

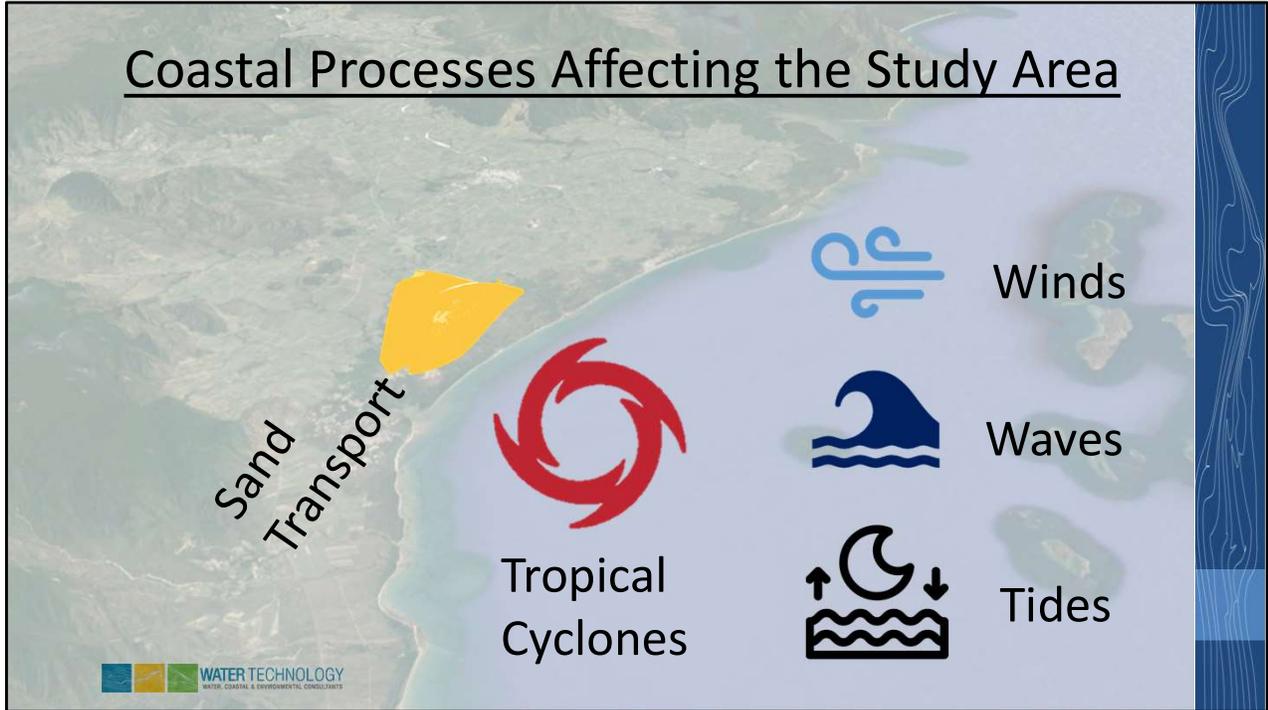


Have Your Say:  
Coastal Reserves

Coastal Processes 101

27<sup>th</sup> Sept 2021



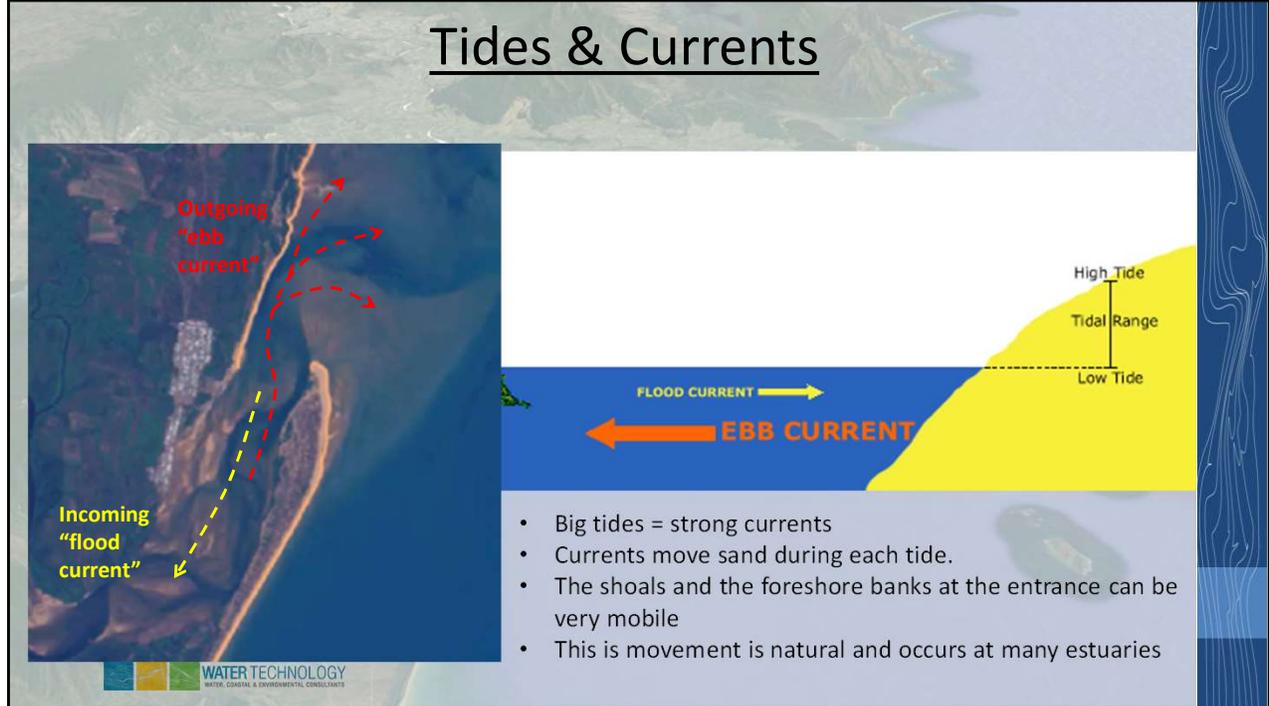


When looking at coastal erosion, we need to consider the different processes that move sand around the coast.

This includes winds, tides, and waves.

This also includes tropical cyclones, which commonly affect the area.

## Tides & Currents

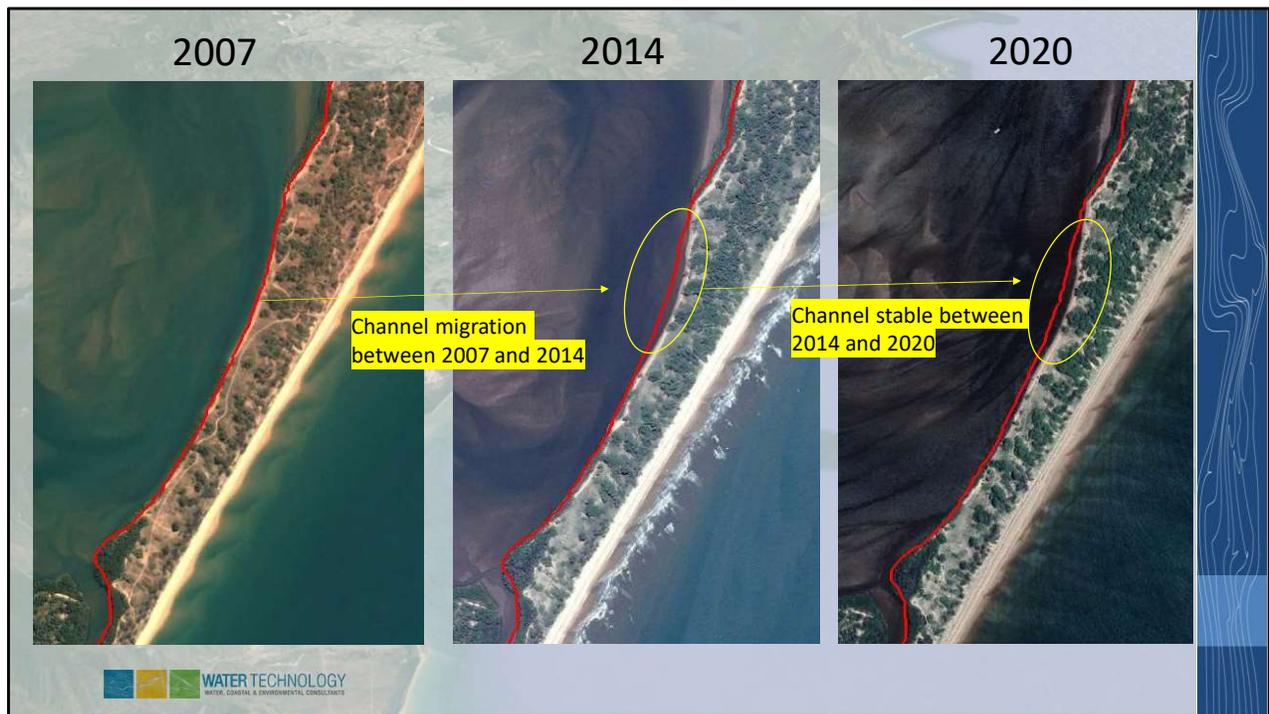


The strong tidal currents in the creek entrance are constantly moving the sand in the delta around. Because the tides never stop, this means that the sand in the delta never stops shifting around – and the flow channels through the creek entrance are constantly changing.

This is natural, and happens at most estuary entrances that are similar to Victoria Creek.



This channel movement has affected the western side of the spit in recent decades.

