenefits</b>	<p>Infrastructure</p> <ul style="list-style-type: none"> <li>• 2million cubic metres of fill was imported to the site.</li> <li>• Single road access from Highway causes significant traffic congestion and presents a potential hazard in case of emergency.</li> </ul> <p>Economy</p> <ul style="list-style-type: none"> <li>• Management of excessive seagrass growth in the artificial lake has proven expensive (around \$1m annually).</li> <li>• Costly housing construction due to need for screw pile foundations.</li> <li>• Median house prices have risen steadily to \$622,750 (2016).</li> <li>• Residents pay body corporate to maintain facilities, over and above Council rates.</li> </ul>

	<p>Environment</p> <ul style="list-style-type: none"> <li>Interface between urban development and Cheetham Wetlands conservation area has proven complex, with unauthorised human access into restricted areas and attacks on wildlife by dogs, cats and foxes reported.</li> <li>Lakes and wetlands filter storm water before it enters Port Philip Bay.</li> <li>Community environmental education is run through initiatives including the Four Seasons Club which focuses on environmental education for children and families, and online photo galleries.</li> </ul> <p>Heritage</p> <ul style="list-style-type: none"> <li>Negligible evidence of protection of cultural and industrial heritage relating to former salt works.</li> </ul> <p>Community</p> <ul style="list-style-type: none"> <li>Limited community integration due to gated communities and limited external access to residential enclave.</li> <li>One road entrance limits interface and interaction with surrounding residential areas.</li> </ul>
<b>Staging of the project</b>	Incremental development over the last 20 years, with new parcels of land released periodically.
<b>Cost and funding mechanism</b>	<p>Total cost – Estimated \$300 million +</p> <p>Golf course – Estimated \$20 million</p> <p>Residents contribute \$2,000 per year (on average) additional to council rates for upkeep and maintenance services. Council pays a flat rebate back to each rateable property, reflecting the body corporate's delivery of some local services and maintenance activities.</p>

### 13.7 Potential lessons for the Moolap Plan

- Renewal projects mostly focused on residential areas should consider alternative transport options and multiple road access points.
- Conservation projects including wetland habitat on saltwork sites can be mixed with future residential development, although remediation costs may necessitate a high property cost to recoup costs. This may impair affordable housing options at lower development densities.
- Some engineering or manipulation of wetland systems may be necessary to preserve water levels for shorebird habitat.
- Interface areas between significant wetlands and residential development need careful management – pest animals, dog walkers and people can have major impacts on sensitive environments.
- Educational opportunities are vital in promoting connections between residents and surrounding natural environment, particularly sensitive wetland areas.
- Balancing recreation values of open space and conservation significance of wetlands presents a significant challenge for land managers with conflicts between people, pest animals and wildlife requiring particular management. Access tracks and landscape design measures have had some success in encouraging interaction with wetlands and preventing access into environmentally sensitive areas.
- Residential development can indirectly encourage incursions of pest animals and predators including foxes and species such as the Little Raven into wetland sites. Research has identified the native Little Raven as a particularly active predator species in the Cheetham Wetlands, and that foxes and crow species are particularly adaptive in the interface between suburban and nearby wetland areas.
- Educational programs should be considered to raise environmental awareness, stewardship of and connection with sensitive landscapes.
- Channels, thick vegetation, ponds and buffer zones (more than 250m) may deter human incursion into conservation areas.

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## 14. TROUTDALE REYNOLDS INDUSTRIAL PARK, OREGON, USA

### 14.1 Introduction

The Troutdale Reynolds Industrial Park was developed after the closure of an aluminium processing plant located at the meeting point of the Columbia and Sandy Rivers, around a mile north of the city of Troutdale, Oregon.

Before the 1940s, the site was used for agriculture. In 1941, Alcoa opened an aluminium plant that supplied the US military. Reynolds Metals leased the plant in 1946 and bought the plant in 1949. Over the 1940s the plant produced 11% of US' aluminium production.

In 2002 the plant closed affecting 1200 jobs and extensive site rehabilitation requirements. The following year Alcoa (which now owned Reynolds Metals) began a clean-up process. In 2008 the Port of Portland bought the site.

The redevelopment of the site as the Troutdale River Industrial Park (TRIP) aimed to maximise the property's potential of this strategically located area to create jobs and generate local tax revenue while preserving wetland areas in the area.

Troutdale is 23km east of the city centre of Portland, Oregon. In 2013 Troutdale had a population of around 16,500 people.



Figure 67: Aerial map, Troutdale Reynolds Industrial Park, Oregon.



