General Coastal Processes
- Gold Coast -
July 2009

The Gold Coast beaches are part of a larger coastal system which stretches, from around the Clarence River in the south, to Cape Moreton in the north. The beaches are predominantly a sandy beach system, which is presently in, or near to, a state of equilibrium. There is generally moderate wave energy, but as the area is affected by cyclones the beaches are subjected, at times, to very high wave energy. As a result the beaches are a highly active system. The following coastal processes need to be considered before Gold Cost City Council undertakes any projects:

- Littoral/Longshore drift
- On/Offshore transport
- Tides and storm surge
- Greenhouse effects such as sea level rise
- Wave breaking characteristics
- Beach dunes

The natural forces that influence the coast are:

- Wind
- Waves
- Tides
- Currents

These forces induce movement of sand in the active coastal zone or littoral zone. This movement of sand characterise the natural behaviour of our beaches. Interruptions to this natural behaviour (i.e. development, coastal structures, and estuaries) alter the patterns and cause adverse effects to the beach system.

The average rate of sand movement along the Gold Coast varies. It is dependant on a number of factors:

- Weather conditions (storms increase sand movement)
- Equilibrium (no net movement of sand, i.e. amount coming into a beach system equals the amount going out)
- Interference (structures, development)

Longshore drift

Longshore drift (LSD) is a process by which sediments move along our beach shore from the south to the north. There is, both northerly and southerly wave induced sand transport in response to the prevailing wave direction, but the predominantly SE swells result in a net littoral drift to the north. This movement of sand is estimated at 500 000 m^3/yr net northward transport (750 000 m^3/yr north, 250 000 m^3/yr south) (NGCBPS, 1997).

Figure 1. Note the oblique angle of the waves relative the beach alignment (Source: GCCC)

This process is generally uninterrupted except where headlands, coastal structures and sediment infilling at the estuaries cause local effects.

There are various rocky headlands and coastal engineering structures along the Gold Coast beaches, which interrupt the longshore sediment transport processes to varying extents. These are: (NGCBPS, 1997)

- Point Danger
- Greenmount
- Kirra Point
- Miles Street groyne
- Flat rock
- Elephant rock
- Currumbin rock
- 11th Avenue groyne
- 21st Avenue groyne
- Tallebudgera Creek groyne
- Burleigh Heads
- Little Burleigh (Nobby) Heads
- Narrowneck
- Nerang River entrance training walls (the Gold Coast Seaway)

Littoral celerity

Littoral celerity is the speed at which sand travels along the coastline. Over the last 25 years the littoral celerity along the Gold Coast has been calculated at approximately 0.8 km/year. This rate is increased during decades or periods of stormy weather. For example, due to the increased frequency of major storms and cyclones between 1951 and 1976, celerity was calculated at approximately 1.2 km/year (GCCM, 2005).

Onshore/offshore sand transport

The onshore and offshore movement of sand (natural erosion or accretion cycle) is induced by natural forces. Shoreline erosion, on both exposed and sheltered coasts, primarily occurs through the action of currents and waves but tidal sea level changes can also play a role. Sediment is transported along the coast in the direction of the prevailing current (longshore drift). When the upcurrent amount of sediment is less than the amount being carried away, erosion occurs.

What causes erosion to be severe in some areas and minor elsewhere is a combination of many factors, including the amount and intensity of precipitation, the texture of the soil, the gradient of the slope, ground cover and land use.

Calm weather conditions: the profile is flat and sand is moved by gentle wave action onto the beach (accretion).

Stormy weather conditions: increased swell causes waves to break high on beach, eroding sand and forming sand bars offshore. A sand bar acts as protective structure, dissipating wave energy and stopping erosion by waves. Coastal Management practices aim at minimising interference with these natural coastal processes wherever possible.

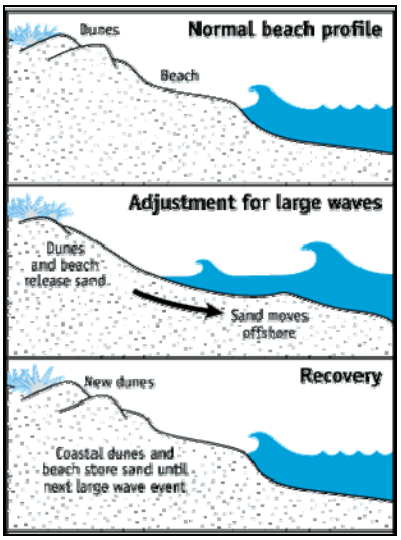

Figure 2. Wave erosion diagram (Source: US Army Corps 1991)

Tides and storm surge

A storm surge is an onshore rush of water that is associated with a low-pressure weather system, usually a tropical cyclone.

Further information

For further information please contact Griffith Centre for Coastal Management on (07) 5552 8506 or email gccm@griffith.edu.au.