

Understanding Coastal Hazards

Port Macquarie-Hastings Coastal Management Program

What is a coastal hazard?

In NSW, the term 'coastal hazard' refers to the natural processes and events, such as storms and East Coast Lows (low pressure systems that cause severe weather), that can damage our natural and built environment. The NSW *Coastal Management Act 2016* defines coastal hazards as being one of the following:

- Beach erosion
- Shoreline recession
- Coastal inundation
- Tidal inundation
- Entrance instability of coastal lakes and lagoons
- Coastal cliff and slope instability
- Erosion and inundation of foreshores caused by tidal waters and the action of waves, including the interaction of those waters with catchment floodwaters.

A brief explanation of each of these coastal hazards is provided in this fact sheet.

Beach erosion

Beach erosion is **when sand is removed from the beach** and dunes by wind, waves and higher water levels. Beach erosion can be short- or long-term. Short-term erosion can occur during a storm event 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.



Lake Cathie Beach in an eroded state (left) and during recovery (right)

Shoreline Recession

Shoreline recession is the term given to the **long-term landward movement of the shoreline** due to an ongoing loss of sand. Unlike storm-related erosion, beaches affected by long-term shoreline recession do not fully recover and the coastline gradually shifts over time.

Beaches in NSW are considered dynamic – this means that over time, we expect them to change. Recession can occur on both the open coast beaches and in our estuaries, particularly where there may be limited

opportunity for sand to be deposited after it has been removed by storm activity. A role of a CMP is to understand which areas are likely to change faster than others, so that we can plan for this change over time.

Coastal Inundation

Coastal inundation is when ocean levels rise high enough that it causes **temporary flooding of a portion of land in the coastal zone**. It occurs due to a combination of marine and atmospheric processes raise ocean water levels higher and floods low-lying areas or rises over dunes, structures, and barriers. It is often associated with storms that result in storm surge and large waves. Coastal inundation is typically short-lived and varies depending on the timing of the storm (e.g. if the storm surge occurs at the same time as a high tide) and how long the storm goes for.

Coastal inundation can have damaging consequences for land and assets close to the shoreline. **Sea level rise** is likely to increase the risk of coastal inundation over time unless we plan ahead. Natural defences like sand dunes, or hard structures such as sea walls, can help to lessen this risk.

Tidal Inundation

Tidal inundation refers to the flooding of normally dry land due to the rise and fall of tides. In contrast to coastal inundation, tidal inundation is caused by the regular ocean tides and is not associated with a coastal storm or catchment flooding. It can impact beaches and low-lying land around our estuaries. For this reason, it is also known as ‘blue sky’ flooding. Tidal inundation can occur daily, weekly or several times a year. We tend to experience particularly high tides around December and in July. These are referred to as King Tides.

Over time, sea level rise will increase the risk of tidal inundation. Some low-lying areas may be inundated more frequently, or even permanently, while others may have difficulty draining after a rainfall event. This will have implications for the way we use low-lying land, particularly around our estuaries.

Estuarine foreshores that are already vulnerable to more frequent riverine flooding are most at risk of tidal inundation in the future.

Coastal Cliff and Slope Instability

Coastal cliffs, headlands and bluffs are battered by waves and wind constantly, and over time this can lead to weaknesses and slipping. Variations in stability can occur due to the interaction of these weathering processes and erosion on different geological formations and rock types.



Following heavy rainfall in March 2021 landslips occurred at the rear of the Town Beach car park (left) and at South Oxley Beach (right) (date: 22/04/2021; source: Regional Geotechnical Solutions (2021) March 2021 Flood Event Landslides in Port Macquarie LGA – Parks and Recreation Assets Initial Geotechnical Assessment)

While weathering of these rocky cliffs and slopes happens slowly, the damage adds up and can cause sudden landslides and rockfalls, with harmful consequences and, potentially, risk to life. These can be difficult to predict and prevent, and once it occurs, it is permanent. A CMP identifies areas at risk of instability so that we can ensure developments and infrastructure (such as walkways) are not placed within the area where collapses may occur and put people at risk.

Entrance Instability

There are two major river systems within the local government area, the Hastings River and Camden Haven, both of which have trained entrances. A third estuary, Lake Cathie-Lake Innes drains to the ocean via Cathie Creek. The term 'entrance instability' relates to the **migration of coastal lake and estuary openings to the ocean**. The location at which the entrances to these rivers and lakes join to the ocean can move over time. They can gradually become choked with sand over time and close off from the ocean for period of time (as is the case with Lake Cathie), or even change in location gradually, opening to the ocean somewhere new.