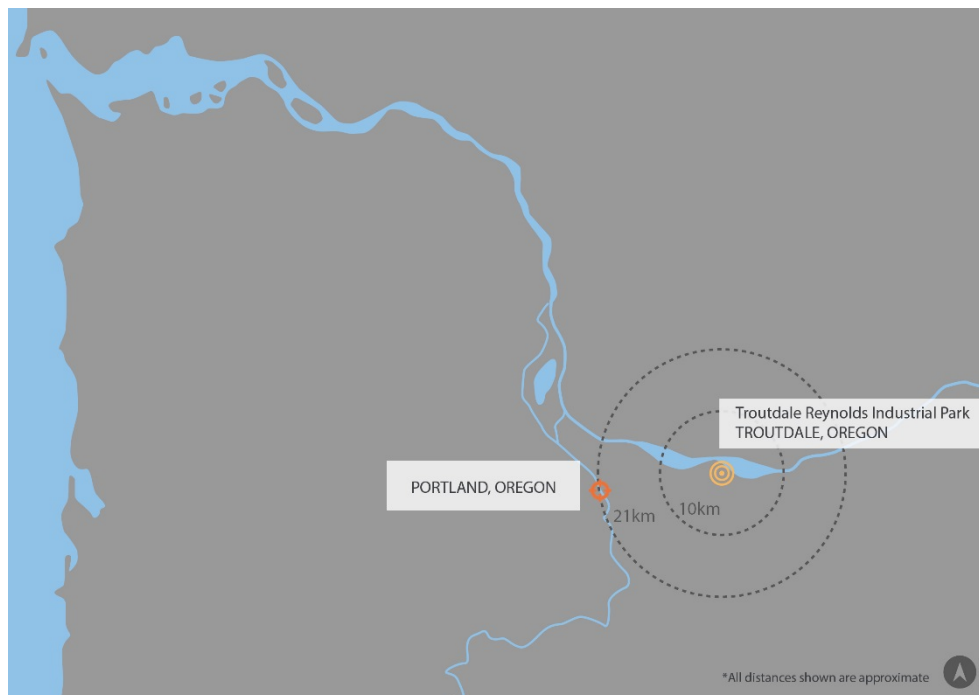


Figure 68: Proximity map of Troutdale Reynolds Industrial Park and nearest city



Figure 69: Scale comparison map of Troutdale Reynolds Industrial Park and Moolap site

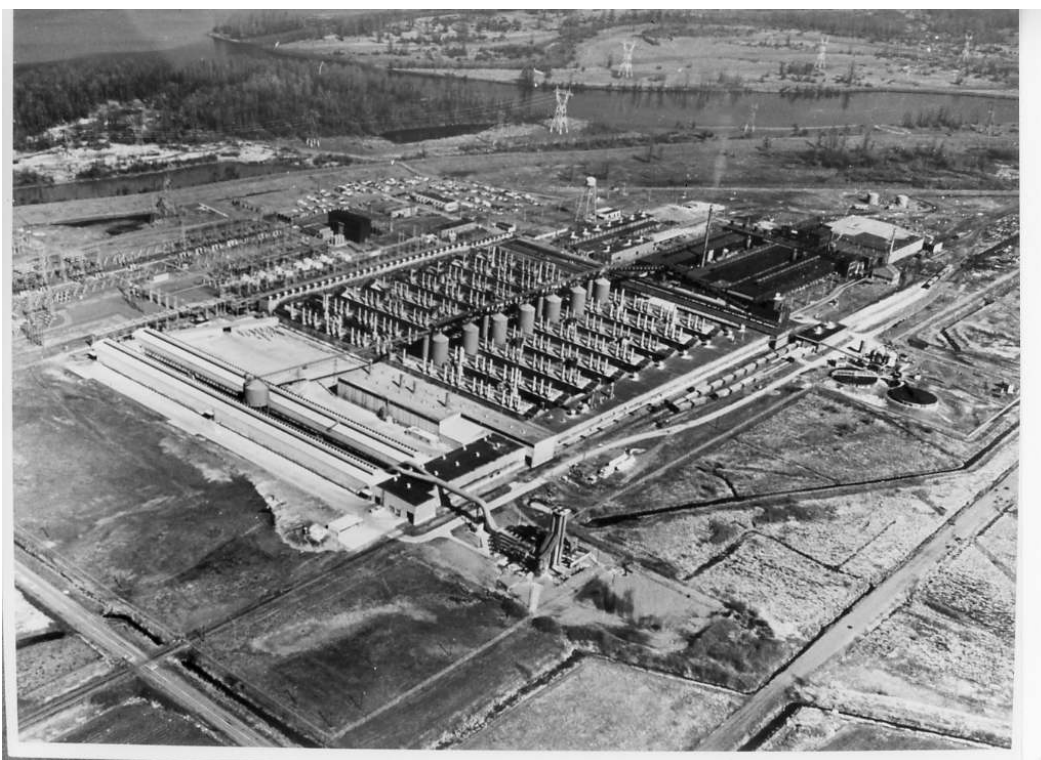
## 14.2 Site conditions

The 283 hectare site includes the former aluminium smelting plant and an adjacent wetland area. Despite the plant being demolished, smelting activity had left the site contaminated with a variety of heavy metals, as revealed in a range of groundwater and site sample tests. As well as demolishing the facility Alcoa decided to dispose of all waste offsite to optimise redevelopment potential. Alcoa invested US\$57m in the site clean up to meet obligations under the federal Superfund Law. The company won a Phoenix Award for excellence in brownfield redevelopment for its efforts.

The industrial development took up 142 hectares of the site, with another 142 hectares preserved as wetlands. The site has strong freight links, including access to two major highways and the Portland-Troutdale International Airport, located directly south of the industrial park. The Columbia River connects Troutdale to Portland and international ports via the Pacific Ocean.

Interstate rail lines travel through the area, while the nearby Interstate 84 is one of only four major highways that cross the west coast's mountain range.

These strategic advantages make the site ideal for industrial development, particularly transit oriented businesses.