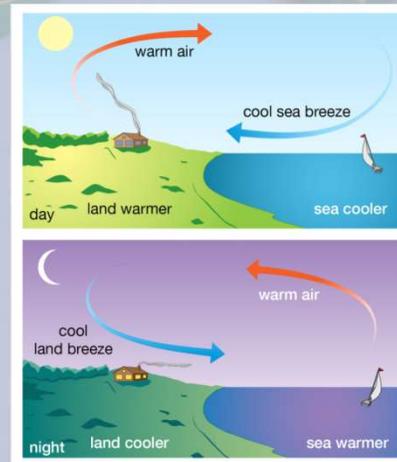
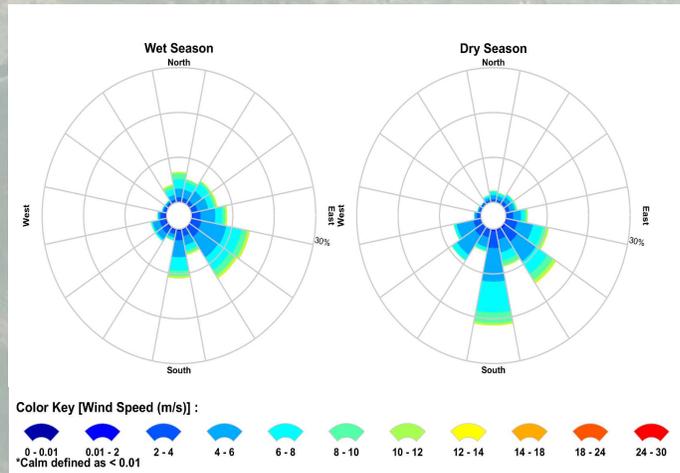


The channel migrated and eroded the foreshore between 2007 and 2014, but has remained relatively stable since. The channel will likely migrate again in the future – but we cant predict in what direction.

# Winds

The South-East Trade winds dominate the region

Within this broader pattern, some sea-breeze effects are also felt closer to the coastline

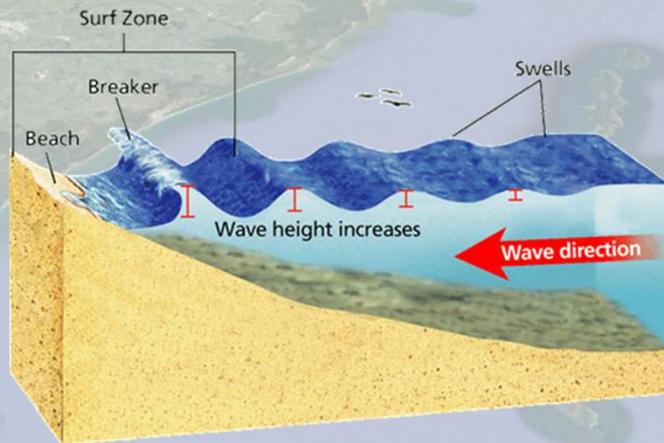


South-East trade winds are very common, particularly in the dry season.

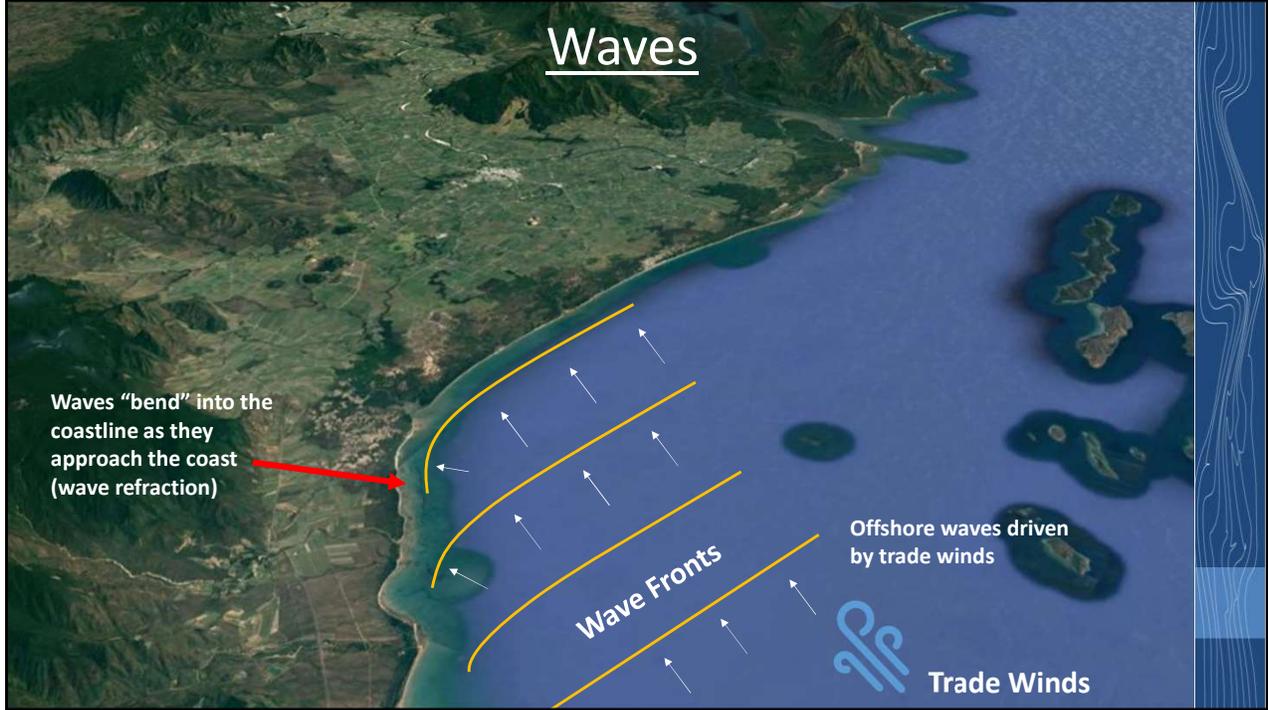
During the wet season, winds are a little bit more east to north-east (including the summer northerlies as well).

