

SECTION I



INTRODUCTION

SUMMARY

Beach areas on the Coromandel Peninsula have been heavily developed over the last 40 years and development has occurred very close to the beach front. In some areas property has been placed within the zone of natural beach erosion and accretion. Natural protection from erosion provided by dunes has been removed to improve views. In some cases native sand binding plants that helped beach and dune recovery after storms have also been removed. As a result some coastal property is threatened by erosion and in some cases structures have been built to protect beachfront property. These structures often adversely affect the beach and prevent or detract from people's activities on the beach.

Development setbacks can be used to manage development within the hazard zone of the beach. Setbacks have been used on the eastern Coromandel Peninsula since the early 1980s. Subsequently, Environment Waikato and its predecessors have gathered a large amount of new information about coastal hazards and shoreline change. This information has been used to revise setback positions for Coromandel beaches. This report summaries these findings. Full details can be found in *Coromandel Beaches: Coastal Hazards and Development Setback Recommendations*. The setbacks have been developed as a tool to assist District Councils manage coastal erosion and flooding in the short and long term. The setbacks are also designed to allow for new development while at the same time not disadvantaging public use of the beach and coast.

The revised development setbacks are measured from a fixed baseline, which is the toe of the frontal dune, mapped from 1995/6 photographs. The position from which the setback is measured, therefore, does not change even though the shoreline at different times erodes or builds up. The first of the setback lines (**Primary Development Setback**) delineates land at risk from fluctuations in natural beach erosion under existing conditions. The second setback (**Secondary Development Setback**) delineates additional land at risk from the effects of sea level rise and climate change over the next 100 years.

On the eastern Coromandel Peninsula two distinct beach types are identified:

- **Dune barrier beach** systems have wide dunes and flat beaches with fine sand (e.g. Whangamata and Pauanui beaches).
- **Pocket beach** systems are relatively short and steep, with coarse sand and a narrow strip of dunes (e.g. Whiritoa and Tairua beaches).

At dune barrier beach systems, aerial photos, surveys and beach profiles have shown that the maximum natural fluctuation of the shoreline is approximately 30 m. At pocket beaches, the maximum natural fluctuation of the shoreline is 25 m. The **Primary Development Setback** for these beaches is 40 m and 35 m, respectively. These figures include a natural (safety) buffer zone of 10 m.

On the western Coromandel Peninsula, the maximum natural fluctuation of the shoreline is 15 m, and is considerably greater (25–30 m) near river entrances and channels. Coastal flooding is also a major hazard on the western Coromandel Peninsula. The **Primary Development Setback** for these beaches is 25 m and includes a natural buffer zone of 10 m.

Projected sea level rise over the next 100 years may begin a long-term erosion trend. This sea level rise has to be considered when designing development setbacks. Additional erosion of 15 to 20 m is likely at beaches on the eastern Coromandel Peninsula as a result of sea level rise. This sea level rise will also increase risks from coastal flooding on the western Coromandel Peninsula. Secondary Development Setbacks are 60 m and 50 m for eastern Coromandel Peninsula dune barrier and pocket beaches, respectively, and 50 m for western Coromandel beaches.

In undeveloped areas, a larger setback of 100 m has been proposed. This setback is designed to provide additional protection from coastal erosion and flooding hazard while also protecting natural character of the beach, public access and amenity values.

Projected sea level rise over the next 100 years may begin a long-term erosion trend.



THIS SUMMARY REPORT

This report summarises the Environment Waikato technical report *Coromandel Beaches: Coastal Hazards and Development Setback Recommendations*. The key objectives and content of the full report include:

- Analysis and reporting of dune dating studies in the Coromandel Peninsula,
- Analysis and reporting of shoreline change at sandy beaches on the Coromandel Peninsula,
- Development of a proposed hazard assessment process for development setbacks on the Coromandel Peninsula,
- Preparation of maps to illustrate the position of these setbacks at beaches (contained in the Appendix at the back of this report).

A summary of the essential concepts and background to the development setbacks proposed in *Coromandel Beaches: Coastal Hazards and Development Setback Recommendations* is presented. However, the full report is more extensive and should be consulted for technical details, including data collection, analysis, methodology and detailed discussion.