Both natural and trained estuary entrances may introduce a range of different issues for the management of the coastline. For example, installing training walls on a river keeps the entrance in one location but changes natural patterns of sediment transport, resulting in the build-up of sand on one side of the river entrance and erosion on the other. In contrast, estuaries like Lake Cathie can, when blocked off from the sea by sand, cause nuisance flooding issues and damaging infrastructure. Management of entrance openings is important to mitigate impacts on the environment, development, water quality and public safety.

Erosion and inundation of estuary foreshores



Undercutting of the bank at the Perch Hole, Cathie Creek (date: 19/11/2024)

Estuaries are susceptible to inundation from tides, catchment flooding or storm swells and waves near the entrance. When coastal low-pressure systems such as East Coast Lows occur, flooding from the catchment interacts with coastal inundation, increasing the inundation and erosion hazard. Bank erosion may also occur as a result of more regularly occurring factors, such as boat wake or smaller wind waves.

Erosion of estuary foreshores is often the result of a combination of these factors over time. It is typically slow, cumulative, and driven by day-day processes, although major erosion may also be associated with episodes such as large flood events. However, unlike ocean beaches, estuarine foreshores usually

have little to no natural recovery once erosion occurs, which can be observed as loss of land to the river and even gradual changes in the course of the river over long periods of time.

Bank erosion can lead to the loss of the important riparian vegetation which stabilises the banks and may damage infrastructure such as roads or footpaths located near the foreshore. A CMP considers all of these risks so that we can plan accordingly and help to maintain these areas for their high environmental and recreational value.

Frequently Asked Questions About Coastal Hazards

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 and lead to increased tidal inundation in low-lying areas. Sea level rise will also impact inland waterways and estuaries through saltwater intrusion and higher groundwater levels. Waterfront and low-lying areas of the Port Macquarie-Hastings region are at risk of impact from rising sea levels as a result of climate change.

What is an extreme weather event and how are these events affected by climate change?

The term '**extreme weather**' is used to describe events such as storms, droughts, heatwaves, or floods, that occur infrequently and exceed historical typical climate measurements for the area. Homes, businesses, and infrastructure are at risk of damage as a result of these episodic events. The Port Macquarie-Hastings region experienced flooding in 2021 as a result of an extreme weather event.

The coast is a changing environment; it evolves in response to extreme weather events and the movement of sediment and water. Climate change is expected to increase pressure on beaches over time. This includes higher sea levels, more frequent or intense storms, and longer recovery periods following erosion. Together, these factors are likely to accelerate long-term shoreline recession and affect how beaches and nearby assets are used and managed. We are already seeing the impacts of climate change on our coast now.

The way we are used to enjoying our coastal environment will change. Changing coastal processes will impact popular fishing, camping, and boating locations, while erosion and rising sea levels will impact our beaches and estuaries. Your homes, businesses, local community facilities, services, and infrastructure will also be at risk from the changes affecting your coast.

How can I help protect our beaches?

Worried you may be loving your local beach to death? Help protect your local beach:

- **Avoid trampling or removing dune vegetation** – use the dedicated accessways, including for 4WD access.
- **Know the rules for beach driving** – Drive only where permissible and obey the rules. Get further information on driving on beaches and apply for a permit [here](#).
- **Respect fenced areas** – these may be set aside for dune recovery or bird nesting areas.
- **Stay clear of erosion escarpments** – they can collapse suddenly and disrupt the recovery of the dune and vegetation.
- **Leave driftwood or stags along riverbanks** – do not remove or relocate natural elements such as driftwood or fallen trees as they help trap sand.
- **Don't build unauthorised structures** – structures such as seawalls or boat ramps can disrupt natural sand movement and increase erosion.
- **Report vandalism** – Let us **know** if you see any unauthorised activities such as vegetation removal so we can rehabilitate the affected area.
- **Join your local Landcare group** – Council supports a number of Landcare groups along our coastline. Find your nearest group [here](#).

What is an estuary?

Estuaries are any part of a river, lake lagoon or coastal creek which is impacted by coastal tides. An estuary will transition from freshwater environments on the land to the marine sea water environments and can have varying levels of salinity. Estuaries are unique ecosystems, home to many species of plants and animals. When estuaries are disturbed, their ecosystems can be harmed.

Where can I find more information on coastal hazards?

More fact sheets are available for viewing on the Have Your Say webpage that provide detailed information on beach erosion and shoreline recession, coastal inundation and tidal inundation. Access the Have Your Say webpage via the QR code.



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