*Figure 70: Reynolds Metals Plant at Troutdale, c.1970s. Photo: Troutdale Historical Society*



*Figure 71: Aerial view of Troutdale Reynold Industrial Park. Photo: Port of Portland*

### **14.3 Governance and planning frameworks**

After it purchased the site in 2008, the Port of Oregon worked with local, regional and state government to develop the brownfield section of the site and provide further infrastructure to support the wetland area. The Port led the redevelopment



of the site through the TRIP Masterplan, investing more than \$36m to acquire the land and spur redevelopment. As of late 2015 the port authority estimated it would need another US\$63.5m to complete the final stages of the project including US\$13m to fund transport infrastructure.

The development was consistent with regional goals to retain development within the Portland Metro's urban growth boundary, which included directions to rejuvenate brownfield sites.

The TRIP Masterplan proposes to redevelop around 142 hectares of the site, leaving the remainder conserved as wetlands with infrastructure including a recreational trail to provide public access.

The Masterplan worked across three phases, with 53 hectares in phase one, 74 hectares in phase two and 14 hectares in phase three.

#### **14.4 Land use and facilities**

In July 2010 FedEx Ground became TRIP's first tenant with a 41,000m<sup>2</sup> freight distribution facility built on the site of the former smelter. FedEx's facility employs more than 750 people and has acted as a catalyst for further growth.

To the north of the industrial park a network of paths has been opened up along rejuvenated wetlands. This area has become a well-used public asset. To the south is the Portland-Troutdale Airport while residential areas to the south-west of the industrial park are buffered by dedicated open space areas.



*Figure 72: Planting of Willows March. Photo: Port of Portland*



Figure 73: Land use and facilities legend, Troutdale Reynolds Industrial Park

### 14.5 Summary table

<b>Location and Context</b>	Located between the Columbia and Sandy Rivers, just north of the Troutdale Airport. On the edge of Troutdale residential suburb, the site is the largest remaining zoned industrial property within the urban growth boundary.
<b>Existing Land use</b>	Reynolds Metals Smelter built during WWII. Permanently closed in 2001. Decommissioning completed in 2002.
<b>New Land use</b>	Sold to Port of Portland. 50% industrial development (making it the Port of Portland's second largest industrial park). 50% recreation, wetlands and natural open spaces, including a multi-use trail.
<b>Size</b>	283 hectares.
<b>Year of development</b>	2002 - Completed decommissioning and preparation for redevelopment.
<b>Issues, Benefits and Disbenefits</b>	<p>Infrastructure</p> <ul style="list-style-type: none"> <li>Storm water - additions to existing storm water system include grassy swales, catch basins, manholes, collector lines, and storm water mainline extension.</li> <li>The site has good road, air, rail, and water accessibility including the Interstate 84, Portland International Airport, Troutdale Airport, and the Union Pacific rail line.</li> </ul> <p>Economy</p> <ul style="list-style-type: none"> <li>High local and national unemployment rates.</li> <li>Upon completion of all stages, the development is projected to generate more than 3,500 jobs, translating to US\$141 million in personal income, US\$218 million in local purchases, and US\$46 million in state and local taxes when considering all job impacts.</li> </ul> <p>Environment</p> <ul style="list-style-type: none"> <li>Contaminated soils and wetlands filled and capped in order to be built on. Capped wetlands are offset elsewhere.</li> <li>Sustainable features include use of recycled concrete aggregates, pervious concrete for carparks and porous asphalt.</li> </ul>



	<ul style="list-style-type: none"> <li>In 2011 the park was awarded the U.S. Environmental Protection Agency national Phoenix Award for the top brownfield redevelopment project in the country.</li> <li>LEED certification or Leadership in Energy &amp; Environmental Design, is a green building certification program that recognizes best-in-class building strategies and practices.</li> </ul> <p>Community</p> <ul style="list-style-type: none"> <li>Improved recreational opportunities.</li> </ul>
<b>Staging of the project</b>	<p>The park is being developed in 3 stages and include 11 lots:</p> <ul style="list-style-type: none"> <li>Stage 1 (53 hectares) – completed 2010.</li> <li>Stage 2 (74 hectares) – begun in 2011.</li> <li>Stage 3 (14 hectares).</li> </ul>
<b>Cost and funding mechanism</b>	<p>Site remediation through The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), which is a trust fund for cleaning up abandoned or uncontrolled hazardous waste sites.</p> <p>Alcoa contributed funding for clean-up. Funding requirements include:</p> <p>Alcoa site clean-up - \$57 million.</p> <p>Acquisition and redevelopment (Port of Oregon) - over \$36 million.</p>

#### 14.6 Potential lessons for the Moolap Plan

- Industrial development on brownfield sites can work if appropriate transport infrastructure is available and open space buffers to more sensitive land uses are provided.
- Consideration needs to be given to adjacent land uses and infrastructure in determining future land uses.
- Buffer zones need to be considered where land uses may clash.
- Government authorities working together can effectively drive brownfield redevelopment.
- Industrial redevelopment can be combined with environmental restoration and public infrastructure work as long as use conflicts are minimised and freight links are available.

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## 15. WILDFOWL AND WETLANDS TRUST (WWT) LONDON WETLANDS, UK

### 15.1 Introduction

The London Wetland Centre has become an international exemplar of urban conservation practice that has inspired other projects throughout the world. The site is managed by the Wildfowl and Wetlands Trust (WWT), a charity that works to conserve wetlands and the fauna that depend on them. The centre, next to the River Thames, is in south-west London less than 12km from Westminster Abbey.

The project is Europe's largest wetland reconstruction project, covering an area of 40 hectares. Much of the project was funded by the sale of a small portion of the site for residential development.

