

# Eastern Seaboard Coastal Management Plan:

Coastal Strategy for the Tairua, Pauanui and  
Whangamata Ocean and Estuarine Shorelines



**Thames Coromandel District Council**

**July 2015**

## EXECUTIVE SUMMARY

The coastline of the Coromandel Peninsula is central to the identities of its settlements.

The purpose of this strategy is to guide management of the ocean and estuary shorelines of Tairua, Pauanui and Whangamata to reflect both community aspirations and policy. The strategy has been developed through consultation with District Council staff and representatives of local community organisations in a series of workshop meetings. Community working parties were established to represent each of the three large settlements at Whangamata, Pauanui and Tairua.

The strategy addresses key issues of concern raised by the community, including coastal erosion, dune management and protection of the beaches and their associated values (recreational, public access, landscape and cultural). This document provides a general strategy for management of these issues and site specific recommendations in key areas.

At present, the ocean beaches simply fluctuate backwards and forwards over long periods of time – with some periods dominated by erosion and others by shoreline recovery. At present, there is no significant long term trend for permanent erosion. However the shoreline fluctuations can result in temporary erosion of 10-20 m in many places. The shoreline width vulnerable to erosion with existing sea level has been assessed by Council in previous work and is identified on Council's planning maps as the Current Coastal Erosion Line (CCEL) (see Appendices B to E). This present erosion hazard risk along ocean beaches in the strategy area can be primarily managed by protecting and enhancing naturally functioning dunes and managing coastal development, specifically:

- Development setbacks and controls (already in the District Plan)
- Dune restoration and management along the full length of all ocean beaches – to provide natural self-repairing protection from coastal hazards
- Use of sand push-ups and top ups to facilitate dune repair after erosion where required
- Site specific erosion management strategies in the few locations where erosion issues are more severe (e.g. southern end of Tairua; parts of Whangamata – see discussion in Section 3.3 for details)
- Community information and education to help communities better understand natural shoreline changes

Urgent review of the CCEL is required at Pauanui as the existing hazard line has not been updated since 2002 and site specific information now suggests that erosion risk may be less than indicated by the current CCEL. This additional work is not required at Tairua and Whangamata as the CCEL lines at these sites have been updated.

In the longer term, there is potential for erosion to be aggravated by predicted sea level rise. This could lead to a trend for permanent shoreline erosion superimposed on the existing dynamic fluctuations. Previous work by Council has identified the additional shoreline width that could be affected by up to 0.9 m sea level rise over the next 100 years and this indicative line is identified on Council planning maps as the Future Coastal Protection Line (FCPL) (See Appendices B to E). This additional risk will only arise in the event that the projected sea level rise occurs and the identified area is not presently at risk. If this aggravation of erosion does occur in the longer term, it would

cause serious problems and management of the hazard would require complex and difficult site specific strategies.

Dune restoration and management on ocean beaches is central to the successful management of coastal hazards and to the protection and enhancement of ecology, amenity values and access. Guidelines and recommendations are provided for dune management on ocean beaches in the strategy area. Particular attention needs to be given to development of dune restoration guidelines for central and southern areas of Pauanui where little to no natural dune width exists. Dune areas dominated by invasive exotic species at all sites also require particular attention as these species displace the native vegetation that is critical to natural dune building and repair after erosion. None of the exotic species are anywhere near as effective as the natives in natural dune repair. Various recommendations are also provided for enhancement of public access and recreational values on coastal reserves.

General recommendations for the management of coastal hazards on the estuary shorelines of Tairua, Pauanui and Whangamata include:

- Coastal erosion can generally be managed with “soft” approaches, specifically beach nourishment and readjustment where necessary.
- Existing engineering structures can be softened using beach nourishment and unnecessary and unsound/unsafe structures should be removed over time.
- New protection structures should be used as a last resort and typically only where they are required to protect important public infrastructure or maintain narrow coastal reserves.
- Minimum floor levels (including appropriate provision for future sea level rise over the design life of the dwelling) should be adopted in areas subject to coastal flooding.

Guidelines and recommendations are also provided for specific sites in each of the 3 harbours.

Recommendations for protection and enhancement of public access and recreational values are also provided including beach replenishment, removal of unnecessary structures, saltwater paspalum control, provision of access along estuary margins, greater shade where appropriate, and continued upgrade of valued recreation areas.

Opportunities to enhance ecological values should be taken where possible, including control of salt water paspalum and creation of high tide roosting areas.

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# 1 INTRODUCTION

## 1.1 Purpose

The purpose of the strategy is to guide management of the ocean and estuary shorelines to give effect to community aspirations and policy. The strategy addresses key issues of concern raised by the community, including coastal erosion, dune management and protection of the beaches and their associated values (recreational, public access, landscape and cultural).

The areas covered by the strategy are shown in Appendix A and include:

- The ocean shoreline between Tairua and Whangamata, including Tairua, Pauanui, Opoutere, Onemana and Whangamata ocean beaches.
- The outer shorelines of the Tairua, Whangamata and Otahu estuaries.

No detailed consultation has yet been undertaken with the Wharekawa or Onemana communities. Therefore, while the general recommendations for ocean and estuary shorelines are relevant in all areas, this strategy does not include detailed recommendations for the management of ocean or estuary shorelines at these sites.

## 1.2 Methodology - Working Party Process

This strategy has been developed through consultation with District Council staff and representatives of local community organisations in a series of workshop meetings. Community working parties were established by invitation to represent each of the three large settlements at Whangamata, Pauanui and Tairua.

An initial workshop was held with each group to collect information about key issues and sites. Field visits were then undertaken at each location to look at the issues that had been raised by the community groups, and to consider options for management. A second round of workshops with the community focus groups presented ideas for management of the key issues and sought feedback. A draft Plan was then taken back to working group members for final comment and changes with the final draft Plan taken to the community board for endorsement.

## 1.3 Statutory Considerations

Coastal management is guided by the New Zealand Coastal Policy Statement 2010 (NZCPS), which outlines key policies and objectives, and by detailed policies in the TCDC District Plan and in Waikato Regional Council plans (particularly the Regional Policy Statement and the Regional Coastal Plan). Shoreline management under this Coastal Strategy must be consistent with and give effect to these policies.

The details of these policies can be found in the relevant plans but they give considerable emphasis to the protection of coastal values; including natural character, natural coastal processes and features, recreational amenity, landscape values, public access to and along the coast, cultural values and surf breaks. The NZCPS also provides guidance for the management of coastal hazards, supported by more detailed policies in regional and district plans.

The NZCPS (and in turn regional policies) directs Councils to manage existing and future development to reduce the risk from coastal hazards, including through the use of landward

relocation of structures and assets where necessary. The national policy also directs Councils to protect and enhance natural defences (e.g. beaches, dunes, wetlands and dune vegetation). There is recognition of the adverse effects that can occur from the use of hard protection structures for managing natural hazards, and therefore Councils are directed to “discourage the use of hard protection structures and promote the use of alternatives to them, including natural defences...”.

The national policy also highlights the importance of public open space and walking access to and along the Coastal Marine Area (CMA).

## **1.4 Structure of Document**

The key issues identified during meetings with the working parties are briefly outlined in Section 2.

Section 3 outlines coastal processes and issues in relation to the ocean beaches and provides associated recommendations.

Section 4 outlines the primary issues identified along the estuary shorelines together with associated recommendations.

Section 5 briefly summarises information and recommendations in respect to tsunami risk, based on other work undertaken by Council.

## **2 KEY ISSUES AND VALUES IDENTIFIED BY WORKING PARTIES**

Two rounds of meetings were held with community focus groups in Tairua, Pauanui and Whangamata to identify and discuss key local issues in the three most extensively developed areas. The first round of meetings identified areas of concern, which were then investigated further in a field visit. The second round of meetings discussed potential management approaches and solutions in these areas. The key issues raised by the working parties can be separated into several broad themes as outlined in the following sections.

### **2.1 Management of Coastal Erosion**

Members of the working parties expressed concern with coastal erosion on ocean and estuary beaches and indicated a need for clear management guidelines. These concerns were emphasised by recent erosion at Pauanui and Whangamata ocean beaches.

