

About the project

Coastal Adaptation Study

Assessing the coastal impacts of rising sea levels

Onkaparinga's coastline is of significant cultural, social, environmental and economic value to the Kurna people, our wider communities and visitors.

What did the study investigate and why?

Changes in our climate are causing sea levels to rise over the long term. The Coastal Adaptation Study aims to understand how people, the natural environment and built assets might be impacted by rising sea levels so that council and other stakeholders, such as state government and private landowners, can plan and take action for the future.

The study was undertaken by consultancy, Integrated Coasts with input from Flinders University coastal experts.

The study is just another step in an ongoing journey of adaptation that is likely to take place over the coming years, decades, and even centuries. Our next step will be to engage with our communities and develop a Coastal Adaptation Plan that responds to the identified risks and lays the groundwork for effective coastal management now and into the future.

This fact sheet will explain how the project was conducted, the key coastal adaptation issues for the Onkaparinga coastline, and where to find more information.

The purpose of the study was to:

- create a baseline upon which to monitor future changes
- create flood modelling (for now, 2050 and 2100) from which to identify plausible futures
- identify key coastal issues and vulnerabilities
- provide risk assessments
- bring all previous work into one place of reference
- provide a basis for ongoing adaptation planning.

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Boating on the Onkaparinga River at Port Noarlunga, South Australia, circa 1940.

Onkaparinga coastline

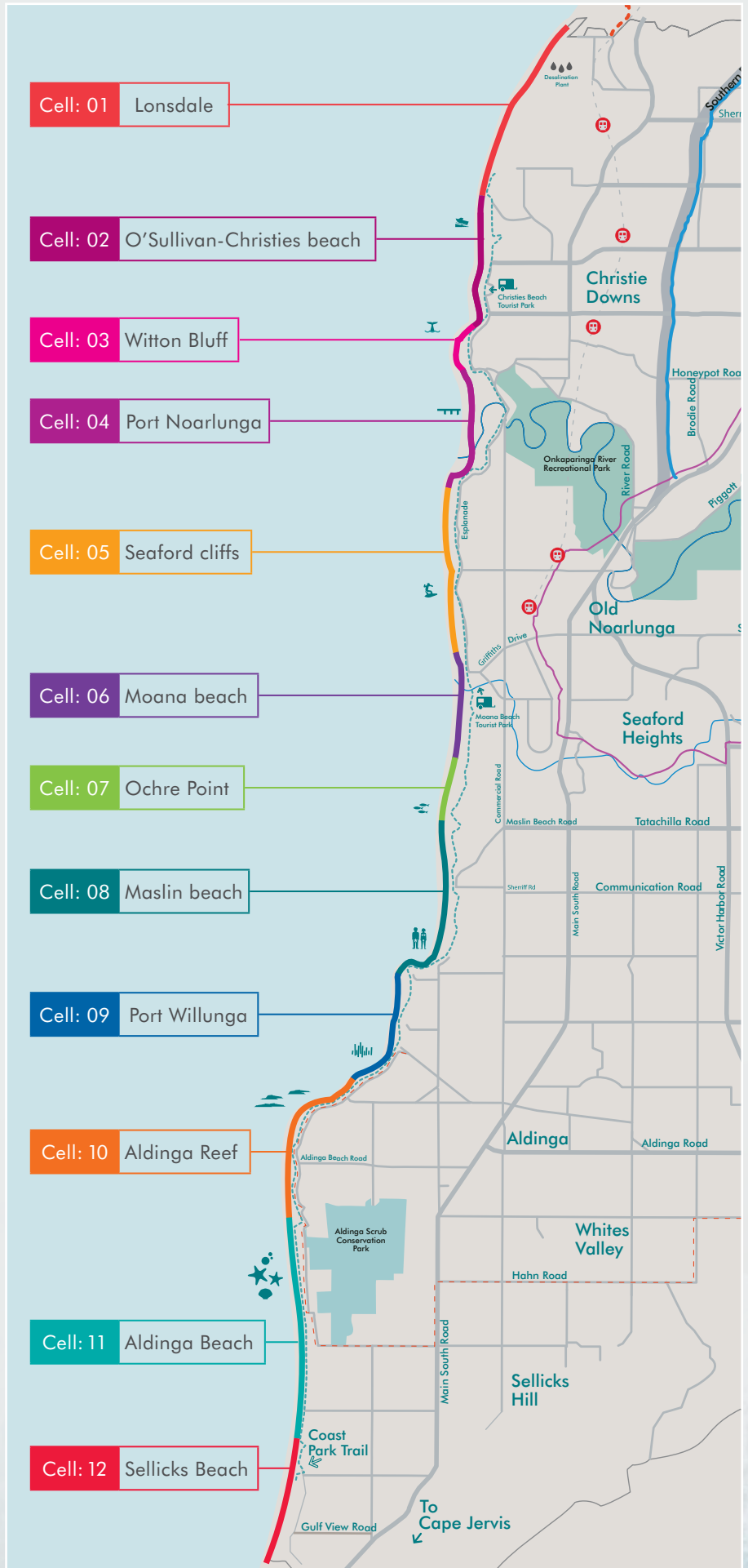
The Onkaparinga coastline is approximately 31kms long and the nature of the coast varies from place to place.