Development began in 1995 with tight planning regulations that included rules preventing the removal of spoil from the site. In 2000 the centre was opened by Sir David Attenborough. The area has created vital habitat for more than 200 bird species including rare species, insects and eight species of bat. In 2001 the Centre won a British Airys Global Award for sustainable ecotourism. It has also inspired other wetland projects including the Hong Kong Wetland Park and the Ras al Khor wetland in Dubai.



Figure 74: Aerial map of WWT London Wetland

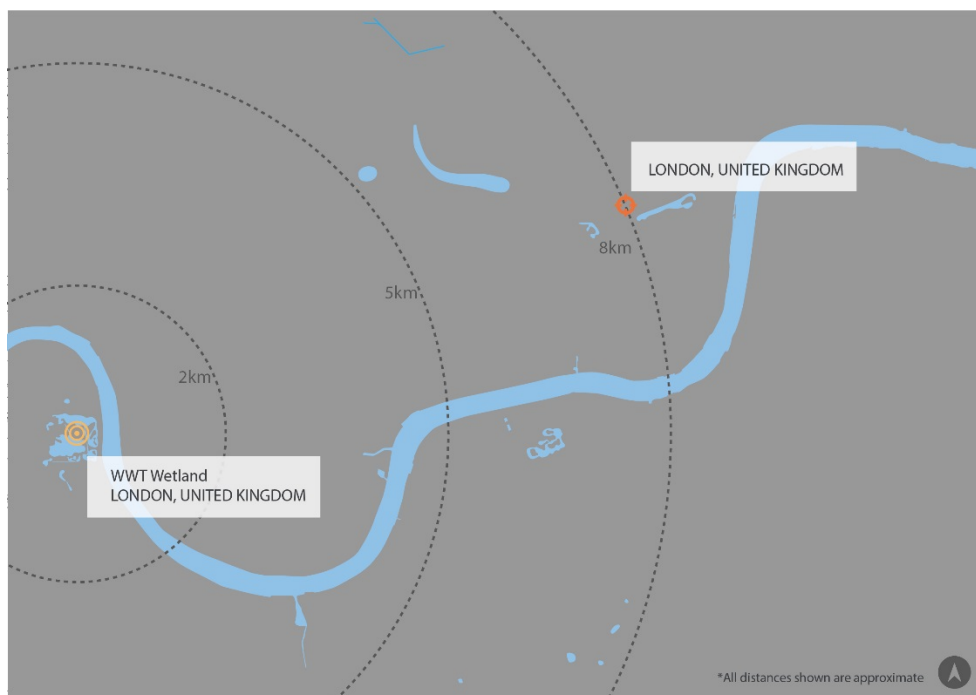


Figure 75: Proximity map of WWT London Wetlands and nearest city.



Figure 76: Scale comparison map of WWT London Wetlands and Moolap site.



*Figure 77: Aerial with housing in foreground Photo: WWT*

## 15.2 Site conditions

The site once supplied drinking water to London's rapidly growing population. In 1988 Thames Water decided the four concrete reservoirs on the site were no longer needed and had to be decommissioned. The local authority advised Thames Water that a commercial development was inappropriate and a more imaginative approach was required.

The company subsequently held discussions with the WWT's founder Sir Peter Scott, who had previously decided he wanted to bring nature to the people with the capital city as his target, and so the project was born.

The planning regulations preventing spoil from being removed off-site meant concrete that had been part of the reservoirs had to be recycled on site to help form paths, car parks and islands.

## 15.3 Governance and planning frameworks

The project is an outstanding example of conservation being achieved through partnerships between local government, a developer, a utility company and a non-government conservation organisation. Following the local planning authority's advice to Thames Water that an imaginative approach was required for the site, an initial cost estimate of £16 million was made for remediation and construction. Thames Water gifted the land and the local planning authority allowed 12 hectares of the 52 hectare site to be developed for housing. The housing development by Berkley Homes netted £11 million in revenue. Thames Water donated another £1 million while the rest was raised through other donations and grants.

The WWT has also benefited from a landfill tax policy passed in 1996 that allows waste disposal companies to donate a portion of waste dumping fees they are liable for to an environmental body. The WWT has received more than £1 million so far.

## 15.4 Sustainability

The project has an array of sustainability benefits. It provides an important green space and vital wildlife habitat in the centre of London that improves water quality from the Thames. It also provides for outstanding opportunities to promote connections between people and nature. These connections include tourism and education. Around 240,000 people visit the centre annually, with 20,000 of them school children.

The centre has also provided opportunities to reintroduce and breed populations of threatened or declining species. These notably include Water Voles, which are established in the reserve after the introduction of 250 individuals in 2001.

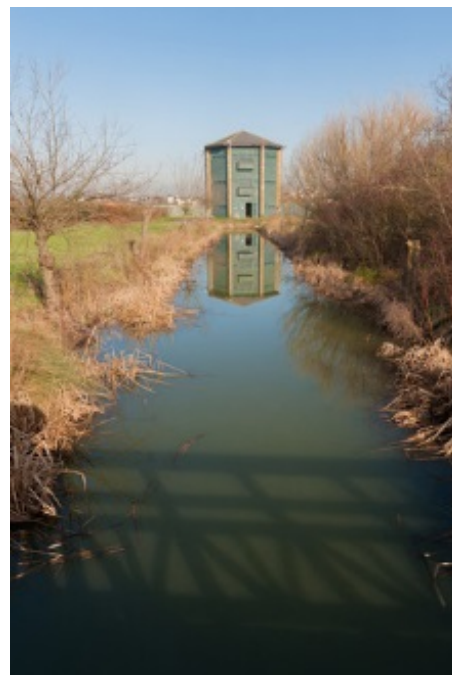


As part of the project, more than 300,000 aquatic plants and 27,000 trees have been planted.