# Waves

- The Great Barrier Reef blocks most of the Pacific Ocean Swell.
- Generated by local winds.
- Generally arrive from the south-east (due to trade winds)
- As they get closer to the coast they align with the shoreline



Because the winds are generally from the south-east, so too are the waves.



Whilst the waves out at sea are pushing mostly from the south-east, as the waves get closer to shore they change direction (a bit) to the cost more from front-on.

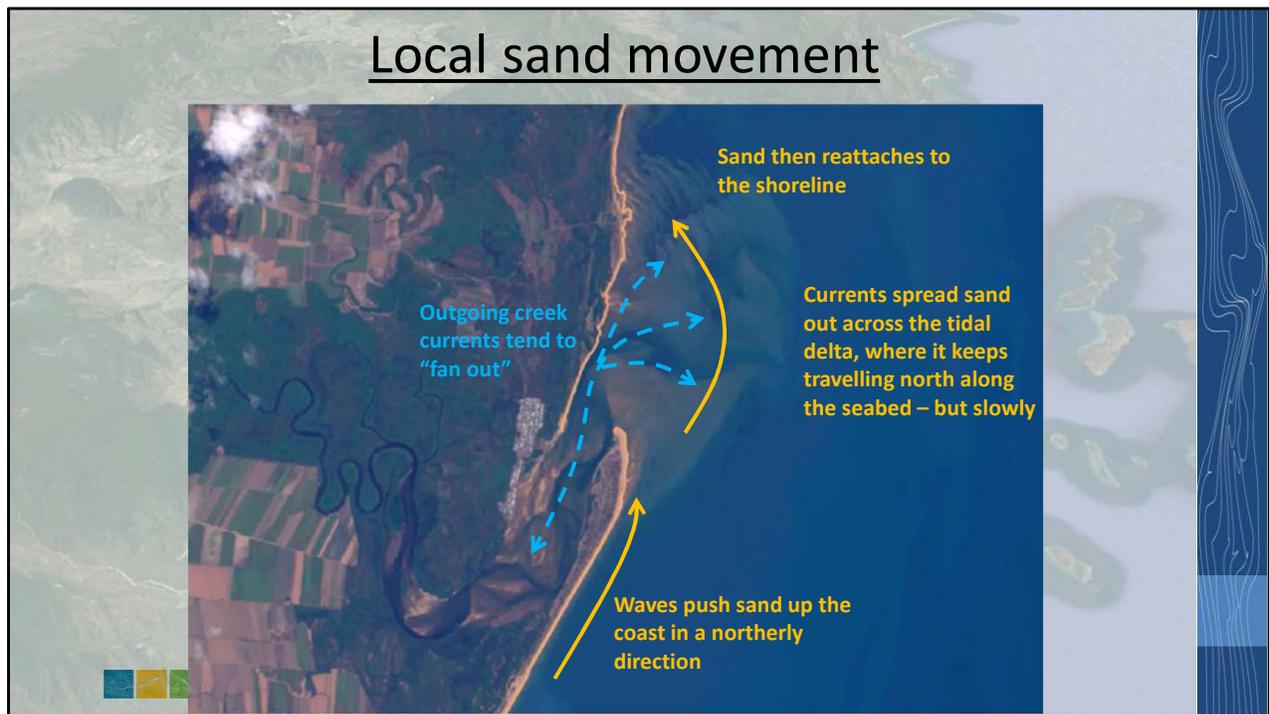
## Coastal Sediment Transport

- Waves can “push” sand up and down the coast
- Most waves come from the south-east, this causes an overall northwards flow of sand along the coast.
- The effect is small on any given day, but can add up to a large amount of sand over years (and decades)



As the waves generally come from the south east – this means that the waves push sand along the coast from south to north. This northerly directed sand movement occurs along much of the east coast of Australia.