The community representatives also noted that there is a general lack of public understanding of coastal erosion and coastal processes and of the importance of natural dunes and dune vegetation in providing protection from coastal erosion and flooding. They felt that it was important that this strategy emphasised communication of key information to the community. In particular it was noted that the complexities of beach erosion and recovery are not always well understood.

### **2.2 Dune Restoration and Management**

Working groups supported the importance of dune restoration and management. A wide range of matters were also identified where improved guidance and practice was required. The working groups stressed the importance of ongoing comprehensive weed management to successful long term dune restoration of the dunes. Other matters identified included the width and method of restoration where natural dunes are narrow (particularly an issue at Pauanui), management of beach

access, management of storm water and runoff, and better guidance for adjacent private landowners.

### **2.3 Public Access and Amenity and Associated Facilities**

The community working parties emphasised the importance of access to coastal reserves and beaches, including adequate and appropriately designed public walkways, ongoing enhancement of public access in public reserve areas (including estuary margins and back dune areas at ocean beaches) and surf club vehicle access to ocean beaches. The working groups highlighted and supported several council and community initiatives to enhance public access along coastal margins.

The importance of community facilities such as boat ramps, wharves/jetties, and parking areas was also noted together with related issues such as sedimentation and tidal restrictions on some boat ramps and the need for maintenance on jetties and wharves. Open space grassed reserves which provide recreational space adjacent to the coast are highly valued and extensively used, and it was noted that in some areas (e.g. Tairua Ocean Beach) these are very limited. Estuarine areas that provide sheltered safe swimming for families are also highly valued.

Coastal structures were often noted as a concern, particularly stormwater outlets (on both open and estuarine shorelines) and various degraded seawall structures. The importance of critical structures was appreciated but the groups felt that these structures should be avoided or reduced where practical and otherwise managed to better enhance natural and amenity (including recreational and visual) values and public access.

### **2.4 Biodiversity and Natural Values**

The working party members raised a number of issues related to natural values including the need to enhance native species and ecosystems where practical and appropriate, including dunes and the margins around estuaries.

The threat posed to natural and amenity values by exotic weed species was also a concern, particularly salt water paspalum around the estuary margins and invasive weeds on dunes.

Concerns were also raised about bird species, including the lack of safe nesting areas for dotterels on the ocean beaches and the need for high tide roosting areas around the estuarine margin (e.g. for wading birds).

## **3 THE OCEAN BEACHES – TAIRUA, PAUANUI AND WHANGAMATA**

The ocean beaches are generally backed by coastal dune reserves, with private development and public infrastructure (e.g. car parking areas) further landward. This section outlines the origin and dynamics of the ocean beaches and issues related to coastal erosion and reserves. Recommended management options are then outlined.

### **3.1 Origin of the Beaches**

Most eastern Coromandel ocean beaches began to form about 7000-7500 years ago when sea level stabilised after rising approximately 120 m after the last glaciation (i.e. “ice age”). Sediments submerged by the sea level rise were reworked by waves and moved landward to form the beaches.



The Whangamata and Pauanui shorelines have advanced by approximately 1.2 km and 1.0 km respectively over the last 7000-7500 years; forming wide sand dune plains (e.g. Figure 1) on which the townships are now built. Dune building initially occurred very quickly but slowed over time and is now negligible (< 5 m per century). Most of the sand for the ocean beaches has moved onshore from the continental shelf, and there is little ongoing contribution from the catchment. In simple terms, the ocean beaches already have most of the sand they are going to get.



Figure 1: View of Pauanui in the 1940s showing the old shore parallel dune ridges formed as the shoreline advanced seaward over the last 6000-7500 years ago.

The dunes at Tairua Ocean beach are narrower than at the other beaches (typically <250 m). Dating indicates that the beach had largely formed by 4000 years ago and the shoreline has not significantly advanced since then. The fact that the shoreline has been in much the same position for a long period of time has resulted in wide high dunes (Figure 2).



Figure 2: View of Tairua Ocean Beach in January 1953 prior to development showing width of dunes landward of the beach

The ocean beaches at Opoutere and Onemana have also developed over the last 7500 years. Opoutere is a sand spit composed of a number of dune ridges similar to Pauanui, while Onemana is a pocket beach backed by a single dune overlying older materials.

## 3.2 Shoreline Dynamics

Shoreline fluctuations are associated with storm erosion and beach and dune recovery. The process of storm erosion and recovery is shown in Figure 3 and can be summarised as follows:

- During storms, sand is eroded from the beach and dunes and moved offshore (see second diagram in Figure 3. Sometimes, storms also move the sand alongshore. This is particularly common at Tairua where storm waves arriving from one direction can cause erosion at one end of the beach and build up at the other.
- Once the erosion is over, sand gradually moves back onshore under more gentle waves and rebuilds the eroded beach (see third diagram in Figure 3). This beach repair process can occur in several weeks after an isolated storm event but the eroded beach state may persevere for some time during an extended erosion period.
- Dune repair occurs when native sand trapping plants grow down the eroded dune face and trap windblown sand (bottom diagram in Figure 3). This natural repair process depends completely on native sand trapping vegetation, particularly spinifex and pingao. After severe dune erosion, natural repair can take some years. Erosion occurs rapidly during storms, which means it is much more noticeable to human observers than the much slower process of shoreline recovery.

During some periods (often lasting several years), erosion tends to cumulate over time (i.e. with successive storms) and the worst erosion usually occurs towards the end of such periods. Similarly, there can be many years (or even decades) which are dominated by dune recovery and building, with the most seaward dune positions occurring towards the end of such periods.

The greatest shoreline fluctuations are therefore observed over cycles of many years or even decades rather than single storms. These shoreline fluctuations can cause the dune toe to move 15-30 metres and sometimes more (particularly near estuary entrances). As these cycles of extremes in shoreline position tend to occur over decades, there are usually lengthy periods (e.g. 30-50 years) between the most severe erosion. This means often very few people can recall the earlier erosion and sometimes over-react even though in most cases the same erosion has been experienced many times in the past.

The reasons for these longer term cycles of shoreline erosion and recovery are not yet fully understood. However, it is thought that they relate at least in part to climate patterns and cycles, including the Pacific Decadal Oscillation (PDO) and El Nino Southern Oscillation (ENSO), as well as various local factors.

The extent of shoreline change on the ocean beaches has been investigated using historic surveys which in some cases date back over 100 years, aerial photography (from the 1940s) and beach profile monitoring surveys (undertaken since 1979). This information indicates that the ocean shorelines are presently in dynamic equilibrium. This does not mean the shoreline is fixed in place,

but rather over decades the shorelines simply fluctuate backwards and forwards and do not show any significant trend for permanent long term advance or retreat. Examples of dune erosion and repair at each of the three developed ocean beaches are provided in the following sections.

