

The coastal zone is a dynamic environment that is at times subjected to pounding waves, strong winds, swirling currents and driving rain. It is therefore exposed to a variety of hazards – such as beach erosion, flooding, wave attack and inundation by sand – that are a potential threat to coastal developments. At places like Groot Brak and Stilbaai, old houses were built in the flood plain of the estuary, and it is no surprise that they periodically experience flooding. At Milnerton lagoon near Cape Town a river flood removed 5 m of the bank on Woodbridge Island development – underpinning the need for ‘setting back’ developments a safe distance from the edge on both sea and riverside.

Coastal hazards

About 60% of South Africa's 3 000 km-long coastline is made up of sandy shores, interspersed by estuaries. Winds, waves and currents constantly exchange sand between surf zones, beaches, dunes and estuary mouths, linking them into a single unit called the littoral active zone. The erosion and accretion that occurs within this zone is naturally in a state of ever-fluctuating equilibrium, and this will be disturbed by any structures impeding the movement of sand.

During storms, however, large waves, elevated water levels and strong winds can severely erode sandy beaches. These forces

may even undercut the foredune to form a pronounced erosion escarpment, which will later slump back to a natural slope. Buildings and facilities located within this high-risk area will probably be undermined, and collapse as a result. Low-lying areas in the coastal zone, particularly on beaches and around estuary mouths, are also at risk of flooding by large waves and elevated water levels during storms.

In addition, coastal developments are subjected to the potential hazards of sand drift, caused by wind. Detrimental effects include the abrasion of motor vehicles, buildings, vegetation and park and garden fittings; the burial of roads, railways, agricultural land and coastal ecosystems; the blockage of street gutters and stormwater drains; and structural damage to buildings caused by the weight of the sand.

Since they are much harder than sand, rocky shores are relatively resistant to the erosive forces of winds, waves and currents, and are therefore less physically sensitive than sandy shores and estuaries. However, cliff tops and steep slopes, which are particularly favoured for housing developments because of the sea views they afford, can become an unstable hazard under some conditions.

Coastal cliffs, which comprise vertical faces of rock or consolidated soil, are subject to infrequent but sudden collapse. While this may occur during a single storm event, it is usually the result of weathering that has weakened the formation over time. In contrast, steep slopes such as bluffs and sand dunes are made up of sand or loose soil held in place by vegetation. Slumping may occur if such a slope is undercut by erosion, or if heavy rainfall reduces the stability of the soil.



Aerial view of Woodbridge Island showing setback line for development

Development setback

Because of the sensitivity of coastal environments, developments must be set back far enough from the high water mark of the sea, the water level of an estuary or river system, or the edge of a cliff, to be safe. Behind the setback line, the effects of wave attack, flooding, erosion, sand drift, cliff collapse and slumping of steep slopes are unlikely to pose a hazard to development.

The objectives of a setback distance are therefore to:

- Protect developments from damage as a result of natural hazards
- Protect ecological functioning, including dune dynamics and hydro-dynamics in estuaries, wetlands and swamps
- Protect public access to coastal landforms
- Protect the visual integrity of coastal landforms.

For sea-facing developments the setback distance is usually measured from the high water mark, and is large enough to avoid damage to property during extreme conditions such as storm surges coupled with spring high tides. In recent years, the possibility of sea level rise is also taken into account in determining appropriate setback distances.

On sandy shores the setback area should include the fore-dunes, which provide a buffer against erosion, act as natural sand storage for the littoral active zone, and also possess a protective strip of dune vegetation. In South Africa, setback lines have commonly been set at 50 m behind the high water mark for sandy shores. However, each case should rather be assessed individually, with the following parameters being considered in the determination of a setback line:

- Natural fluctuations or trends in beach profile, e.g., net erosion or accretion reflected in long-term historical data
- Beach profiles showing height above mean sea level
- Local wave, current and wind conditions and the presence of other influences such as river mouths
- Frontal dune types and size
- The layout of the coastline in relation to wave and storm approach.
- Plants and animals occurring in the area.

Setbacks for riverine systems are based on long-term flood levels, with development normally discouraged below

the 1:50 year floodline. In estuaries, development situated too close to the water's edge will not only be at risk of flooding during high-flow conditions, but also as a result of elevated water levels during periods of mouth closure. The latter may lead to pressure from property owners for artificial breaching of the mouth or construction of protective levees, with associated negative environmental impacts.

Apart from being a flood prevention mechanism, riverine setbacks should aim to prevent erosion by ensuring that construction, grazing and planting of crops is set well back from the water's edge. The setback should include a buffer strip of natural river-bank vegetation, which not only prevents erosion by stabilising soil, but also acts as a natural filter, absorbing nutrients from polluted effluent and runoff.

Floodplains and wetlands also have remarkable water purification capacities, as well as the ability to reduce the severity of floods and enhance flows during the dry season. They do this absorbing excess water and releasing it slowly over time. Any activities that interfere with their natural functioning should therefore be avoided.

In the case of cliffs and steep slopes, analysis of soil and geological properties is required in order to determine an appropriate setback. In general, however, development should be located to avoid naturally eroding areas and to limit disturbance of stabilising vegetation.

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FURTHER INFORMATION: • *Guidelines for the Control and management of Activities in Sensitive Coastal Areas.*
Obtainable from Marine & Coastal Management, Private Bag X2, Roggebaai 8012.

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