## Local sand movement

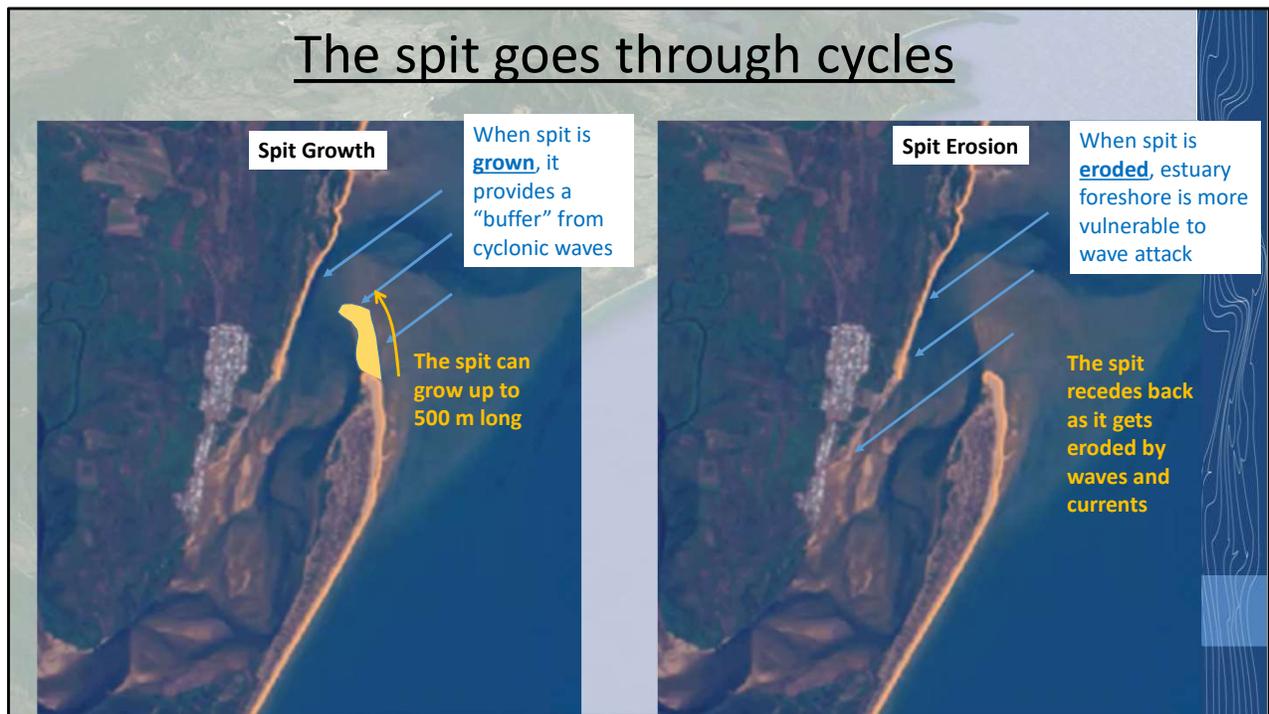


As sand travel north up the coast, it gets "intercepted" by the currents coming in and out of the Victoria Creek entrance.

Some sand gets sucked into the creek entrance by incoming currents, and has helped to create the sandy shoals in the creek entrance.

Some sand gets pushed out onto the seabed by the outgoing currents. This has created the sandy sub-sea delta in the nearshore waters. That sand keeps travelling north along the seabed and "reattaches" to the coastline further north.

## The spit goes through cycles

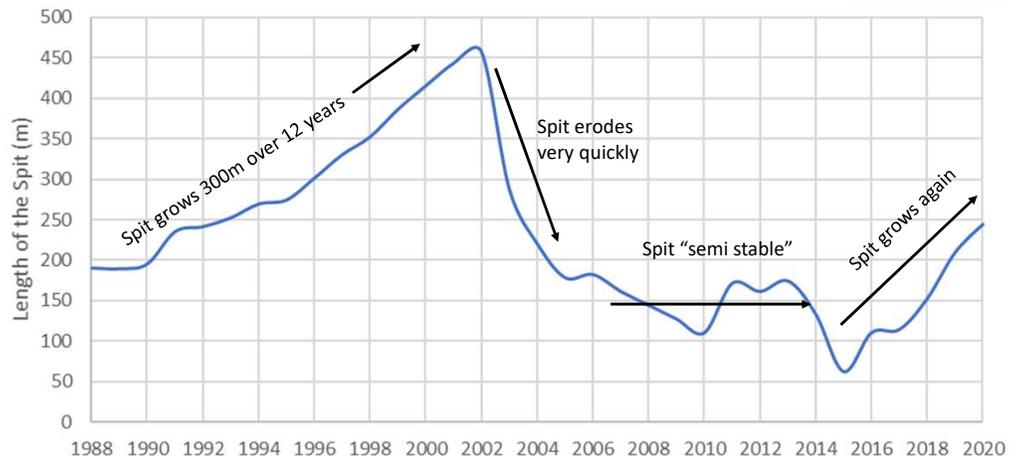


As sand travel north along the coast, it also causes the spit to grow over time – but it isn't stable. The sand spit can grows over a number years, until it gets so big (long) that it can no longer hold itself there, and then the sand detaches and keeps travelling north. After it detaches, the spit shortens. And so, the spit goes through years-long cycles of lengthening and shortening. This is natural, and happens at many creek entrances.

When the spit is naturally long, it provides a protective buffer from northerly winds/waves (from either summer northerlies or from cyclones).

When the spit is naturally shortened, the shoreline inside the creek at Taylors beach is more exposed to wave attack, and erosion.

## Recent history of the spit



This graph shows how the spit has grown and receded over the last 30 years. It can grow up to nearly 500 m long.

It can grow for many years, and then recede very quickly as the sand detaches and keeps moving north.

These growth & recession cycles mean that the spit can come and go over decades. Again, this is a very natural process.