The recycling of materials from the site to help form wetlands and other infrastructure has added a significant further sustainability dimension to the project.



*Figure 78: Interface of wetlands and urban area.  
Photo: WWT*



*Figure 79: Tower hide with 360° view of wetlands and River Thames. Photo: WWT*

### **15.5 Land use and facilities**

The project has involved the construction of more than 30 different wetlands, 600m of boardwalk, 3.4km of pathway, 27 bridges and 27 water control sluices, as well as the 2,500m<sup>2</sup> Peter Scott Visitor Centre and interpretative facilities around the site. These include a conservation-themed adventure playground, a pond-dipping area and a captive collection of wildfowl.

The 12 hectare housing development includes 250 high-end waterfront townhouses and multiple apartment complexes.



*Figure 80: View across lakes to observatory and visitor centre. Photo: WWT*



*Figure 81: Observatory with views over reserve. Photo: WWT*



Figure 82: Land use and facilities legend, WWT London Wetland

## 15.6 Summary table

<b>Location and Context</b>	The London Wetland Centre is based in south-west London, less than 12km from Westminster Abbey, and adjacent to the River Thames.
<b>Existing Land use</b>	Four reservoirs created in the late nineteenth century to provide drinking water to the rapidly growing population of London. Due to their non-compliance with European Union regulations they had become redundant and were a financial burden to the Water Company as the site had to be kept secure.
<b>New Land use</b>	Housing development and Wildfowl and Wetlands Trust nature reserve. The housing development consists of 250 townhouses and apartment complexes. Over 30 different wetlands were constructed, including: <ul style="list-style-type: none"> <li>Planting of over 300,000 aquatic plants and 27,000 trees.</li> <li>600 meters of boardwalk and 3.4 km of pathway.</li> <li>Six hides (including two and three-storeys), 27 bridges and 27 water control sluices.</li> <li>2,500m<sup>2</sup> Visitor Centre.</li> <li>Administrative and service buildings.</li> </ul>
<b>Size</b>	40 hectares of wetlands. 12 hectares of housing.
<b>Year of development</b>	Site construction began in 1995. The Reserve was opened in 2000.
<b>Issues, Benefits and Disbenefits</b>	<p>Infrastructure</p> <ul style="list-style-type: none"> <li>Lack of through routes for vehicles in the housing development enhances security but creates a suburban de-populated character.</li> </ul> <p>Economy</p> <ul style="list-style-type: none"> <li>Around 240,000 people visit the wetlands' visitor centre annually.</li> </ul> <p>Environment</p> <ul style="list-style-type: none"> <li>Designated a Site of Special Scientific Interest (SSSI) by Natural England, a public body charged with protecting England's environment.</li> <li>Recycled material used in construction work due to planning restrictions requiring no spoil be removed from the reservoir site.</li> </ul>

	<ul style="list-style-type: none"> <li>• Stormwater treated through the construction and monitoring of nine treatment wetlands.</li> <li>• Work on-site has sought to control spread of existing invasive species and preventing introduction of new invasive species.</li> <li>• Provides an important habitat for wetland wildlife.</li> <li>• Provides an environmental education resource for visitors.</li> <li>• In 2001, the Centre won the British Airways Global Award for sustainable ecotourism.</li> <li>• Discrete fencing around the entire site prevents the incursion of predators such as foxes, cats and stray dogs.</li> <li>• Control measures are required for Black-headed gulls as they pose a threat to nesting shorebirds and terns.</li> </ul> <p>Community</p> <ul style="list-style-type: none"> <li>• Education a major emphasis. Programs and facilities include conservation-themed adventure playground, a pond-dipping zone, interactive exhibits, a captive collection of wildfowl, daily education events including school excursions, self-guided tours, guided tours and 11 programs focusing on wetland flora, fauna and hands-on activities.</li> <li>• In 2012 London Wetland Centre was voted Britain's Favourite Nature Reserve in the BBC Countryfile Magazine Awards.</li> </ul>
<b>Staging of the project</b>	Not known.
<b>Cost and funding mechanism</b>	<p>The site was secured for free, but funds were required to transform the site into a bio-diverse wetland. Funding was secured by selling a small section of the site to a property developer, Berkeley Homes, for £11 million, whilst the remaining £5 million was obtained through a series of donations and grants.</p> <p>The reserve is managed by the Wildfowl and Wetlands Trust, a charity with the specific remit of conserving wetlands.</p>

### 15.7 Potential lessons for the Moolap Plan

- It is possible to blend conservation and quality housing development to achieve an outcome that provides economic, environmental and significant social benefits.
- The wetlands' central location and prominent interpretive centre have been instrumental in allowing the wetlands to provide opportunities to connect London's residents and tourists with nature.
- A non-profit organisation, such as the World Wetlands Trust, can bring substantial renewal projects to fruition with the support of government and the private sector.
- Interpretive and educational facilities can add significantly to the social value of rejuvenated wetland areas by promoting better connections between people and the natural environment.
- It is important to strike the right balance when using residential development and private investment to fund environmental conservation work.
- The WWT has lodged feedback to the Moolap Coastal Strategic Framework Plan, noting the importance of the Moolap Saltworks site to the network of wetlands, including Ramsar listed sites, along Port Philip Bay.
- The implementation of pest control measures is required to successfully manage and protect wetlands in urban environments.