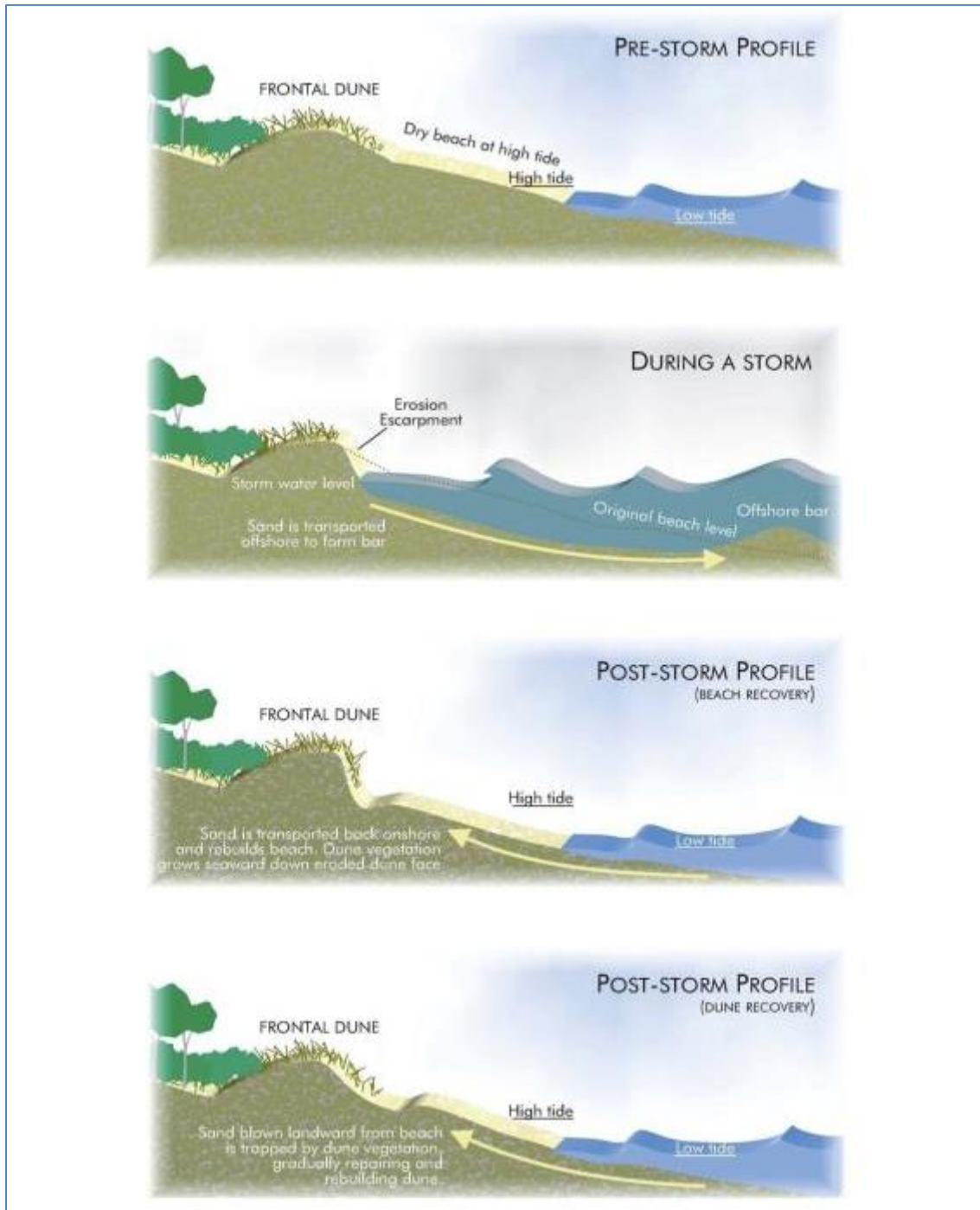


Figure 3: Schematic illustration of the process of storm erosion and subsequent beach and dune recovery. Understanding this process and decadal shoreline fluctuations is critical to understanding and managing coastal erosion on ocean beaches (see text for discussion)

### Whangamata Shoreline Change: Esplanade Drive

A number of storms in the 1970s caused progressive erosion fronting Esplanade Drive, which reached a maximum in a major coastal storm in July 1978. Figure 4 shows a view of severe erosion in this area following the 1978 storm. At the southern end of the Esplanade Drive, the erosion reached the grassed reserve behind the dune and to within 2-4 m of the sealed road and car park.

In contrast, Figure 5 shows a view of the southern end of Esplanade Drive in August 2009, following a period dominated by dune repair and seaward dune advance lasting over 10 years. At this time, the seaward toe of the dune was located up to approximately 15-17 m seaward of the 1978 erosion scarp.

These two photographs illustrate the natural dynamic shoreline fluctuations which occur in this area. Similar dynamic shoreline fluctuations occur along the full length of the Whangamata ocean shoreline and are perfectly natural.

Since about 2011/12, the dune in this area has moved into an erosion phase and is now slowly eroding with successive storm events. If this period of erosion persists for several more years, it may result in similarly severe erosion to that experienced in July 1978.

### Pauanui Shoreline Change

Mapping of historic shoreline changes indicates significant shoreline fluctuations occur over time along the full length of Pauanui Beach (Figure 6). Over the southern half of the beach the dune line fluctuations are usually less than 12 m but increase towards the northern end, with fluctuations of up to 35 m measured near the entrance (Figure 6).

Analysis of these historic changes shows that the shoreline built up between 1944 and 1967 and then eroded by a similar amount between 1967 and 1978/85. After the 1978/85 erosion, there was another period of shoreline recovery. There has been erosion over much of the southern half of the beach since about 2009.

Figure 7 shows a view of Accessway 9 (located towards the southern end of the beach) in 2012 after about 8-9 m of erosion between 2009 and 2012. Prior to the erosion, the dune reached near the end of the beach accessway. As with earlier cycles, this recent erosion is temporary and will eventually give way to a period of natural dune repair. These cycles of beach and dune erosion and recovery are perfectly natural and do not require human intervention as long as there is enough width of naturally vegetated dune to provide for natural dune repair.



Figure 4: View of south end of Esplanade Drive near the surf lifesaving club showing severe dune erosion which occurred during a storm in July 1978. (Photo provided by Mr. Ray Madden).



Figure 5: View of the south end of Esplanade Drive in August 2009 after a sustained period of dune building lasting several years (Photo: J Dahm). The 1978 erosion extended up to 2-3 m landward of the rope and bollard fence evident on the landward side of the dune.