# Shoreline Change

[Earth Engine Timelapse](#)

2020



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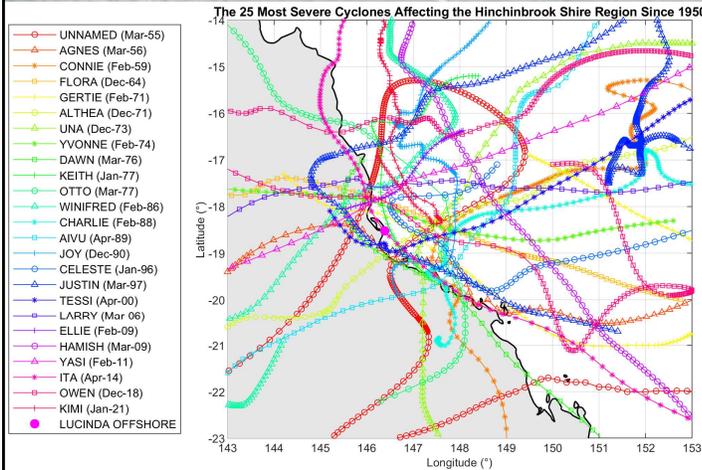


## Taylor's Beach



There are a number of coastal protection structures inside Taylor's beach to provide a “last line of defence” from erosion.

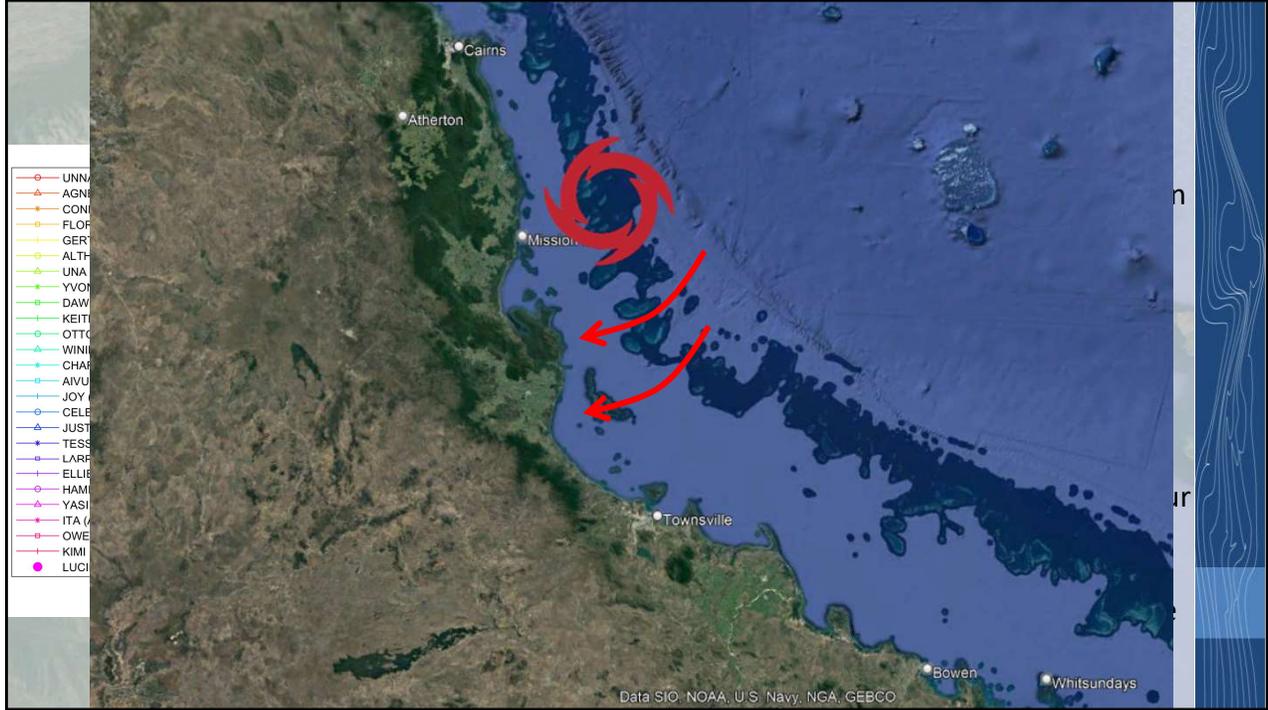
# Tropical Cyclones



- From 1969-2019:
  - 40 cyclones within 200 km
  - Average = Almost 1 per season
- Twice as likely during La Niña periods, but severe ones can occur in any given season
- More dangerous when they make landfall to the North of us
- Notable:
  - TC Yasi (Feb 2011)
  - TC Larry (March 2006)
  - TC Winifred (Jan 1986)

We also need to consider severe erosion that can occur due to Tropical Cyclones.

They are very common in this area, with one coming within 200 km of the area just under once per season (on average).