On our northern border in Lonsdale are old hard rock cliffs. On the southern border at Sellicks Beach are soft sediment sloping cliffs. Situated between these are a range of sandy beaches, limestone cliffs, and headlands such as those at Witton Bluff and Ochre Point. Most of the coastline as we know it today was formed in the past 7000 years in a period known as the Holocene.

What were the focus areas of the study?

To effectively study these different locations, we divided the coast into 12 sections or coastal 'cells', with a separate report prepared for each cell.

There are 12 fact sheets that summarise each of the coastal cell reports.



Onkaparinga coastline

What is coastal adaptation?

Coastal adaptation involves adjusting our practices in response to the impacts of our current and expected climate. This means identifying actions to manage our coastline that provide benefits across many sectors (for example safety, tourism, health, environment and recreation). It also means avoiding things that would make it more difficult to cope with coastal hazards and climate risk in the future.

THERE ARE SEVERAL COASTAL ADAPTATION OPTIONS AVAILABLE TO US:

1. **Avoidance** – Avoid the impacts of coastal hazards by ensuring that assets or services are not in areas that could be impacted now or in the future.
2. **Managed retreat** – Progressively move assets or services away from areas that could be impacted by coastal hazards now or in the future.
3. **Accommodate** – Modify construction of assets or how services are delivered to reduce the impact of coastal hazards.
4. **Hold the line** – Install protection or defense infrastructure that reduces the impact of coastal hazards, especially during extreme events such as storm surge.
5. **Loss acceptance** – Accept that coastal hazards will cause negative impacts on assets and services and that when this occurs, they will not be replaced.

Within each of the first four categories there is a range of potential adaptation options in the areas of planning, engineering, environmental management and community awareness and education.

City of Onkaparinga has already completed extensive coastal adaptation work including replenishing dunes; managing outlet flows from rivers and creeks; revegetating cliffs and dunes; sand drift fencing; installing sandbag groynes; building geofabric sea walls; building rock sea walls; stabilising eroding cliffs from the top with piling; moving roads and footpaths inland to accommodate current and future erosion; and community messaging, signage, fencing and by-laws that encourage people not to access highly erodible areas.

Our long history of proactive coastal adaptation means that we have built a solid foundation upon which to respond to future coastal hazards and climate risks.

Evaluating coastal hazards and their impacts

The shoreline is the dynamic edge between the land and the sea and is often changing. We like to live in coastal regions because of their natural beauty and over time we have built roads, paths, parks, and buildings.

In this study, we consider two hazards that can impact coastal regions: erosion and sea flooding (or inundation). If sea levels continue to rise, then the severity of these hazards will increase. Sometimes hazards may directly impact the safety of people such as in cliff locations. In relation to erosion, actions of the sea can cause the coast to move landward, and this is known as coastal recession or erosion. Natural processes can also cause the coastline to build out towards the sea and this is known as coastal accretion.