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## 16. SUMMARY AND CONCLUSIONS

### 16.1 Overview

The 12 case studies investigated in this report present a range of approaches to urban regeneration and the management of environmental constraints. From these studies, a number of clear themes emerge that can inform planning for the Moolap site:

- Managing environmental risks
- Climate change adaptation and mitigation
- Understanding place and context
- Relationships with major centres
- Governance and planning approaches
- Costs and benefits

### 16.2 Managing environmental risks

First and foremost, planning for the site must recognise the capacity of the land and any environmental constraints. Particular attention needs to be paid to managing coastal acid sulphate soils, which have proven particularly problematic in areas where tidal flows have been restricted by human intervention such as East Trinity. Managing the environmental and social fallout from the exposure of acid sulphate soils in East Trinity caused by attempts to farm the land during the 1970s has been expensive and intensive. The challenges posed by acid sulphate soils on the site remain, despite world-leading remediation practices, with significant public cost.

### 16.3 Climate change adaptation and mitigation

Planning on waterfront renewal sites must be based on an understanding of how climate change may affect the subject site and surrounding areas, as well as the site's role in supporting climate change resilience. The Dutch Delta Commission has recommended a "build with nature" approach to new development in low-lying areas. Many of the case studies employ innovative approaches to climate change mitigation and adaptation that recognise the multiple ecological functions of urban renewal sites, including:

- The Adelaide International Bird Sanctuary's use of wetlands and saltmarsh as a multi-functional landscape that manages inundation risk/sea level rises, stores carbon and treats stormwater flows from surrounding areas.
- HafenCity's approach to building design that requires the development proponents to fund plinths on which buildings are constructed, while designing some public spaces to accommodate riparian flooding and preserve links with the waterfront.

The Adelaide International Bird Sanctuary suggests that the Moolap site has the capacity to support climate resilience in surrounding areas by managing sea level rises and treating stormwater inflows. These broader "eco-system services" warrant further consideration in light of improved urban resilience and potential downstream economic and social benefits. The function of these wetland ecosystems can also be improved through intervention and infrastructure development, as many of the case studies demonstrate.

Case studies that include more urban-scale development suggest the need to cater for significant upfront costs in climate change mitigation and landscape design. Many of the case studies that focus on urban-style development employ a range of sustainability measures ranging from the low-tech (neighbourhood composting on the Île de Nantes) to higher technology (waste collection and processing networks in Hammarby). The most sophisticated approaches to sustainability infrastructure seek to manage flows of water, energy and waste in an integrated way, requiring strong upfront planning and infrastructure investment.

### 16.4 Understanding place and context

The 12 case studies show varying understandings of place and context. The most successful demonstrate a nuanced approach to the political context, sound integration with surrounding land use, enhancement of the local identity, and an understanding of how the urban renewal area relates to the city centre. Place and context are relevant to all projects, from industrial developments through to residential, mixed use and conservation.

Place factors including the local landscape and history provide vital cues to explore potential redevelopment options. No two sites are the same, so no one approach will suit every site. The Île de Nantes redevelopment goes to the level of encouraging

adaptive reuse of abandoned industrial warehouses which has helped inspire creative activity, formed a cluster of creative enterprises and integrated the precinct as a firm part of the city's identity. The project's design has also sought to link the precinct with the city centre on the opposite bank of the Loire River through urban design. Similarly, house designs on Borneo-Sporenburg draw from centuries of Dutch tradition to deliver an approach to high-density housing that supports and fosters a distinctive local sense of place. The Adelaide International Bird Sanctuary presents a sophisticated response to the natural landscape and internationally significant bird migration paths that draws social and economic benefits by building on an environmental asset. These three projects benefit from a deep, imaginative and sophisticated engagement with place dynamics.

Troutdale in Oregon shows that industrial development projects also benefit from a strong understanding of place considerations. While the decommissioned aluminium processing plant was demolished as part of site rehabilitation, planning for the site recognised the need to integrate with the natural environment, draw on strategic advantages provided by surrounding infrastructure (such as an international airport and nearby highways) and manage interfaces with surrounding land uses.

Similarly, projects that have been perceived as out of scale and out of place with the surrounding environment have faced significant challenges, or have not proceeded. The Redwood City Saltworks proposal was politically problematic, in part due to its scale and response to a sensitive location. The resulting stalemate has sent the proponents back to the drawing board seven years after initial plans were presented.

The case studies demonstrate the importance of carefully planning and managing interfaces between any development, existing land use around the site and natural landscapes including the wetlands and waterfronts. When mixing uses on a renewal site, particular care should be taken in planning for interface areas (with options like landscape buffers or design solutions considered) and their ongoing management through infrastructure maintenance, public education or community development programs.

## **16.5 Relationships with major centres**

Urban renewal precincts cannot be planned in isolation. The scale, character, viable uses and infrastructure in a renewal area depends on its relationship with surrounding landscape and settlement, particularly its proximity to major centres of population and employment.

