Understanding Beach Erosion and Accretion

Port Macquarie-Hastings Coastal Management Program

Our region has 20 beaches stretching across 62 kilometres of coastline. Our beaches are central to community life in the area, supporting swimming, sunbathing, walking and tourism.

These beaches constantly change, experiencing natural cycles of sand loss ('**erosion**') and sand replacement ('**accretion**') that can affect the width of the beach and access to the sandy shoreline. Predictions show that our region will continue to face even more extreme weather events and rising sea levels due to climate change. Erosion can impact our natural environment, and increase the risk of physical damage to property, businesses, and infrastructure.

This fact sheet explains how erosion works, what's changing, and how this knowledge is being used in the Coastal Management Program (CMP) to plan for the future of our coastline.

Beaches naturally change over time. Understanding how and why beaches erode and recover helps Council and the community make informed decisions about coastal management, access, safety and long-term planning under the Coastal Management Program.

What is beach erosion?

Our beaches and dunes are dynamic and sand is constantly moving around our coastline. This is a natural process, however, when there is an ongoing imbalance in sand movement resulting in the continued loss of sediments, we know beach erosion is occurring.

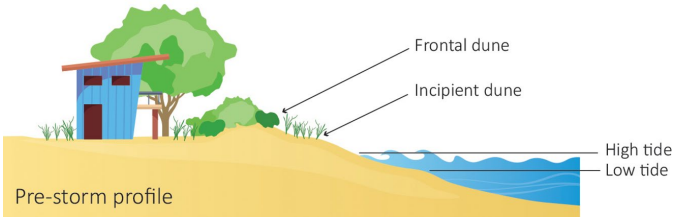
Beach erosion is when sand is removed from the beach and dunes by wind, waves and higher ocean water levels. Beach erosion can be short- or long-term. Short-term erosion can occur during a coastal storm or period of high wave energy. Long-term erosion refers to the ongoing and continual loss of sand from the beach, despite the short-term erosion and recovery cycles.

Lighthouse Beach viewed from Tacking Point (date: 4/01/2026)

Natural short-term cycles: storms, erosion and recovery

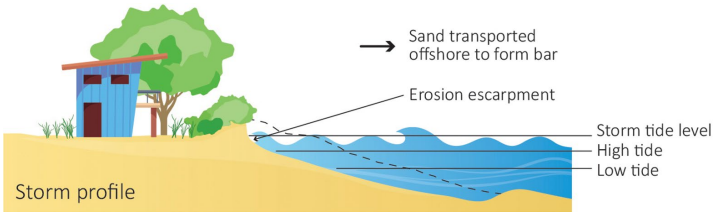
Short-term erosion (or '**storm bite**') occurs over a period of hours or days due to a storm event such as an East Coast Low. During storms, storm surge and wave activity erodes sand from the beach and transports it into the sea, where it forms an offshore '**storm bar**'. Once the storm passes, the beach gradually recovers over a period of weeks or months as the sand is transported back onto the beach under normal wave conditions. This process of recovery is referred to as beach accretion.

The conceptual models below illustrate the short-term process of erosion and accretion.



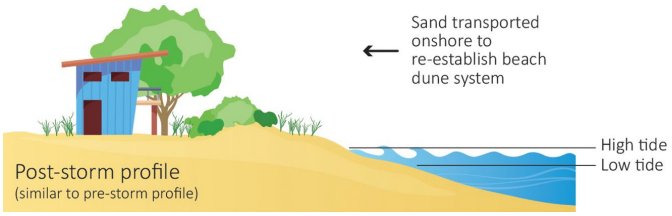
Before the storm (accreted beach):

- The beach slopes gently down to the waterline.
- The dunes are stabilised by vegetation.
- A wide beach typically separates the dunes & the high tide line, providing space for recreation.



During the storm (erosion phase):

- High water levels & strong waves reach higher up the beach than normal.
- Sand is eroded from the beach & dune ('storm bite') creating an erosion escarpment.
- The eroded sand is transported into the ocean forming an offshore 'storm bar'.