In this project, we have adopted a conceptual framework with four key elements to think about the impact of sea level rise hazards:

1. **Coastal fabric** – coastal form and geology that is either natural or has been modified by humans
2. **Coastal exposure** – actions of the sea such as tides and waves
3. **Coastal hazards** – in this study we are considering inundation and erosion associated with sea level rise
4. **Risks** – to public and private assets, safety of people and ecosystems.

CONCEPTUAL FRAMEWORK

natural

modified

1. **Coastal fabric**
(geology)

2. **Coastal exposure**
(tides, waves)

3. **Coastal hazards**
(inundation, erosion)

4. **Risks**
(public and private assets,
safety of people, ecosystem disruption)

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The conceptual framework is explained on the following pages

1. Coastal fabric – form and geology

Analysing the geology of the coastline upon which our settlements are located helps us to determine one part of the nature of our hazards.

Intuitively, we understand that if we are standing on an elevated coastline of hard rock like granite it will not easily erode and it's unlikely the area would be subject to flooding. We also understand that if we are standing on a low sandy dune, erosion may be a factor. If we are located on a river, flooding may be an issue. Therefore, the first thing to consider is our coastal fabric. We do this by assessing:

- elevation (height above sea level)
- the nature of the fabric of the coast e.g. is it sand or hard cliff; is it natural or modified; how resistant is it to erosion?



Port Willunga beach in 1910.



Port Willunga in 2020 - very little change over 110 years.



Snapper Point
2006

Shoreline
position
2017



Snapper Point
2017

Shoreline
position
2017

Coastal modifiers

In some locations there are additional factors that modify the core relationship between 'fabric' and 'exposure.'

For example, rock has been added to Christies Beach and Witton Bluff to change the backshore from soft sediment to rock. A seawall has been installed at Moana Beach. At Port Noarlunga jetty the backshore, which was once a dune system, has now been changed to concrete. In this project, we have identified how humans have modified the coast and what the implications of these structures may be in the context of sea level rise.

2. Coastal exposure – actions of the sea such as tides and waves

The way that the ocean uniquely impacts each section of the coast forms the second part of our hazard equation assessment.

If we are standing on a beach on the Southern Ocean and listening to the roar of the waves, we intuitively feel that we are exposed. On the other hand, if we find ourselves on the shore of a protected bay, or in the upper reaches of a gulf, we intuitively know that the impact from the ocean is likely to be limited. As the Onkaparinga coastline is situated within the Gulf St Vincent, it is generally classified as only moderately exposed with low wave heights.

The way we evaluated Onkaparinga's coastal exposure in this project included:

- Using photographs from the storm event of 9 May 2016 (the highest event on record at the Outer Harbor and Port Adelaide tide gauges), we identified the impact along the Onkaparinga coastline. This storm was significant because it almost reached the risk level set by South Australian Coast Protection Board known as the 1-in-100-year extreme event. A 1-in-100-year event is a rare event that has a one per cent chance of occurring in any one year.
- The storm event of 21 November 2018 provided an opportunity to analyse the different wave impacts along the coast by surveying seaweed strands.
- We installed a low-cost tide gauge on the footbridge over the Onkaparinga River at Southport and conducted tidal studies at Maslin Beach and Sellicks Beach.
- We utilised our 3D computer model of the coastline to model current risks and future risks in the context of sea level rise projected for 2050 and 2100.

3. Coastal hazards

The coastal hazards considered in this study are 'inundation' and 'erosion' associated with sea level rise. By reviewing the sea level rise modelling, we were able to make assessments about the nature and extent of these hazards.

4. Risk assessments

Finally, we drew upon all the information gathered in this study to assess how the coastal hazards associated with rising sea levels will impact public assets, private assets, public safety and ecosystems for 2020, 2050 and 2100.



Example: The 1-in-100-year extreme event risk was modelled for Moana Beach in 2020 and projected for 2050 and 2100.

Considering sea level rise

Sea levels have been quite stable for several thousand years; however, it is generally agreed that seas began to rise again around 1850. In the last century, sea levels rose globally on average at approximately 1.7mm per year, but larger rates of rises have occurred since 1993 (averaging 4-5mm per year in our region).