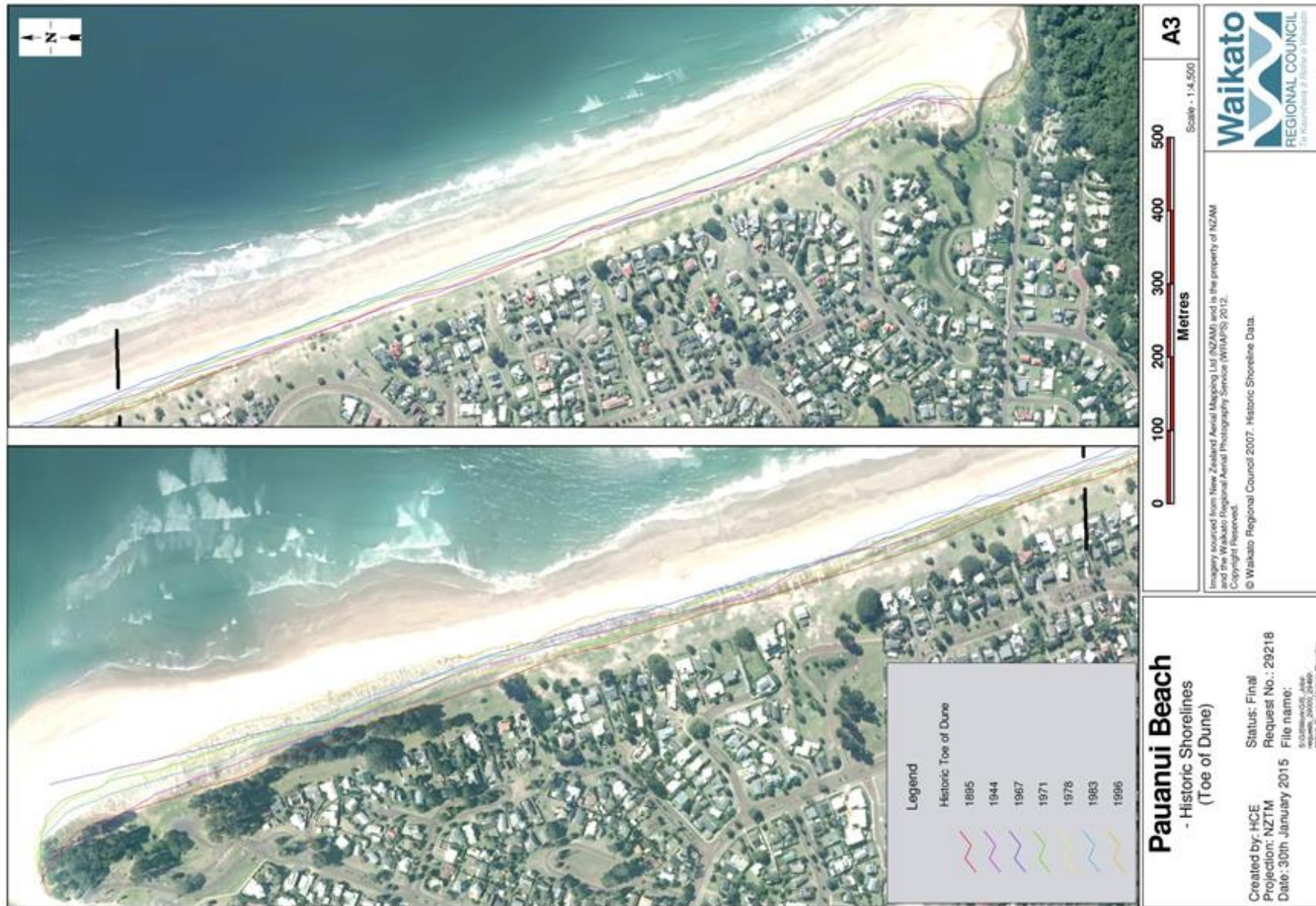


Figure 6: Shoreline fluctuations along the southern (top) and northern (bottom) ends of Pauanui Ocean Beach – as mapped from historic surveys dating from 1895 to 1996 and historic aerial photographs from 1944 to 1983. The mapped shorelines show the dune line at each date - except for the most seaward shoreline which was surveyed in 1962 and fixed high water mark.



Figure 7: View of beach accessway 9 located towards the southern end of Pauanui Beach in 2012. In 2009, the seaward edge of the dune toe was approximately 8m further seaward. These changes are typical of the natural shoreline fluctuations which occur over time and the erosion will naturally recover.

### **Tairua Shoreline Change: Southern End**

The extreme southern end of Tairua Ocean Beach was eroded severely in August 2003 (Figure 9). The bottom photo shows the same area in 2014 after natural and human-assisted dune repair (Figure 9). The seaward edge of vegetation on the repaired dune is approximately 10-12 m seaward of the 2003 eroded dune toe.

Previous studies show that severe erosion also occurred in this area in 1978 and 1988, but the 2003 erosion is the worst since at least the 1940s. There is some evidence that even more severe erosion may have occurred earlier in the 1930s – possibly in 1936 when two major storms occurred within a few weeks of each other. Each of these earlier erosion events was also followed by natural dune repair.



Figure 8: The south end of Tairua Ocean Beach following severe erosion in 2003.



Figure 9: The south end of Tairua Ocean Beach after dune repair (2014).



## Future Sea Level Rise

Sea-level has been rising around New Zealand at average rate of about 0.16 m per century since the early-mid 1800s. In the future, projected climate change is expected to generate an increase in the rate of sea level rise, probably persisting for some centuries. While the existing shorelines are simply fluctuating backward and forward over time, projected sea level rise accompanying climate change may alter shoreline dynamics and potentially lead to a long term trend for coastal erosion.

There are a number of effects likely to accompany predicted global warming that may exacerbate coastal erosion, including:

- A rise in mean sea level
- A possible increase in the frequency and intensity of coastal storms on north-east exposed coasts of the North Island
- A possible change in wave climate, which could result in reorientation of shorelines in response.

The scale and timing of any such effects are uncertain and apart from sea level rise it is not yet possible to make any useful estimates of these effects on coastal erosion. Therefore existing coastal development setbacks only estimate the likely additional erosion due to sea level rise.

### 3.3 Erosion Hazard Areas

The shoreline widths potentially vulnerable to coastal erosion have been defined for most eastern Coromandel beaches. The following hazard areas have been identified (and are included in the proposed District Plan):

- **The Current Coastal Erosion Line (CCEL)** – is the area that is at risk from coastal erosion with existing sea level. This line only considers the current risk and does not include any allowance for the effects of projected future sea level rise.
- **The Future Coastal Erosion Line (FCPL)** – defines the shoreline width that may be at risk from erosion with sea level rise of 0.9 m (based on present national guidelines for the next 100 years). It is important to appreciate that the additional area defined by the FCPL is not yet at risk. This area will only become vulnerable to erosion if the projected sea level rise occurs, and drives a trend for permanent erosion.

These hazard areas as defined for Whangamata, Onemana, Pauanui and Tairua are shown mapped on aerial photos in Appendices B to E and summarised below. The following sections briefly discuss these hazard areas. Management of the hazards is discussed later in Section 3.5.

#### Whangamata

The CCEL at this beach indicates that the worst likely erosion could extend inside the front boundary of nearly 90 private properties (Appendix B). In some cases the setbacks indicate that erosion could come close to some dwellings. However, the CCEL includes a small safety factor and so the likely risk is probably less; with most beachfront private properties probably either not currently at risk from erosion or having potential risk to only the more seaward portion of the properties. The hazard setbacks are used to locate dwellings and therefore necessarily have to include a level of precaution to address uncertainties. The CCEL also contains a small allowance to ensure there is a small buffer of land between a dwelling and the sea following the worst likely erosion.

The most significant erosion risk is to properties at the end of Hinemoa Street and the properties immediately south of Williamson Park, which are potentially subject to risk during rare and severe erosion. The risk to the properties immediately south of Williamson Park reflects the local influence of a large Council stormwater outfall and this risk has been reduced in recent years by additional works.

In terms of public infrastructure, there is potential for erosion to occasionally threaten the Esplanade Drive car park, even though the last period of severe erosion in July 1978 (Figure 4) stopped just short of the car park. The Island View car park and the seaward end of Hinemoa Street are also potentially at risk but would only be threatened by unusually severe erosion with existing sea level.

### **Onemana**

All residential properties at Onemana are well set back from the shoreline and are not at risk from coastal erosion associated with existing sea level (Appendix C). Some public infrastructure may be threatened by rare and severe erosion, but the only significant risk is from longer term possible erosion caused by future sea level rise. The dune at this site is also underlain by older and more erosion resistant materials which may limit erosion.

### **Pauanui**

All residential properties are landward of the CCEL and are not therefore currently at risk from coastal erosion (Appendix D). It should also be noted that the CCEL at this site has not been updated since 2002. More updated and site specific information now suggests that erosion risk may be less than indicated by the current CCEL. This is significant because the location of the CCEL affects the location of the FCPL, which currently extends into some beachfront properties and affects the way they can be developed. The FCPL for Pauanui is therefore probably not correct due to outdated information and this needs to be noted in relevant planning documents (e.g. an addendum or note linked to the District Plan).

Accordingly, urgent review of the CCEL is required at Pauanui as this has not been updated since 2002 and information now available suggests that erosion risk may be less than indicated by the current CCEL. This further work is not required at Tairua and Whangamata as the CCEL at these sites was updated in 2009.

### **Tairua Ocean Beach**

Most properties at Tairua are landward of the CCEL and therefore very unlikely to be impacted by coastal erosion with existing sea level. However, the properties at the very southern end of the beach (either side of Hemi Place) are at risk of being seriously impacted by erosion during rare and severe events (Appendix E).

### **Potential Future Impact of Sea Level Rise and Climate Change.**

The FCPL line mapped in Appendices B-E illustrates the potential for projected future sea level rise to result in permanent shoreline erosion which would significantly increase erosion risk at the ocean beaches. These maps indicate that with future sea level rise of just 1 m most beachfront properties and some Council infrastructure could be seriously affected. For example, the location of the FCPL at

Whangamata indicates that 1 m of sea level rise could give rise to serious erosion risk to both private property and public infrastructure along almost the full length of Whangamata Beach.

It is important to emphasise again that this line does not define the existing erosion risk – but only the potential risk that may occur if projected sea level rise occurs. Despite uncertainty about the extent and timing of future sea level rise, the best present science indicates that human-induced sea level rise is likely to occur over the next 1-2 centuries and probably beyond. National and Regional policy therefore requires the Council to plan for these potential future risks.

### **3.4 Reserves and Dune Management**

#### **Extent of Reserves**

All of the ocean beaches are backed by coastal reserves which extend along the entire seaward margin of the beaches; with private development and public infrastructure further landward. The beaches and reserves are extremely popular with heavy human (largely pedestrian) use, particularly over summer.