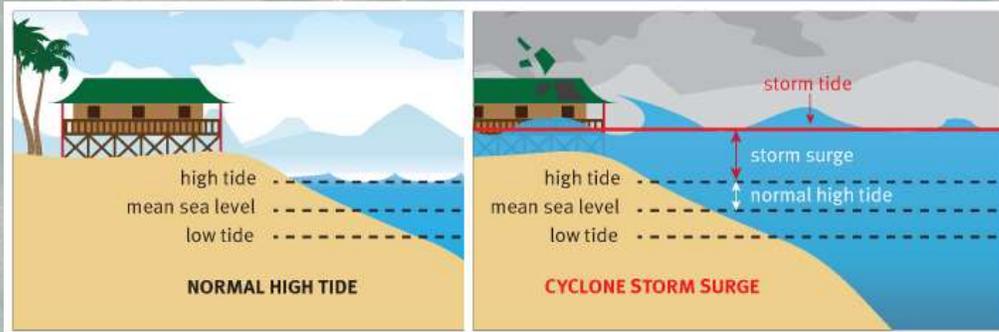
Because cyclones rotate clockwise in the southern hemisphere, they are more dangerous when they make landfall to the North of us.

When they are positioned to the north, the clockwise rotation causes easterly winds that push water and waves up onto the coast – resulting in erosion and flooding.

## Storm Tides

Strong winds can cause water to “pile up” against the coast and generate a “storm surge”.

When coinciding with a high tide, this can cause a super-elevated sea levels known as a “storm tide”



Cyclones can generate severe storm surges and wind causes water to pile up against the coast.

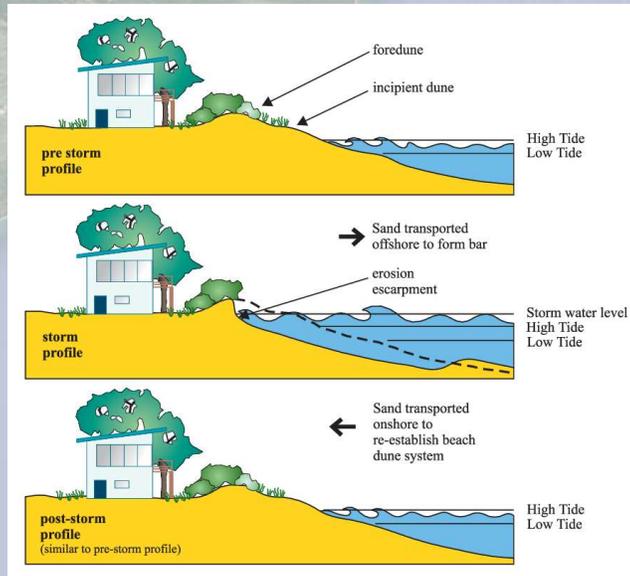
This can cause severe coastal flooding that can damage properties and important infrastructure.

## Coastal Erosion

High tides and large waves can generate storm erosion at the coastline – especially during cyclones

Large waves erode sand from the upper beach face and sand dunes → and deposit that sand into surf zone sand bars

After the storm, calm waves gradually return this sand back up on to the beach (but can take months or even years to naturally recover)

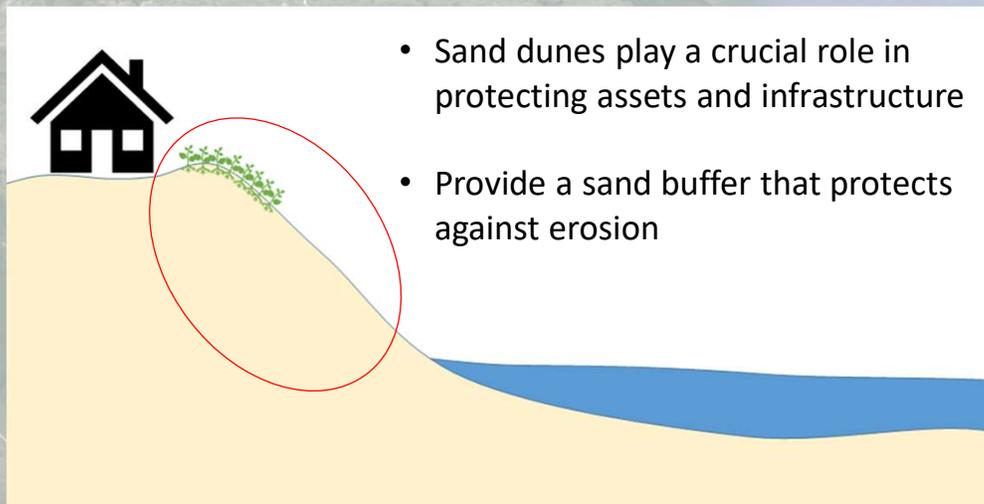


When large waves coincide with high tides, that can cause severe erosion of the foreshore.

Most open coast beaches will naturally recover in the month/years/decades after a big erosion event – as the sand naturally returns.

Based on this, most beaches go through cycles of erosion and rebuilding. Therefore, the shoreline is almost never “stable” and is constantly changing.