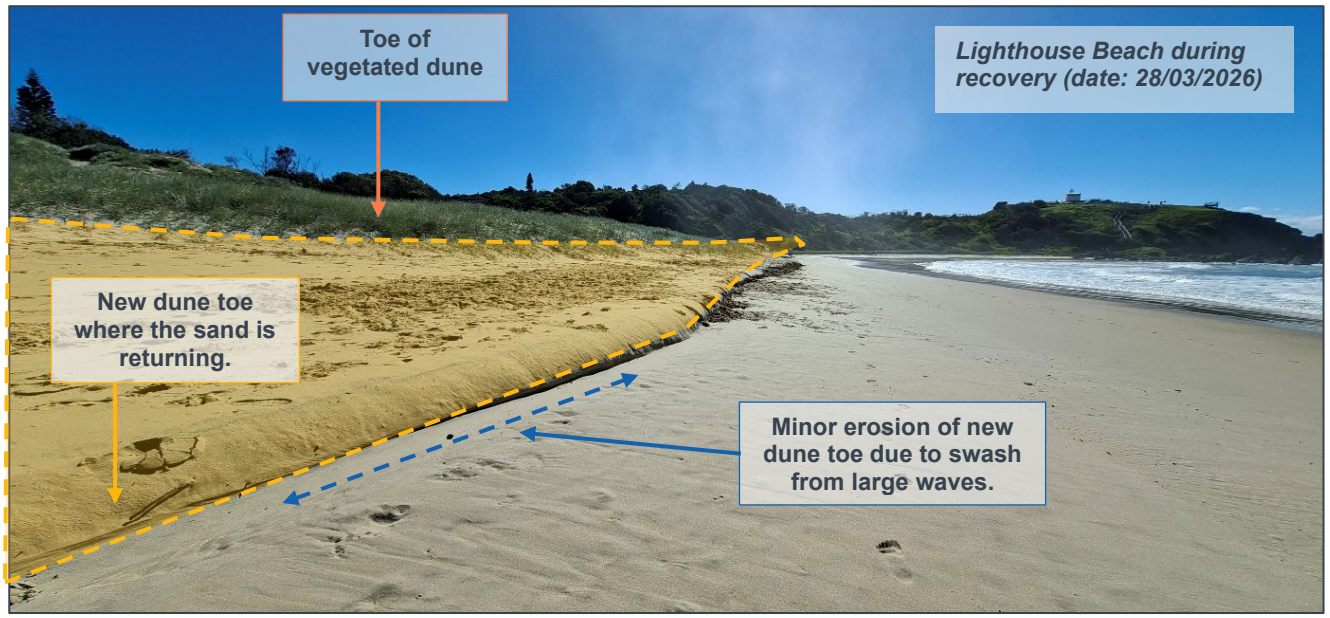


After the storm (accretion phase):

- In calmer conditions, normal wave activity gradually moves the sand from the storm bar back to the beach.
- Initially a small 'toe' forms at the base of the erosion escarpment, showing recovery is underway.
- A high tide beach begins to re-form, gradually getting bigger over weeks or months.
- If the dune was also eroded, vegetation will gradually re-grow, trapping sand & re-building the dunes behind the beach.

Beach erosion and recovery phases
(source: NSW Department of Land and Water Conservation (2001) Coastal Dune Management Manual)

This process of erosion and recovery can be seen in the photos below, taken on Lighthouse Beach, which demonstrates how a beach erodes due to a storm and then recovers a period of months.



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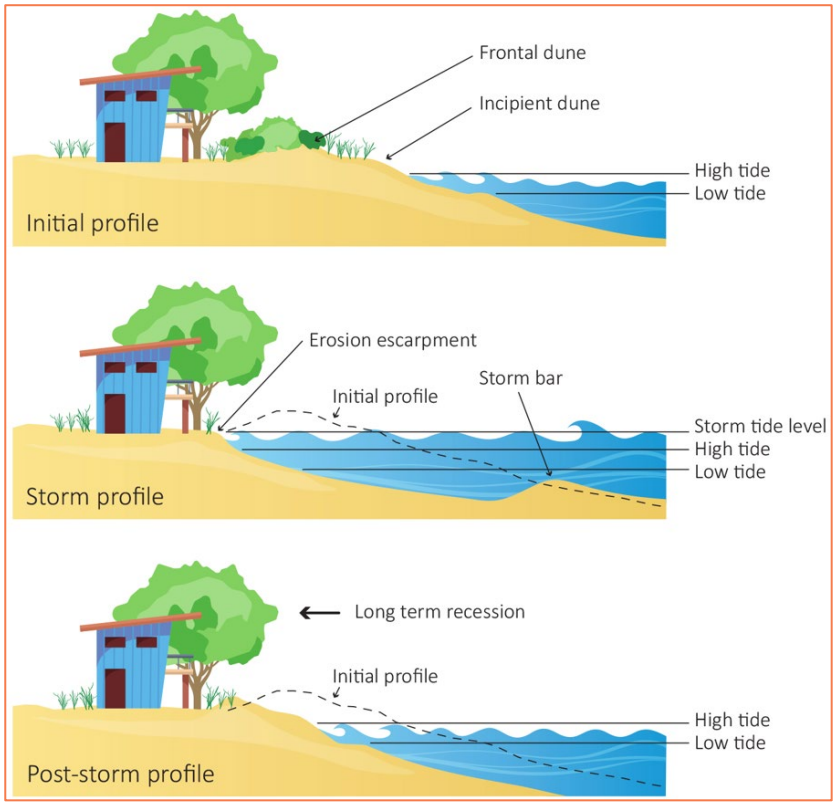
How does long-term beach erosion occur?