The scale of development in Hammarby, HafenCity and the Île de Nantes has been possible because of their connection to city centres. Each of these projects has been planned in a way that allows them to effectively function as extensions of existing central business districts, with transport infrastructure delivered upfront. Leveraging from existing city centres and providing strong connections through transport and urban design allows a larger scale of development that still contributes to local identity.

Borneo Sporenburg, while a 15-minute bicycle ride from Amsterdam's city centre, is part of a broader strategy to limit urban sprawl by encouraging higher density housing near employment opportunities. Pedestrian and cycling infrastructure has been designed to allow access to the city centre.

Troutdale's industrial park is possible because of its strong transport connections, including interstate highways, river ports and an international airport.

By contrast, Sanctuary Lakes is notable for its high standard of amenity but lack of integration with surrounding residential areas and the limited transport connections to Melbourne's CBD. Access to the area is via one road and is overwhelmingly car dependent. This separation from the surrounding suburbs and city centre may present social issues including increased car dependence and longer commuting times.

Any planning for the Moolap site must recognise its limited connectivity to Geelong's CBD, limited transport options and the residential/industrial mix prevalent in surrounding land use. Planning should also recognise the environmental function of the saltworks site in supporting Corio Bay and its potential to provide environmental and public health benefits through well-targeted environmental restoration and open space.

## 16.6 Governance and planning approaches

As well as environmental constraints, many of the case studies involve complex administrative and political environments. The issues involved in the Redwood City saltworks redevelopment proposal and the success of SAMOA's work on the Île de Nantes demonstrate the importance of inter-governmental collaboration in urban renewal projects.

Planning approaches across the case studies differ, from the rigid master planned approaches of Borneo Sporenburg to the iterative "Plan-guide" approach deployed in Île de Nantes. Both rigid and more adaptive approaches have proven successful in the case studies, however some lessons can be learned. The Borneo Sporenburg plan, while rigid, has mandated diversity of facades and built form by requiring different designers to work across buildings. This mandating of diversity has brought about a richer, more navigable urban form. The Île de Nantes' Plan-guide has been blended with a strong focus on community engagement that has helped respond to urban change and guide the framework's ongoing evolution with three monthly review cycles.

Successful projects have involved an initial investment that has provided a catalyst. The London wetland project secured much of its initial funding through sales of residential land, while Borneo-Sporenburg, La Camargue and Île de Nantes have received funding from multiple levels of government. These catalyst investments are vital to the future success of redevelopment projects.

Planning approaches need to be able to respond to urban change and the fluidity of the broader environment. This can be done through a more adaptive planning approach, or by planning for a more flexible environment that can adapt to pressures like climate change.

## 16.7 Costs and benefits

Proposals for urban renewal sites in sensitive locations need careful approaches to cost-benefit analysis that go beyond immediate economic gains. The Delta Commission report suggests that cost-benefit analyses should mandate that the costs of development in low-lying areas should not be passed on through levels of government, to broader society or to groups not benefiting from development.

Further, the predicted impacts of climate change suggest that ecosystem services and flood protection provided by wetlands or tidal zones should be considered in any cost benefit analysis.

Many of the case studies demonstrate sophisticated approaches to managing and understanding costs and benefits. In pursuing the London Wetlands project, the WWT made the early decision to sell off part of the site as a luxury housing development with subsequent funds largely subsidising the construction of wetlands. This careful pragmatism has delivered a significant social and environmental asset that is also economically sustainable while providing social benefits by promoting connections between people and the natural environment.

Cost benefit analyses should look beyond upfront economics to incorporate social, environmental and future land management implications. Such an approach is more likely to achieve a development that provides a range of broad long-term benefits to Geelong.