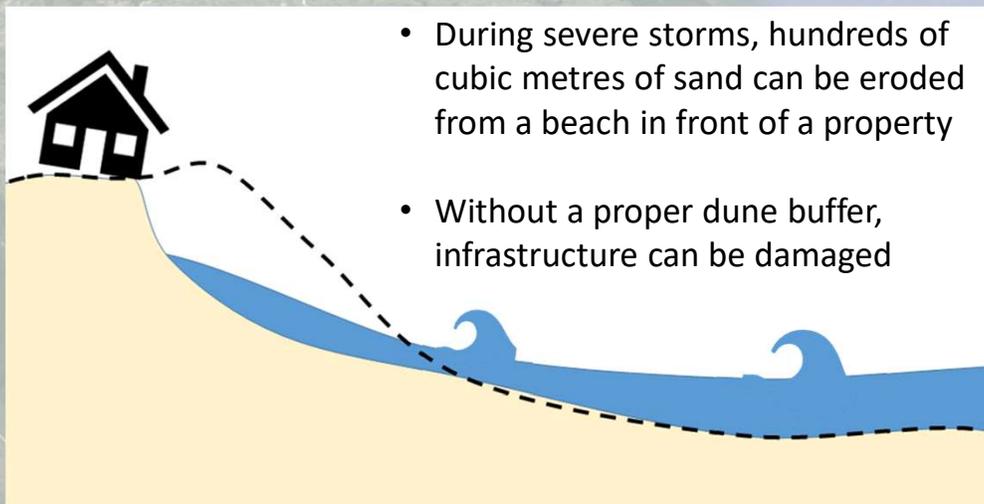
## Importance of Dunes



- Sand dunes play a crucial role in protecting assets and infrastructure
- Provide a sand buffer that protects against erosion

A healthy, vegetated coastal dune systems provide a natural buffer against erosion and coastal flooding.

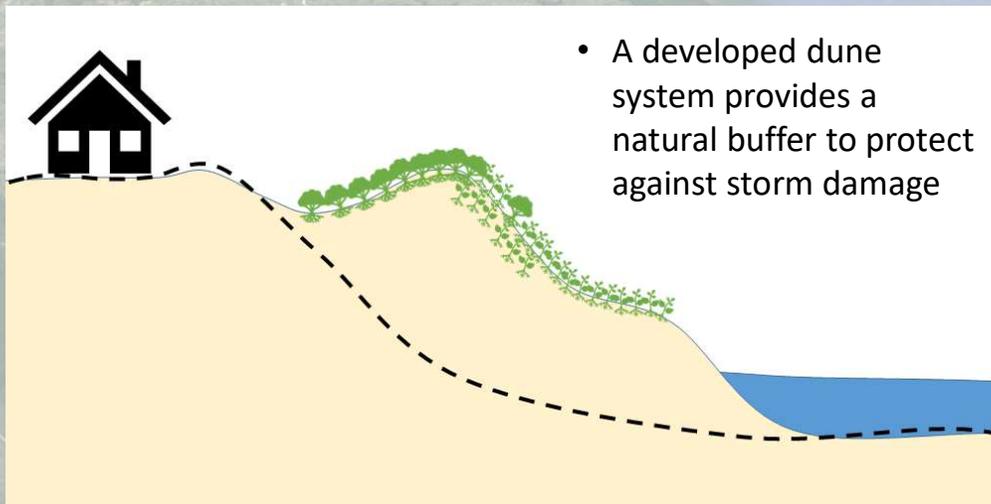
## Importance of Dunes



- During severe storms, hundreds of cubic metres of sand can be eroded from a beach in front of a property
- Without a proper dune buffer, infrastructure can be damaged

If we build too close to the front of the dunes, property and infrastructure can get washed away by erosion and flooding.

## Importance of Dunes



A natural dune system gives us a protective buffer. If the dunes are tall and wide enough, then when cyclones come and erode dune, there is still enough sand left in front of our property to remain safe.

# Future, Longer Term Issues



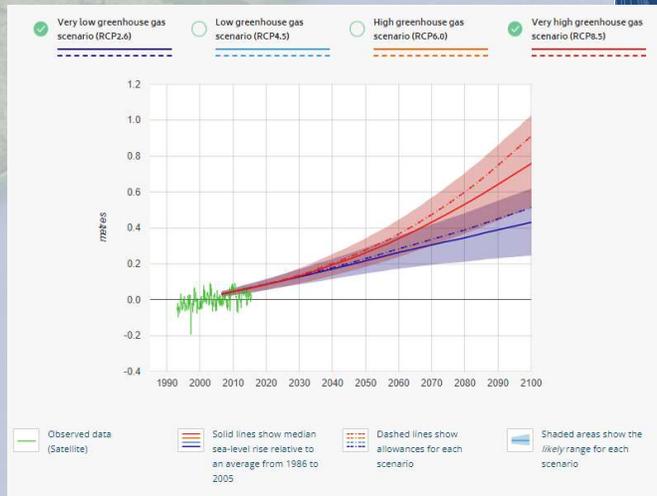
Sea Level Rise and coastal flooding



Coastal erosion and long term shoreline recession



Increased cyclone intensity



We also need to think about how these erosion processes might change over coming decades due to long-term processes, like those associated with climate change.



## Questions

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