We have seen storms remove sand from our local beaches and observed their recovery many times over the years. This is a natural cycle, but when there is an ongoing imbalance in sand movement and loss of sand from the system, long-term beach erosion occurs, referred to as '**shoreline recession'**, as shown in the conceptual model below.



Long-term shoreline recession (source: NSW Department of Land and Water Conservation (2001) Coastal Dune Management Manual)

Shoreline recession may occur for different reasons, such as:

- More sand is removed from the system than is naturally replaced through day-to-day sediment transport processes (e.g., longshore transport). For example, where sand is transported alongshore and into the mouth of a river or creek and is effectively removed from the system.
- If a very large storm occurs, or a series of storms occurs one after the other, the sand eroded from the beach may be taken too far offshore into deep water and be unable to make it back onto the beach once the storm passes.

If there is no new sand coming into the system, these issues can translate into a permanent loss of sand, and the coastline gradually moves landward. Unlike storm-related erosion, beaches affected by long-term shoreline recession do not fully recover and the coastline gradually shifts landward over time, as shown in the conceptual model to the left.

How will the CMP consider beach erosion and shoreline recession?

Beach erosion hazard has been mapped for the area in the Coastal Hazard Assessment. This mapping indicates potential future shoreline positions for the near-term (10-15 years), medium-term (50-60 years) and long-term (90-100 years) and can be used to provide guidance on managing beach erosion through, for example:

- Planning provisions and development controls that reduce the risk for new development
- Avoiding intensification of development on vulnerable coastal land
- Engineering options to mitigate erosion risk, such as beach nourishment or seawalls
- Planned relocation of development and infrastructure.

Activities like beach nourishment or temporary coastal protection works (e.g., seawalls) may be implemented as a short-term solution while planning for longer-term adaptation solutions progresses.
The CMP will also include a Coastal Zone Emergency Action Strategy which will identify actions to be undertaken by Council, the NSW State Emergency Service and other authorities before, during and after a coastal storm that places members of the public and infrastructure such as roads, surf clubs and foreshore reserves at risk from beach erosion.

Frequently Asked Questions About Beach Erosion

Why is one end of the beach wider and the other narrower?

Changes in wave climate may also result in a slightly narrower or wider beach at certain times of year or from one year to the next. Slight changes in wave direction and wave strength can result in what is referred to as '**beach rotation**'. Beach rotation may occur due to seasonal changes in wave climate, or due to climatic factors like the El Niño-Southern Oscillation, which causes changes in ocean water levels and wave direction.

Does coffee rock limit erosion?

The type of material present on the beach can influence beach erosion as well. '**Coffee rock**', or indurated sands, present on some beaches and headlands. It is present almost the entire length of Lake Cathie Beach, extending from Middle Rock northwards to Lake Cathie. Coffee rock may be exposed when the beach is in an eroded state.
While these indurated sands (or coffee rock) are more erosion resistant than sand, they are highly variable, ranging from extremely low to moderately strong materials. This means that, while coffee rock can slow erosion in some places, it does not stop beaches from eroding, especially during large storms or over the long-term.

Coffee rock, Lake Cathie (date: 27/04/2024)

What happens if sea levels rise?

According to the **CSIRO** *State of the Climate Report* (2024), global sea level has risen by over 22 cm since 1900. Half of this has occurred since 1970. However, observations show sea levels have risen higher along south-eastern Australia when compared to global averages.

Rising sea levels can accelerate erosion along the coastline. It will cause shoreline recession along all our beaches. Beachside areas of the region are at risk of impact from rising sea levels as a result of climate change.

How can I use Coast Snap to help monitor our beaches?

Interested in seeing how our beaches change over time? Council has established Coast Snap monitoring stations at several beaches. Your support for Coast Snap provides valuable data on changes in our coastline. Learn more about the Coast Snap program and how to get involved **here**.

For more information on the Coastal Management Program, scan the QR code below.

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