Some of New Zealand's best coastal heritage is on the Coromandel Peninsula, which is a very popular holiday destination. Close to major population centres like Auckland and the Waikato, the Coromandel Peninsula has been under heavy development pressure over the last 40 years. Over 75 percent of all sandy beach locations on the Coromandel are now developed to some extent and development is often very close to the beach front.

The distance between the toe of the dune closest to the sea (frontal dune) to a house or piece of infrastructure is known as the setback distance. Environment Waikato studies have shown that over 70 percent of all Coromandel beachfront development is currently set back less than 100 m on the eastern coast and less than 50 m on the western coast. The ranges in Eastern Coromandel Peninsula setbacks are shown in more detail in Figure 1 below.

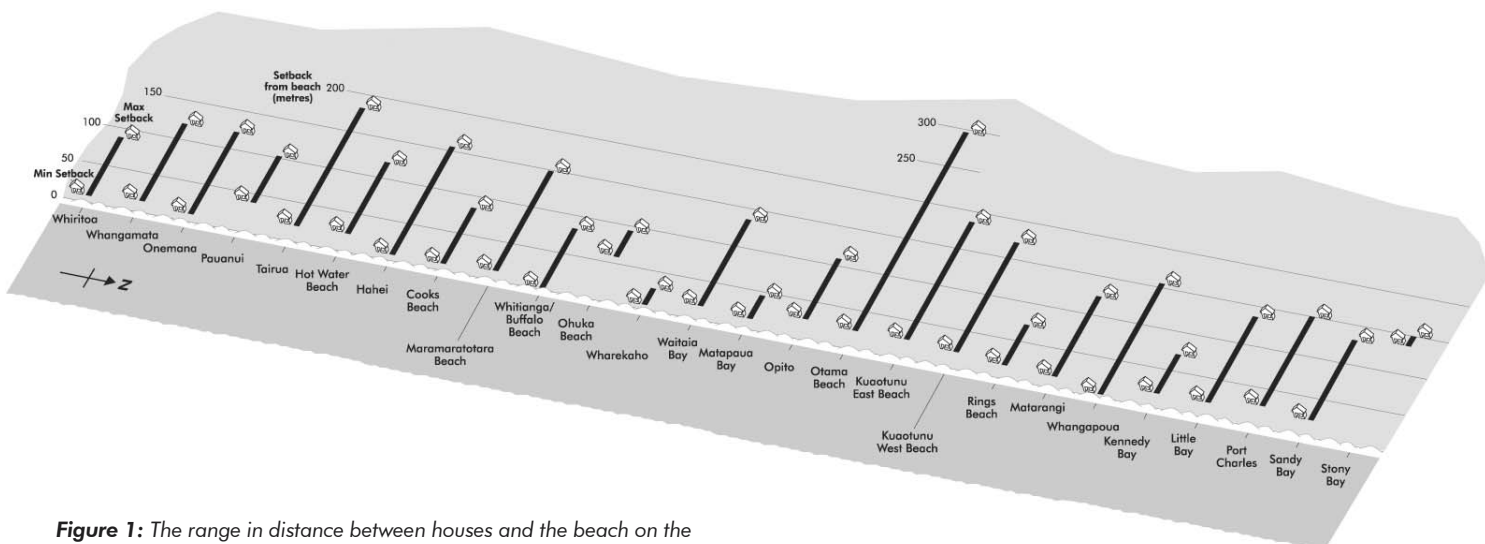


Figure 1: The range in distance between houses and the beach on the eastern Coromandel Peninsula, measured from 1995/6 aerial photographs. The average setback at any beach is generally much closer to the minimum than the maximum.

Development close to the sea and damage to natural dune systems, such as bulldozing dunes to improve sea views, has created widespread coastal hazard problems. Many houses and properties are now threatened by coastal erosion and flooding. In some cases, structures have been built to protect beachfront property. These structures can restrict public access to and along the beach, are often unsightly, and interfere with the natural shoreline processes on either side of the structure.

A recent review of coastal erosion and flooding in the Waikato Region identified a large number of settlements on the Coromandel where buildings or private properties are vulnerable to coastal erosion or flooding (see *Figure 2*). These problems could get worse over the next 50 to 100 years because of:

- Increased coastal hazards because of sea level rise and other changes (for example, increased frequency and intensity of storms) that may accompany global warming; and
- Ongoing subdivision and development, particularly more intense beachfront development.