At Pauanui and Onemana a grassed reserve provides easy public access along the full length of the beach. The working group at Pauanui stressed that the wide grass reserve along the full length of the beachfront is key to the amenity of Pauanui. At Tairua and Whangamata, public use tends to be concentrated at nearshore public car parks (e.g. Hunt Road, Esplanade Drive, Island View and Pohutukawa Crescent at Whangamata) and the available beachfront grassed reserves (e.g. the extreme northern end of Tairua Beach; Williamson Park and Island View reserves at Whangamata); and to a lesser extent various beach accessways. In most other areas of Whangamata and Tairua, the main pressure on the dune reserves is associated with adjacent private property.

#### **Original Dune Vegetation**

Studies have shown that most dune systems on the east coast of the middle and upper North Island were heavily forested prior to human settlement. This vegetation was seriously disrupted by early Maori and European settlement leading to widespread sand de-stabilisation and wind erosion problems around New Zealand. Wind erosion problems were common on many eastern Coromandel dunes up to at least the mid-1900s.

Since that time, with removal of stock and improved management, pioneer species such as spinifex began to re-colonise the dunes. Historic aerial photographs of Tairua, Pauanui and Whangamata prior to subdivision indicate wide vegetated dune systems much wider than the present reserves (e.g. Figure 1). The photos indicate that the vegetation cover was generally light (e.g. Figure 2); probably largely spinifex, though there is also some evidence in places of more dense backdune communities (e.g. native rushland and vineland and probably various exotic species such as lupin). The lack of any established forest or even extensive shrubland reflects the early state of recovery following destabilisation by stock and other human activities.

#### **Reduction and Loss of Natural Dunes**

Subdivision significantly reduced the width of naturally vegetated dune at most Coromandel beaches, but reasonable widths were retained along most of Tairua and Whangamata beaches and the northern end of Pauanui Beach. However, over most of the length of Pauanui Beach, the naturally vegetated frontal dune was levelled and covered with clay fill. The loss of spinifex and

other native dune vegetation needed for natural sand trapping largely stopped natural dune repair in this area. As a result, little natural dune repair occurred after severe erosion in 1978 and 1985, with the erosion scarps still clearly visible in the early 2000s. In this area the scarp had become vegetated with exotic species, which are not as effective as spinifex in natural sand trapping and dune repair (Figure 10).



Figure 10: Views of southern Pauanui foreshore in early 2000s prior to dune restoration showing absence of native sand trapping dune vegetation such as spinifex. The seaward dune face is dominated rather by exotic vegetation that is not as effective at natural dune building and repair. Note the perseverance of the steep dune face from historic storm erosion due to the absence of natural dune repair processes - despite nearly two decades since the previous major storm erosion events (1978 and 1985).

Subsequent dune restoration with native sand-trapping vegetation resulted in significant sand trapping and dune repair over a narrow width along the seaward face of the dune (Figure 11). However, the dune restoration was only undertaken over a narrow width as there was public resistance against the loss of grassed reserve. As a result the restored area was largely lost in the recent erosion phase (Figure 12; see also Figure 7).

The loss of the restored dune width can lead to local concern that “dunes do not work”. This comes from a common misconception that dunes should stop erosion, which is not accurate. Rather, the value of the native vegetated dune is the sand trapping and natural dune repair that occurs after the erosion. For this to occur, the restored dune must be wide enough so that a reasonable width (at least 3-5 m) of spinifex and other native sand trapping vegetation remains after the worst erosion. More recently, restoration at Pauanui has focused on establishing a slightly wider dune, so that some spinifex width survives a severe erosion phase.

### **Invasive Exotic Vegetation and Encroachment**

At all local beaches, the natural dunes have been invaded by a range of exotic species. While some of the exotics are relatively harmless, several species are seriously invasive and tend to displace the native vegetation. The most problematic are usually garden species that have been introduced by garden waste or planted by adjacent landowners, such as agapanthus, gazanias, arctotis, South African ice plant and various succulent (e.g. agave and yucca) species. These species (often planted for their pretty flowers) have in many areas replaced native dune species on the, significantly degrading ecological values.

The spread of these invasive exotic species seaward also narrows the spinifex zone from landward (e.g. Figure 13). This makes the spinifex zone very vulnerable to loss during severe erosion, which as discussed above prevents natural dune repair. While exotic species can successfully prevent wind erosion of sand dunes, they do not provide for natural dune rebuilding following storm erosion. Native grass species such as spinifex are tall enough to catch and trap windblown sand and therefore play a critical role in natural dune rebuilding after erosion. In the absence of this native sand trapping vegetation, dunes may become stabilised by exotic vegetation but will not grow forward following erosion to reform the natural buffer that was lost during the last storm or erosion phase.

In some areas, restored areas have not been well maintained and have been re-invaded by weeds, either by exotic garden plants or simply by lawn grasses from reserves and private properties further landward.

There are also places where private lawns have been actively established within the natural dune reserve, further aggravating weed invasion issues. Thames Coromandel District Council reserve management plans prohibit private encroachment and planting exotic vegetation on public reserves is also in violation of Council bylaws (see Appendix F). Tauranga City Council has successfully developed and implemented an approach to retreat public encroachment off public dune reserves, with the work progressively implemented each year. Lessons from development and implementation of the Tauranga City approach could assist Council in addressing this issue.



Figure 11: View of southern end of Pauanui in 2006 following reshaping of dune face and restoration of native sand trapping vegetation. Note how the native vegetation extends down the seaward face and onto the beach during accretion phases – actively trapping windblown sand and repairing the eroded dune face.



Figure 12: View of restoration area on southern Pauanui foreshore after period of dune erosion (in 2009 and following years). The narrow width of the restored native dune vegetation has largely been lost to erosion – with about 1m width remaining. This indicates the importance of having a natural dune of sufficient width to absorb the worst likely storm erosion. Otherwise, replanting has to occur after the erosion before natural dune repair can commence.



Figure 13: Views to the north (top) and south (bottom) of Island View Reserve at Whangamata. Note in the top photo how the seaward advance of exotic species (arrowed) has resulted in only a narrow width of spinifex and other native sand trapping vegetation being left to seaward. This narrow zone could be completely lost during severe erosion, preventing natural dune repair once the erosion phase was over. In contrast, the area to the south of the Island View reserve retains a wide zone of native sand trapping vegetation (spinifex and pingao).

### Access Management

The popularity of the beaches means there is significant pedestrian (and some vehicle) traffic across the dune reserves. It is important to ensure good public access to and from beach but the accessways need to be carefully managed to protect dune vegetation. Poor management of beach access can disrupt sand trapping vegetation, leading to issues with wind erosion and windblown sand, as well as physically damaging the dune face.

In recent years, management of public beach access has significantly improved, markedly reducing vegetation damage. However, there are still areas where wind erosion and windblown sand issues remain and management of access needs to be further improved – including both public and private beach accessways.

### **Stormwater Outlets**

At Pauanui and Whangamata, stormwater outlets generate localised issues. Stormwater discharges can cause enhanced beach and dune erosion during periods of heavy rainfall. While ideally stormwater outlets would not discharge to sandy beaches, it is generally not reasonably practical to move these outlets as there is significant infrastructure draining to these points. The costs and disruption associated with removing the outlets is likely to be very high.

However, there are various actions that can be undertaken to reduce the adverse effects of the discharges. For instance, significant reductions in scour and erosion have been achieved by extending the stormwater outlets on Pauanui Beach and reducing exit velocities. Similarly, various works have reduced the serious scour associated with periodic storm discharges from the Williamson Park stormwater pond. Nonetheless, some localised issues remain.

In addition to issues with stormwater outlets, stormwater draining off grassed reserves can damage recently restored dunes. This has been an issue with dune restoration in isolated areas along the southern end of Pauanui Beach. Swales should also be created/constructed along the landward margin of the restored dune when restoration is undertaken.

### **Grassed Reserves**

The Tairua working party noted that there is only one grassed beachfront reserve at Tairua, located at the northern end of the beach and emphasized that this area is highly valued and widely used and needs to be protected (i.e. not lost if car parking is expanded, etc).