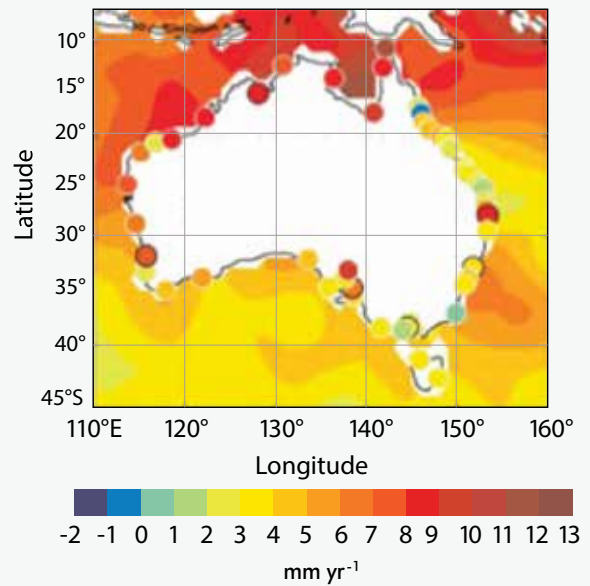
The rate of global sea level rise is not necessarily easy to identify because climate systems such as El Niño and La Niña cause local natural variability in rates of sea level rise. This natural variability can be observed in the Sea Level Trends diagram which depicts the different rates of rise around Australia.

In 1993, the South Australian Coast Protection Board adopted a sea level rise policy of 0.30m rise by 2050 and 1.00m rise by 2100, which the board believes is based on the best available advice, including advice from the Intergovernmental Panel on Climate Change.

More recently in 2015, the Intergovernmental Panel on Climate Change (IPCC) adopted four projections for sea level rise that related to various outcomes in greenhouse gas scenarios. The Sea Level Projections diagram depicts the projected rate of rise for the 'very high greenhouse gas scenario,' which is similar to the sea level rise policy adopted by the Coast Protection Board.

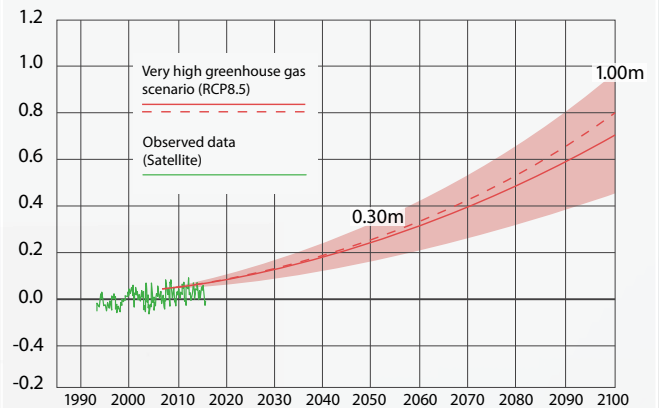
If seas do rise as projected, then the current relationship between 'fabric' and 'exposure' will change along the Onkaparinga coastline.

SEA LEVEL TRENDS



Sea level trends from January 1993 to December 2010 from satellite altimeters (colour contours) and tide gauges (coloured dots). Source: CSIRO and BoM 2015 © Commonwealth of Australia.

SEA LEVEL PROJECTIONS



Sea level projections for the 21st century. For more information about sea level rise review CoastAdapt.



Beach scene at Moana, South Australia, 1930s.

Key findings for City of Onkaparinga

- The Onkaparinga coastline is generally elevated and therefore will not be vulnerable to sea-water flooding (inundation). Exceptions are Onkaparinga River, Pedler Creek and the Aldinga Washpool, if seas rise as projected after 2050.
- The erodibility of the Onkaparinga coastline is characterised as moderate to high erodibility, depending on the location. Exceptions are the Lonsdale region, which is characterised as low erodibility, and the Seaford cliffs, which are characterised as very high erodibility.
- The coastline has been relatively stable over the past 70 years, but there are some pockets of erosion, for example Snapper Point near Aldinga Reef.
- Sea levels have been rising at 4–5mm in our region since the 1990s, which was at a faster rate than the previous decades (1950s to 1980s). The rate of sea level rise is not projected to significantly accelerate until after 2050.
- If seas rise as projected, then beaches and soft sediment cliffs will increasingly undergo recession, which will place infrastructure at risk.
- In most places, a public road is positioned between the coast and private assets. This means that most risks will initially impact council-owned assets. However, in the longer term, private infrastructure, public safety, and the health of our ecosystems are likely to be impacted.
- The study has created a baseline understanding of how the coast has operated over time. Ongoing monitoring of the coast will provide the basis for making timely, cost-effective adaptations to the coast where feasible.