Development has occurred too close to the beach, and cannot accommodate natural changes in the shoreline.

Previous reports and available evidence indicate that most coastal hazard problems arise from the way people have used and developed the coastline. The natural behaviour of the beaches has not markedly changed in recent decades. Rather, development has occurred too close to the beach, and cannot accommodate natural changes in the shoreline. In the past, beachfront development has often occurred without giving enough consideration to coastal processes and natural changes that occur in these complex beach systems.

It is important to manage existing and future development so that new problems are not created, and ongoing intensification of current development does not further increase vulnerability to such hazards.

District Councils can include coastal development setbacks in publicly available planning documents. Development setbacks identify a zone on the coastal margin in which subdivision and development is either excluded, or restricted for coastal management and hazard protection.

It is important to manage existing and future development so that new problems are not created...

THE COROMANDEL COASTLINE



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Figure 2: Coromandel Peninsula coastline and the location of main settlements. The settlement names are marked in larger text where an existing threat from coastal erosion has been identified to development or important cultural sites

SECTION 2



SETBACKS & DEVELOPMENT

EXISTING SETBACKS

The Thames Coromandel District Council (TCDC) has used development setbacks for planning coastal development at sandy beaches on the eastern coast since the early 1980s. Two setbacks exist, measured at 30 m and 60 m from the toe of the dune. These setbacks are applied and enforced under the Building Act (1991) at all developed sandy beaches along the eastern coast of the TCDC district. No new buildings, structures, septic tanks or their disposal fields may be located within 30 m from the toe of the dune unless site-specific reports show they are outside the high risk area. Relocatable buildings may be put between the 30 m and 60 m setback lines, subject to certain conditions.

The Hauraki District Council has also been using these setbacks and similar rules for Whiritoa Beach since the early 1990s.

Currently there is a 15 m development setback line on the western coast of the Coromandel Peninsula. The 15 m setback was adopted in the late 1990s following problems with coastal erosion at various locations around the coastal margins of several Thames Coast settlements, particularly fronting Te Puru School. There were problems in areas where there was little or no width of esplanade reserve between properties and the shoreline. New houses were tending to be built as far seaward as possible and were often large and non-relocatable.

The setback of 15 m is based on an estimate of the maximum shoreline fluctuation along the frontage of Te Puru School prior to Cyclone Drena. The 15 m setback is a building exclusion zone.

The present setback positions move with the toe of the dune. So, as the shoreline fluctuates backwards and forwards ('erosion' and 'accretion'), the position of the setback boundary changes. Houses that were consented when dunes were in a relatively well formed state could be built much closer to the sea than those built after a period of erosion. This raises issues of equity and sea views for property owners and neighbours. Similarly, houses built at different times will have quite different levels of protection from erosion. By contrast the revised development setbacks are fixed in space, and do not move with the dune line. This is explained later in the report.

Since the implementation of the existing development setbacks in the early 1980s, Environment Waikato and its predecessors have gathered a large amount of information about coastal hazards and shoreline change on the Coromandel Peninsula. This information has been brought together and interpreted in *Coromandel Beaches: Coastal Hazards and Development Setback Recommendations*, and has led to the development setback recommendations summarised here. The setbacks are based on all available information. As ongoing monitoring and research provides more information about shoreline behaviour and hazard risk, they can be further revised in the future.

Key Points

- > On the eastern coast of the Coromandel Peninsula, there are currently two setbacks used to control development, at 30 m and 60 m from the toe of the dune.
- > On the western Coromandel Peninsula, there is currently one setback used to control development, at 15 m from the toe of the dune.
- > All current setbacks are measured from the toe of the dune at the time of the building application. The setbacks therefore move as the toe of the dune moves.
- > Since the implementation of the existing setback lines approximately 20 years ago, Environment Waikato has gathered a lot of information on coastal hazards and shoreline change on the Coromandel Peninsula, which has led to revised development setback recommendations.

WHY CONTROL DEVELOPMENT?

Much of the early development of coastal margins on the Coromandel Peninsula occurred between the 1950s and the 1970s. There was less knowledge then about coastal processes and natural shoreline change, as well as less acknowledgement of the importance of public access and natural character values. As a result, some properties were located close to the shore and within the zone of dynamic shoreline change.