Existing grassed reserves which extend well landward (e.g. Williamson Park and Island View at Whangamata and the grassed reserve along much of Pauanui) have considerable resilience to aggravated erosion that may accompany future sea level rise. The landward depth of these reserves will help maintain these valued areas in the face of future sea level rise.

There is also potential to enhance the amenity values of grassed reserves over time. For instance, the Whangamata working party observed that the recent enhancement at the Island View reserve has improved this area and increased the use by children and families.

### **Lack of Shade and Vandalism of Trees and Shrubs**

A further issue noted at all three sites was the lack of beach shade on the beachfront reserves – with limited trees in many areas. Council staff also noted that there were serious ongoing issues with trees and shrubs on reserves being killed or extensively (and usually very poorly) pruned to enhance views from properties to landward (e.g. Figure 14). Thames Coromandel District Council bylaws exist to protect vegetation and structures on Council reserves, and any act that damages trees is in violation of Bylaw 1706 (see Appendix F). A strategic approach to this issue may also be required if the existing issues continue.





Figure 14: A poisoned pohutukawa at Pleasant Point, Pauanui. Vandalism of young trees makes it very difficult to develop succession planting to provide amenity and shade in the future.

### Backdune Accessways

At the northern end of Whangamata beach, the backdune area has been impacted severely by heavy pedestrian use, which occurs over a large number of ad hoc pathways. As a result the dune vegetation in this area is heavily degraded and there is widespread wind erosion. The recent trial of a compost pathway in this area has been particularly successful in channelling foot traffic and reducing these impacts.

There is also considerable potential to expand backdune accessways at both Tairua and Whangamata. Such accessways are commonly established and have reduced issues in many backdune areas in other areas of New Zealand and overseas, and are often extensively used (e.g. Motu Cycleway in Opotiki District).

Well designed and managed, backdune accessways also have very little adverse effect on native dune vegetation communities, and can actually reduce the impact on vegetation by directing foot traffic onto defined pathways. This beneficial effect can be seen at Whangamata. The accessways can often be used to enhance community information (e.g. discrete and appropriate signs highlighting native vegetation) and increase public support for restoration of backdune plant communities.

It is important however to ensure adequate beach accessways from these paths so that short-cutting to the beach is not encouraged. This is not likely to be an issue at Tairua or Whangamata where there are already a good number of beach accessways.

## 3.5 Recommendations

### General Strategy for Ocean Beaches

The following are the primary recommendations for the management of ocean beaches:

- Existing coastal erosion can generally be managed by protecting and enhancing natural shoreline defences and managing coastal development, specifically:
  - Development setbacks and controls (District Plan)
  - Dune restoration and management along the full length of all ocean beaches – providing natural self-repairing protection from coastal hazards
  - Use of sand push-ups to facilitate dune repair after erosion where and when required
  - Site specific erosion management strategies where the above measures are insufficient (as outlined below)
  - Community information and education

In the longer term, aggravation of erosion by projected sea level rise is likely to require more complex and difficult site specific strategies.

- Dune restoration and management is required for a variety of purposes including management of coastal hazards and the protection and enhancement of ecology, amenity values and access. Dunes restoration and management will need to address reinstatement of naturally functioning dunes where they do not exist, restoration of native vegetation communities, and management of weeds, access and encroachment. Ongoing weed management will be critical to the success of this approach.
- Enhancement of public access and recreational values can be achieved through provision of back dune accessways, greater shade where appropriate, improved signage for key use areas, and continued maintenance and upgrade of valued recreation areas.

An outline of site specific recommendations is provided in the following section below. The various recommended options are also discussed in more detail further below.

### Tairua Ocean Beach

Coastal erosion risk can presently be adequately managed along most of the beach using **setbacks and development controls** together with dune restoration and management. However, at the southern end of the beach, **property specific strategies** are required for the most at risk properties, though some properties already have these. Dune repair using **sand push-ups** may also be required at the south end after severe storm erosion.

**Dune restoration and management** activities should continue to maintain and enhance ecological values and provide for natural recovery from coastal erosion (see also following section below for more detail).

The **grassed beachfront reserve** at the northern end of the beach is highly valued and should be maintained as open space. The reserve management plan highlights the value of this area and provides for landward relocation of the existing toilet block in future upgrades to free up prime beachfront reserve for amenity. While the working party did not indicate the need for more grassed reserves at Tairua, there is sufficient space to create further such reserves at Tairua if desired. In doing so, high ecological value areas should be avoided, such as the central beach areas with significant remnant areas of native backdune vegetation. Any future creation of grassed reserves along the foreshore at Tairua should also maintain a naturally-vegetated dune wide enough to withstand the worst likely erosion with existing sea level. The CCEL setback provides a useful indication of this width, though lesser widths may be adequate in many areas.

A **backdune accessway** would enhance public access and amenity in central and northern reserve areas at Tairua. The walkway should be linked to beach accessways to direct foot traffic, limit the number of beach access tracks, and reduce the impact on vegetation. This accessway can also be used to connect and ultimately reduce the number of informal private accessways from beachfront properties by providing easy access along the backdune to established walkways. This walkway will most logically begin at the northern reserve and can be extended as required.

Remnant native backdune communities in central and northern areas of the beach have high ecological values and should be managed to protect from weed invasion and other damage. There is potential for further restoration planting to occur in the backdune area, including shade trees where appropriate. This is consistent with existing reserve management policy. Further consultation and negotiation with adjacent property owners and the wider community will be necessary to finalise the most suitable alignment of the walkway. It will be important to ensure the accessway is constructed to preserve the natural character of the dunes, and would most likely follow the Whangamata model in being a simple path without hand rails, fences or other obvious structures which may detract from the naturalness of the area.

**Improved signage** for the beach area in the vicinity of the Tairua Surf Life Saving Club would help to guide visitors to the area that has reasonable parking and is the safest swimming area. This area is currently not clearly evident to visitors who do not know the area.

### **Pauanui Ocean Beach**

Coastal erosion risk can be adequately managed along most of the beach using **setbacks and development controls** together with dune restoration. The wide grassed reserve at Pauanui means that dune repair can primarily be left to natural processes, but sand push-ups can be used to facilitate more rapid dune repair and/or to reinstate beach accessways after severe erosion (as described further below).

The **CCEL setback at Pauanui** should be updated to take advantage of further information since the late 1990s. This update will refine the landward extent of this setback and ensure appropriate positioning of the FCPL.

**Dune restoration** and management activities should continue to maintain and enhance ecological values and provide for natural recovery from coastal erosion. Restoration and maintenance of an adequate width of naturally vegetated dune is important along the southern end of the beach to promote natural dune building and repair following periodic erosion. Pauanui Beachcare needs to agree with other appropriate parties an appropriate width of dune and dune profile for restoration.

Ideally it should extend at least 3-5 m landward of the most severe erosion recorded in the past (shown in Figure 6). The recent erosion is similar to the erosion of 1978 and 1985 but not as severe as this earlier erosion. The inclusion of a swale on the landward margin of the restored dunes could help address the problem of stormwater damaging accessways.

## Whangamata

At present, coastal erosion risk can be adequately managed along most of the beach using **setbacks and development controls** together with dune restoration and management.

However, **property specific strategies** may be required for the area around the seaward end of Hinemoa Street and Esplanade Drive, which could be impacted by rare and severe erosion. At other areas where the CCEL extends into private property (e.g. Pipi and Tangaroa Roads at Whangamata), **site specific strategies** may be required in the event of rare and severe erosion, though dune repair using **sand push-ups** will probably suffice (see further discussion in following section).

**Ongoing dune restoration and management** is important to restore and maintain a naturally vegetated dune along the shoreline.

The defined **backdune accessway** at the northern end of the beach should be extended alongshore and better linked to adjacent beach accessways to **improve access and amenity**. Over time, this will also reduce the many ad hoc access paths in this area and associated dune damage and provide opportunities to enhance public information on natural dune vegetation. Appropriate native shrubs and trees could also be planted in this dune reserve, in areas that will not adversely impact views (e.g. seaward of high dunes or in low lying areas within the dunes). Strategically placed trees could provide valuable shade in the long term and improve the amenity and ecology of the area.