Summary

This coastal adaptation study forms part of a larger body of coastal adaptation work. The study establishes a baseline understanding of how our coast operates and assesses the coastal risks and vulnerabilities from sea level rise. This provides a foundation upon which to build the next stages of coastal adaptation that will take place over the coming years and decades.

ESTABLISHING A BASELINE

We have established a baseline understanding of how our coast operates by analysing coastal changes over the last 70 years. This understanding will help us to identify what are normal coastal events and impacts, or when global sea level rise is beginning to make long term changes to the way our coastline operates.

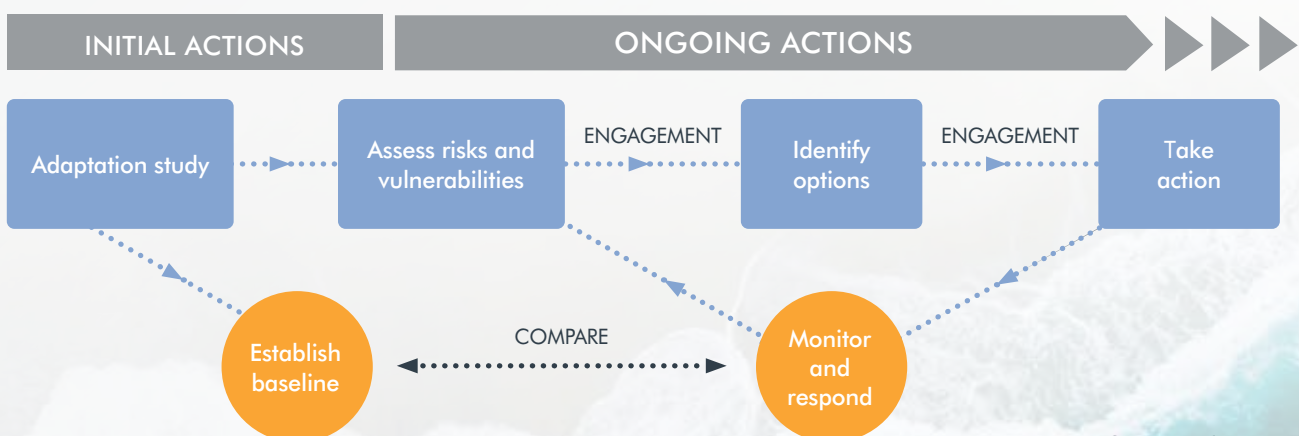
ASSESSING RISKS AND VULNERABILITIES

By assessing current and future risks and vulnerabilities, we now have a better understanding about where our coast is likely to be vulnerable and at what time in the future it may become more vulnerable in the context of projected sea level rises.

IDENTIFYING OPTIONS, TAKING ACTION, MONITORING AND RESPONDING

Coastal adaptation will be an ongoing process. Our next tasks will be to analyse and identify adaptation options, to engage with our communities and take action where required. One of our key ongoing activities will be to monitor our coast and compare changes against the baseline we have established in this project. Based upon the results of our monitoring work, we will be continually assessing risks and vulnerabilities, identifying adaptation options and taking action over the coming years and decades.

MODEL OF ADAPTATION



Next steps

Now that the study is complete, we'll be engaging with our communities and developing a Coastal Adaptation Plan that responds to the identified risks and lays the groundwork for effective coastal management now and into the future.

COASTAL ADAPTATION PLANNING AND ENGAGEMENT PROCESS



More information

To learn more about the Coastal Adaptation Study visit yoursay.onkaparinga.sa.gov.au/coastal-adaptation-study, email mail@onkaparinga.sa.gov.au or phone 8384 0666.



The Coastal Adaptation Study was delivered by Integrated Coasts with input from Flinders University coastal experts.

Historical photos courtesy of Onkaparinga Libraries

Disclaimer

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