The crucial role of natural dunes in protecting properties from coastal hazards was not well recognised, and many dunes were bulldozed to improve sea views, leaving very little land between the sea and beachfront development (see Figure 1). Native sand binding plants that help the dunes to rebuild after a storm were replaced with lawns and exotic ornamental plants. Soon after coastal development began it became clear that in a number of new subdivisions there was not enough dune reserve remaining in the front of properties. For example, in 1978, storms threatened many properties along the Coromandel Peninsula (Figures 3 and 4).



Figure 3: Cooks Beach after a major storm in 1978.



Figure 4: Hahei Beach has only small sand reserves, just a layer of sand over harder surfaces. In 1978, all this sand was washed from the beach, exposing the hard layers underneath. During calmer periods, waves and currents work the sand back to create the sandy beach.

When houses and roads are threatened by coastal erosion, coastal armouring structures (e.g. seawalls) are often built in an attempt to halt erosion. Many of these structures affect the appearance of the beach, affect public safety and restrict public access to and along the beach (Figure 5). During times of erosion, the level of the beach drops in front of a seawall, so that there is no dry beach left at high tide.



Figure 5: Coastal structures at Cooks Beach, 2001. The structures degrade the appearance of the beach, and the beach level has dropped in front of the structure, restricting public access to and along the beach.

Key Points

- > Some past coastal development has not adequately allowed for natural movements of the shoreline.
- > Coastal structures intended to protect property from erosion often affect beach features important to the public such as appearance and access to and along the beach.
- > Native sand binding plants play a critical role in dune and beach recovery following storm erosion. This vegetation has been removed and replaced with grass and exotic shrubs at many coastal subdivisions.

SECTION 3



DESIGNING DEVELOPMENT SETBACKS

Both long-term and short-term changes must be understood to ensure setbacks are sufficient to protect properties from natural changes in the shoreline. Natural shoreline changes that occur over different time-scales are explained below.

LONG-TERM SHORELINE TRENDS

Long-term shoreline trends are determined by the 'sediment budget' of a beach system. If a beach has a positive sediment budget (where over time, it receives more sediment than it loses), the whole beach system will build seaward over time (**progradation**).

Similarly, if a beach is losing more sediment than it gains (negative sediment budget), there will be a landward movement of the whole beach system with time – commonly referred to as long-term erosion or **recession**.

If the beach system is neither gaining nor losing sand over time, the beach is in **dynamic equilibrium**. In this state, the shoreline position will fluctuate about an average position. While the shoreline is not moving in the long term, these fluctuations can be quite large.

A setback designed to protect properties for 100 years from the time of design must obviously include the total shoreline change expected over the 100 years. This is how the long-term trends have been considered in the development setbacks proposed in *Coromandel Beaches: Coastal Hazards and Development Setback Recommendations*.

Key Points

- > Long-term building up (**progradation**) occurs when the system receives more sediment than it loses (positive sediment budget).
- > Long-term erosion (**recession**) occurs when the system loses more sediment than it receives (negative sediment budget).
- > If a beach system neither gains nor loses sand over time, it is in **dynamic equilibrium** and will fluctuate about an average position.
- > Recognising long-term trends for progradation or recession is an important part of establishing a suitable development setback.
- > When designing development setbacks, the long-term trend is the change that is expected to occur over the time period that the setbacks are designed to manage.

DYNAMIC SHORELINE CHANGE (SHORT TERM TRENDS)

A long-term trend can be masked by dynamic shoreline changes ('short term trends'), which are periods of erosion and building up occurring over years or decades. These short-term trends are often much greater, and therefore more visible over these time-scales, than slow underlying trends for progradation or recession.

Short-term trends include storm erosion, recovery, and variations over decades in the magnitude and frequency of storm events and cycles such as El Nino Southern Oscillation (ENSO) and Interdecadal Pacific Oscillation (IPO). Processes such as interactions at tidal entrances, stormwater outlets and deltas may also cause shoreline changes at a particular site.

Shoreline movements at all sandy beaches on the Coromandel Peninsula appear to be dominated by cycles of change occurring over several decades. These phases of erosion and build up can occur at different times at different beaches, but the overall extent of these changes is very similar throughout the east coast of the Coromandel Peninsula (see the following section and Figure 6).