Open space areas such as Williamson Park and Island View should continue to be upgraded to enhance **amenity values and public use**. Feedback from the working party indicates that the recent upgrade at Island View has considerably enhanced recreational amenity for families and increased public use of the area.

## Details of Recommended Options

### *Setbacks and development controls*

Coastal setbacks (i.e. the CCEL and FCPL) and associated controls are existing measures which already apply to private beachfront properties and public land. The primary objectives of these measures are to prevent exacerbation of erosion hazard risk and, where practical, to progressively reduce risk over time. The setbacks also provide landowners and communities with information on the areas potentially vulnerable to coastal erosion – both the existing risk and the potential for aggravation of this risk in the longer term.

The CCEL (i.e. the area at existing risk from erosion) is used by Council to control the location of new and replacement housing to reduce erosion risk to dwellings over time. Council requires new dwellings and renovations to be located landward of the CCEL. This is similar to many other coastal councils and is consistent with national policy requirements. Over time, the controls should progressively reduce the risk to dwellings posed by existing coastal erosion. Council does however generally allow low decks to extend into the existing risk zone at owners risk as these are viewed as relatively low value structures.

As the CCEL setback imposes significant constraints on the use of some private properties, Council undertakes regular review and update to consider new information. This ensures the setback adequately reflects best available information – thereby providing for risk avoidance and reduction in line with Council’s statutory responsibilities, while also minimising impact on use of properties. The most recent review in 2009 considered Tairua and Whangamata but not at Pauanui. The present CCEL does not directly impact private property at Pauanui but does influence the location of the FCPL.

Council does generally consent dwellings and renovation between the CCEL and the FCPL as this area is outside of the current erosion risk area. However, because the area is potentially at risk from future sea level rise, Council in the past has imposed conditions including a requirement that new dwellings and renovation to be practicably relocatable so the dwellings can be moved if required in the longer term . In granting consents and building permits seaward of the FCPL, Council typically has also required measures to protect ratepayers from liability (e.g. damage waivers) and to ensure that future purchasers are aware of the potential longer term risk (e.g. Section 73 Building Act notices on titles). In this way, the FCPL setback is used to reduce longer term risk and to ensure existing and future owners are aware of the potential risk. We recommend that the Council continue to implement these measures to limit future risk.

The Council generally tries to avoid subdivision of existing properties within the CCEL and FCPL unless there is sufficient room landward of the FCPL for dwellings and other reasonable use (e.g. appropriate infrastructure) on all lots created by the subdivision. This ensures that subdivision does not exacerbate existing risk and that the sections created will remain usable for at least the next century. New subdivision (i.e. in Greenfield areas) is generally required to be landward of the FCPL, to provide certainty that the sections will remain usable for at least the next 100 years. At present, Council only considers erosion hazard over a planning period of 100 years (the minimum required by the NZCPS). While there are moves in some councils (e.g. Auckland Council is considering use of 2 m sea level rise for assessment of Greenfield subdivision) to consider a longer planning period because sea level rise and climate change effects are projected to continue for several centuries, TCDC is not presently considering such action.

### *Dune restoration and management*

Dune restoration and management is required for a variety of purposes, including management of coastal hazards, and the protection and enhancement of ecology, amenity values and access. Given the narrow width of the protective dune and the vulnerability of adjacent properties to erosion (e.g. Appendices B to E), it is particularly important to restore and maintain native dune vegetation to provide for natural dune repair.

Restoration is also important to maintain and enhance ecological values within the narrow width of natural duneland that remains. Dunes are among the most degraded of New Zealand’s natural ecosystems and have been identified as a national priority for restoration.

The following recommendations are proposed for dune restoration and management:

- **Restoration and maintenance of an adequate width of naturally (native) vegetated and functioning dune along the full length of all three ocean beaches.** This will ensure natural dune protection for public and private land further landward, natural dune repair following periods of erosion and provision for restoration and protection of ecological values. Ideally, the minimum

width of the dune should be similar to the CCEL setback – sufficient to absorb the worst likely erosion with existing sea level. In many areas however a lesser width will need to be adopted because of other constraints and the width of restored dune will require site-specific agreement.

- **Work with Beachcare and other relevant community interests to develop an agreed dune profile and width for restoration of a naturally vegetated dune along the southern end of Pauanui Beach.** The agreed width needs to be sufficient to ensure some natural dune width remains after the worst likely erosion. Problems with scour of the restored natural dune due to stormwater runoff from the landward grassed reserve can probably be significantly reduced by designing the restored dune to create a swale along the landward margin to encourage soakage of the runoff. A list of common key native species which should be used in restoration planting where practical and appropriate is provided in Appendix H. The list is not exhaustive and there are many other native species which can also be used.
- **Continued use of community-based partnerships** (e.g. Beachcare/Coastcare) for dune restoration and management. At present, the Regional Council provides plants and technical advice for restoration projects. The District Council covers other costs, including any reshaping and earthworks and the installation and maintenance of access ways. The District Council is primarily responsible for ongoing weed control on the restored dunes.
- **Maintain restored areas through ongoing weed control.** It is particularly important to control both invasive exotic species (e.g. agapanthus, arctotis, gazanias and succulents) that will otherwise displace native vegetation communities and the invasion of exotic perennial grasses from lawns further landward. Council should also work with landowners to retreat existing private encroachment. The Tauranga City Council has successfully addressed this issue and may be able to provide advice on a suitable approach. A list of some of the key weed species requiring control is provided in Appendix I.
- **Ongoing access management** is important to facilitate easy beach access and prevent damage to natural dune vegetation and associated (e.g. windblown sand) issues. A wide variety of accessway types can be used according to circumstances, including:
  - Fixed structures (e.g. Figure 7) can be useful (e.g. often not disrupted by erosion events). However, the structures need to be sufficiently wide so they are not outflanked by severe erosion and the piles sufficiently deeply embedded to prevent undermining during severe erosion events. The structures can cause some localised aggravation of erosion during storms but this is typically a minor effect that can be minimised with appropriate design. Fixed access structures can become unusable following severe erosion.
  - Board and chain are used on dunes world-wide and are relatively cost-effective and simple to install. The structures must use timber that is easy to step on (e.g. bevelled edges, half rounds) and ensure a good spacing (ideally at least 35-40cm) between boards. Otherwise, the structures can be difficult to use and users will tend to walk either side, aggravating windblown sand issues. However, where wheeled access is desired (e.g. wheel chairs, prams, kayak trolleys etc) a closer spacing of boards is required (e.g. 3-5 cm). With closely spaced boards, a low gradient is essential for safety

reasons. The structures need reinstatement after severe dune erosion but this is generally relatively simple;

- Sand or compost accessways are also appropriate in many areas, particularly less used areas. With sand accessways it is important to orient the accessway oblique to prevailing winds to minimise windblown sand issues.
- **Advise beachfront landowners** that encroachment, planting of exotics and the dumping of garden wastes is not permitted on Council reserves. Additional action (including enforcement) should also be undertaken where required.
- Over time, consider options to enhance beach shade and minimise vandalism to existing trees/shrubs. For instance, appropriate pruning and opening up of trees can minimise impact on views. There are also places where tree/shrub plantings are practicable without impacting views.

### *Dune repair using beach sand push-ups*

In most cases, dune repair after periods of erosion can be left to the natural processes described in Section 3.2 and illustrated in Figure 3. However, in the case of severe erosion, leaving dune repair to natural processes may result in unacceptable risk to private property and dwellings or pose a significant risk to nearshore infrastructure (e.g. Esplanade Drive car park at Whangamata). In these situations, appropriately designed sand push-ups can significantly mitigate the risk from coastal erosion. This method involves pushing up sand from the beach to facilitate dune repair following periods of severe erosion.

The primary areas where the approach is likely to be required to protect private property and dwellings are the southern end of Tairua Beach and properties in the vicinity of Hinemoa Street in Whangamata. Some of the dwellings at the southern end of Tairua Beach have been designed and constructed to withstand the worst erosion likely with existing sea level (e.g. foundations on natural rock platforms underlying the dunes). Nonetheless, sand push-ups are likely to be useful to mitigate risk and to reinstate dunes after severe erosion.