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## APPENDIX I

# Twelve recommendations for the future

<b>Recommendation 1</b> <b>Flood protection level</b>	Until 2050	The present flood protection levels of all diked areas must be raised by a factor of 10. To that end, the new standards must be set as soon as possible (around 2013). In some areas where even more protection is needed, the Delta Dike concept is promising (these dikes are either so high or so wide and massive that the probability that these dikes will suddenly and uncontrollably fail is virtually zero). With regard to specific or local conditions, this will require a tailor-made approach. All measures to increase the flood protection levels must be implemented before 2050.
	Post 2050	The flood protection levels must be updated regularly.
<b>Recommendation 2</b> <b>Plans for new urban development</b>		The decision of whether to build in low-lying flood-prone areas must be based on a cost-benefit analysis. This must include present and future costs for all parties. Costs resulting from local decisions must not be passed on to another administrative level, or to society as a whole. They must be borne by those who benefit from these plans.
<b>Recommendation 3</b> <b>Areas outside the dikes</b>		New development in unprotected areas lying outside the dikes must not impede the river's discharge capacity or the future water levels in the lakes. Residents/users themselves are responsible for such measures as may be needed to avoid adverse consequences. Government plays a facilitating role by giving information, setting building standards and warning for floods.
<b>Recommendation 4</b> <b>North Sea coast</b>	Until 2050	Build with nature. Flood protection of the coasts of Zeeland, Holland and the Wadden Sea Islands will be continued by beach nourishments, possibly with relocation of the tidal channels. Beach nourishments must be done in such a way that the coast can expand seaward in the next century. This will provide great added value to society.  Sand extraction sites in the North Sea must be reserved in the short term. The ecological, economic and energy requirements needed to nourish such large volumes must be investigated.
	Post 2050	Beach nourishments need to be continued with more or less sand, depending on sea level rise.
<b>Recommendation 5</b> <b>Wadden Sea area</b>		The beach nourishments along the North Sea coast contribute to the adaptation of the Wadden Sea area to sea level rise. The continued existence of the Wadden Sea area as we know it at present is by no means assured, however, and depends entirely on the actual rate of sea level rise in the next 50 to 100 years. Developments will have to be monitored and analysed in an international context. The protection of the island polders and the North Holland coast must remain assured.
<b>Recommendation 6</b> <b>South-western delta: Eastern Scheldt</b>	Until 2050	The Eastern Scheldt storm surge barrier fulfils the safety requirements. The disadvantage of the barrier is the reduction of flood and ebb volumes going in and out of the tidal basin and, as a result, the loss of the intertidal zone. This is to be countered by additional sand nourishment from outside (as from the Outer Delta).
	Post 2050	The life span of the Eastern Scheldt storm surge barrier will be extended by technical interventions. This can be done up to a sea-level rise of approximately 1 m (to be reached in 2075 at the earliest). If the Eastern Scheldt storm surge barrier is no longer adequate, then a solution will be sought that largely restores the tidal dynamics of its natural estuarine regime, while maintaining the desired level of flood protection.
<b>Recommendation 7</b> <b>South-western delta: Western Scheldt</b>		This must remain an open tidal system to enable navigation to Antwerp and to maintain the valuable estuary. Flood protection must be maintained by enforcement of the dikes.
<b>Recommendation 8</b> <b>South-western delta: Krammer-Volkerak Zoommeer</b>	To 2050	The Krammer-Volkerak Zoommeer, the Grevelingen and possibly also the Eastern Scheldt must be re-arranged to provide temporary storage of excess water from the Rhine and Meuse when discharge to the sea is blocked by closed storm surge barriers.  A salinity gradient (a natural transition between fresh and salt water) in this area is a satisfactory solution to the water quality problem and can offer new ecological opportunities. In this case an alternative fresh water supply must be provided.



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**Recommendation 9**  
**The major rivers area**

- Until 2050 The *Ruimte voor de Rivier* [Room for the River] and *Maaswerken* (Meuse Works) programmes must be implemented without further delays. Subject to cost-effectiveness, measures must be taken already now to accommodate discharges of 18,000 m<sup>3</sup>/s for the Rhine and 4,600 m<sup>3</sup>/s for the Meuse. In this context negotiations with neighbouring countries have to be conducted under the *European Directive on the assessment and management of flood risks* in order to harmonise the measures. Furthermore, room must be reserved and, if necessary, land purchased so that measures can be taken in the future to safely discharge the 18,000 m<sup>3</sup>/s of Rhine water and 4,600 m<sup>3</sup>/s of Meuse water.
- 2050 - 2100 Completion of measures to accommodate Rhine and Meuse discharges of 18,000 m<sup>3</sup>/s and 4,600 m<sup>3</sup>/s, respectively.

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**Recommendation 10**  
**Rijnmond**  
**(mouth of the river Rhine)**

- Until 2050 For the Rijnmond an open system that can be closed when needed ('closable-open') offers good prospects for combining flood protection, fresh water supply, urban development and nature development in this region. The extreme discharges of the Rhine and Meuse will then have to be re-routed via the south-western delta.
- The fresh water for the Western Netherlands will have to be supplied from the IJsselmeer lake. The necessary infrastructure will have to be built. Room must be created for local storage in deep polders. Further research into the 'closable-open' Rijnmond system should be initiated soon.

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**Recommendation 11**  
**IJsselmeer area**

- The level of the IJsselmeer lake will be raised by a maximum of 1.5 m. This will allow free discharge from the lake into the Wadden Sea beyond 2100. The level of the Markermeer lake will not be raised. The IJsselmeer lake retains its strategic function as a fresh water reservoir for the Northern Netherlands, North Holland and, in view of the progressive salt water intrusion in the Nieuwe Waterweg, for the Western Netherlands.
- Until 2050 The measures to achieve the elevated water level can be implemented gradually. The aim must be to achieve the largest possible fresh water reservoir around 2050. The measures needed to adapt the lower reaches of the river IJssel and the Zwanter Water to a 1.5 m higher water level in the IJsselmeer lake must be investigated.
- Post 2050 Depending on the phased approach adopted, follow-up measures may be needed to actually implement a maximum water level increase of 1.5 m.

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**Recommendation 12**  
**Political-administrative,**  
**legal, financial**

1. The political and administrative organisation of our flood protection must be strengthened by:
  - ~ providing cohesive national direction and regional responsibility for the implementation (ministerial steering committee chaired by PM, political responsibility lying with the Minister of Transport, Public Works and Water Management, the Delta director for cohesion and progress and regional administrators for the implementation of the (individual) regional assignments);
  - ~ initiating a permanent Parliamentary Committee on the theme.
2. The financial means must be secured by:
  - ~ creating a Delta Fund, managed by the Minister of Finance;
  - ~ supplying the Delta Fund with a combination of loans and transfer of (part of) the natural gas revenues;
  - ~ making national funding available and drafting rules for withdrawals from the fund.
3. A *Delta Act* will embed the political and administrative organisation and funding within the present political system and the current legal framework. This must in any case include: the Delta Fund and its supply; the Director's tasks and authority; the provision that a *Delta Programme* shall be set up; regulations for strategic land acquisition; and compensation for damages or the gradual loss of benefits due to the implementation of measures under the *Delta Programme*.