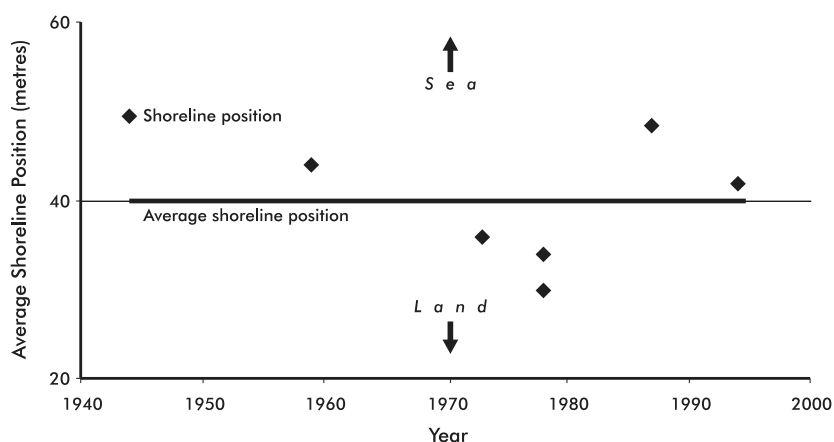


Figure 6: Shoreline change between 1940 and 2000 at Whangamata beach, mapped from aerial photographs (Coromandel Beaches: Coastal Hazards and Setback Recommendations). This graph shows periods of erosion (e.g. the shoreline moves inland between 1940 and 1978) and periods of accretion or build up (e.g. between 1978 and 1988). The shoreline fluctuates around an 'average' position, marked approximately by the line at zero.

Key Points

- > **Dynamic shoreline changes** ('short term trends') occur over periods of years to decades and are driven by storms and cycles such as ENSO and IPO, as well as site specific factors.
- > **Dynamic shoreline changes** are fluctuations, and do not represent net recession or seaward movement of the shoreline (progradation).
- > Shoreline changes at sandy beaches on the Coromandel Peninsula are dominated by short-term trends rather than long-term progradation or recession.

NATURAL BUFFER ZONE

In addition to allowing for shoreline movements, development setbacks should ensure that after the worst likely storm erosion event an amount of land or “buffer zone” still remains between development and the sea. This natural buffer zone serves a number of important functions, including:

- **Protecting natural dune function and integrity.** There must be enough dune width left with sand binding vegetation to help natural dune building following erosion events. Where this zone has been degraded and natural vegetation removed, this buffer zone provides an area that can be restored with native sand binding vegetation to improve dune stability and recovery.
- Providing an allowance for the possible collapse of near vertical erosion scarps formed after severe storm erosion.
- Providing a barrier protecting lower lying areas further landward from coastal flooding.
- Providing a safety factor in estimating erosion. **The prediction of erosion hazard is not a precise science and it is important to include an appropriate factor of safety to ensure buildings are still well protected even after the worst erosion.**
- Minimising the need for shoreline armouring works. **Property owners tend to place shoreline armouring works once the line of erosion approaches within 10 to 15 m of their homes or infrastructure. Armouring works can degrade the values of beaches, so this extra buffer is required to avoid the need for these works to be undertaken.**
- Enabling the relocation of threatened houses should this be necessary. **It is very difficult and often not possible to relocate houses when they are closer than about 5 m to an erosion scarp.**
- **Protecting remaining natural character**, which is a high priority in New Zealand’s resource management legislation.

Along the western Coromandel Peninsula, the buffer zone serves another purpose – it protects from the effects of overtopping by waves and rock debris. This is discussed further in the next section.

The closeness of coastal subdivision to the beachfront at most developed beaches currently limits the practical width of the buffer zone. A narrow buffer width of 10 m has been adopted in areas of existing urban development. This does not provide enough width to allow for natural character or aesthetic and recreational uses of the back-dune area. However, it may provide enough protection for hazard management if combined with other measures, such as protection and restoration of dune vegetation.

Key Points

- > A **natural buffer zone** is needed for many reasons, in particular to maintain an area of dune to protect houses even after the worst erosion. This means shoreline armouring structures are not needed, and allows for some natural dune function and recovery.
- > Natural buffer areas between houses and the sea have often been degraded but can be restored with native sand binding vegetation to improve dune stability and recovery.