In cases of rare and severe erosion, there may also be a need for the approach in some other locations where the CCEL extends within private property boundaries. In areas where erosion is seaward of private properties, the approach will not be required to protect private properties and dune repair in these areas can be left to natural processes.

This approach may also be required to protect important public infrastructure at Esplanade Drive at Whangamata and (to a lesser extent) the both the northern and southern ends of Tairua Beach. However, the approach will have uses at other areas also, such as repair of erosion scarps on public accessways to restore access and reinstatement of severe erosion around stormwater outlets.

It is emphasized that the approach should be used with caution as it can be expensive and in most cases the method is not required and dune repair after erosion can be left to natural processes. In general, the approach is not advised or appropriate immediately after storms and should be left until sufficient high tide beach has recovered (e.g. as per third diagram in Figure 3). Otherwise, the placed sand will quickly erode.

The adverse effects of sand push-ups are minor and temporary provided the work is appropriately designed and executed. Council already holds resource consent for dune repair using sand push-ups

and this resource consent and accompanying documentation provide appropriate guidelines for design and use of the approach.

### *Property/Site Specific Strategies*

Site or property-specific strategies may be required in some limited areas if the above measures are not sufficient to adequately mitigate erosion risk and provide for reasonable use of properties. This occurs where existing dwellings lie within the area at risk from coastal erosion, and the CCEL extends sufficiently far into the property to make it difficult or impossible for owners to replace or renovate the houses.

At these difficult sites, strategies can be developed in collaboration with the affected property owners and typically comprise a range of methods which collectively provide mitigation of erosion risk while reducing the restraints on use of the property. Details of the strategies typically depend on the site but can include special foundations, dune repair using sand push-up, minor retreat to enhance natural protection, development controls and dune management. Other measures such as backstop sea-walls can also be relevant in extreme situations but these measures can be complex as they can have implications for adjacent unprotected properties.

Property specific strategies may be required where existing erosion risk threatens properties and dwellings at the southern end of Tairua Ocean Beach (Hemi Place) and the area around the seaward end of Hinemoa Street in Whangamata. At least two properties at the southern end of Tairua Beach already have site specific strategies.

Other areas where the CCEL extends into private property (e.g. Pipi and Tangaroa Roads at Whangamata) may require site specific strategies in the event of rare and severe erosion. However, given the safety factor (typically up to 5-10 m) in the CCEL calculations, the existing risk to these properties can probably be managed with setbacks and dune management. Nonetheless, dune repair using sand push-ups may possibly also be required in the event of very rare and severe erosion.

A site specific strategy may be required to manage risk to public infrastructure at the Esplanade Drive foreshore in Whangamata. The most recent period of severe erosion in July 1978 affected the grassed reserve to seaward but stopped just short of the car park. However, this may not be the most serious erosion that can occur and the next period of extreme erosion may extend further landward. The Island View car parking areas and the seaward end of Hinemoa Road at Whangamata are also well within the CCEL and may also need site specific strategies. However, there is no evidence that historic storm erosion has extended back as far as these areas and we suspect that dune restoration and (in the event of rare and extreme erosion) sand push-ups will be adequate to manage existing erosion risk in these areas.

### *Education and Communication*

The community members of working parties (especially Whangamata) emphasized that there is widespread misunderstanding and concern with respect to coastal processes/erosion and management options, and therefore a need for better communication with local communities. They noted that better understanding of the local beaches and management options were critical if wise choices are going to be made in regard to ongoing protection and enhancement of these beaches. This could be given greater emphasis in the existing dune restoration programmes and through increased stakeholder engagement in addressing site specific erosion issues.



## Other Measures that may be required in the Longer Term

Additional and more extreme measures (e.g. retreat/relocation, engineering structures, beach nourishment) may be required in the event of significant future sea level rise. A brief discussion of these other methods is provided in this section, but it is not envisaged that these measures will be appropriate or required on any significant scale at any of the ocean beaches in the near future.

In the event of significant sea level rise in the future (as is presently projected), erosion at all three ocean beaches are likely to be seriously aggravated (see FCPL setback in Appendixes B-E). In this situation, site specific strategies will be required for extensive lengths of foreshore, particularly at Whangamata and Tairua. In addition to the above measures, such strategies are likely to have to include one or more of the following options:

- **Landward retreat or relocation of infrastructure and dwellings.** Even without engineering structures or beach nourishment, most beachfront private properties are likely to remain usable with some further sea level rise – but dwellings will need to be progressively located in more landward areas of the properties.
- **Engineering measures – such as structures and beach nourishment:** With low to moderate sea level rise, relatively low impact engineering structures such as backstop sea walls (i.e. buried most of the time while limiting extreme erosion) are likely to be practical options to extend the design life of beachfront properties. These are relatively expensive measures (present day prices probably in the order of \$6-10,000 per linear metre); but likely to be cheaper than abandonment in the short to medium term. Combined with some retreat, ongoing dune management and sand push-ups, it may be possible to extend the design life of properties by many decades or more depending on the severity of the sea level rise and consequent erosion.

With very significant sea level rise and erosion, sea walls would be very expensive, would severely damage the public values of the beaches and would be unlikely to be consented. In this situation, engineering options would reduce to measures such as beach nourishment combined with structures that help to hold the sand in place (e.g. offshore reefs or groynes). These are extremely complex and expensive options. For instance, beach nourishment requires placement of sufficient sand to build the entire beach system seaward. On an ocean beach, the seaward edge of the beach system is typically at least several hundred metres offshore. Very large volumes of sand are therefore required to achieve meaningful outcomes with beach nourishment on ocean beaches. For instance, the sand placement required to offset 1 m of sea level rise (i.e. about 20-30 m erosion) would be in the order of 150-250 cubic metres per metre of beach length! The placement would also need to be undertaken over the full length of the beach. Accordingly, use of this approach would require hundreds of thousands of cubic metres of sand at some sites (e.g. Whangamata). There are also other significant practical obstacles to implementing beach nourishment projects, such as finding a source of suitable sand for the nourishment.

Nonetheless, beach nourishment could be a viable option where there is significant development and the only alternative choice was abandonment.

## **4 ESTUARY SHORELINES - TAIRUA, WHANGAMATA AND OTAHU**

### **4.1 Key Issues**

The estuary beaches differ from the ocean beaches, mostly due to the much lower energy wave environment. The sheltered nature of estuary beaches means they are not backed by significant dune systems. Despite their relatively sheltered nature, estuaries are complex and often dynamic systems, with sediment supplies both from the catchment and the sea, waves, tidal currents, and many human influences. Shorelines near estuary entrances can be particularly changeable.

The estuary beaches are highly valued recreational resources for the local communities. They provide a sheltered and safe environment for beach recreation, swimming and boat launching. The coastal margin of these beaches is used extensively for picnicking, walking and running. For the same reasons, the margins of the estuaries are often heavily developed. This development has often occurred very close to the shore, with only narrow reserves between private land and the coastal margin, so any shoreline change can “pinch” out public spaces and potentially threaten private properties. The estuary shorelines also contain a large number of stormwater outlets.

Where coastal erosion has threatened narrow public reserves or private property, erosion protection structures such as seawalls and occasionally groynes have often been placed in response. These works can damage beach values, including natural character, public access and beach amenity. There is an ongoing balance to be met between protecting the highly valued public reserves and private property on the coastal margin, and preserving the values that make the areas attractive. In some places these structures are at or near the end of their useful life, and/or are having adverse impacts on the adjacent beach or coastal margin. Where private development has historically encroached onto public coastal reserves, it can also be difficult to establish responsibility for the maintenance of these structures.

Land adjacent to the estuary beaches is also sometimes very low-lying and vulnerable to coastal flooding.

Reserve areas are popular for families in summer, and as such shade is an important resource. Conflicts occur when private residents don't want trees to interfere with coastal views. Poisoning and felling of large trees on council reserves is relatively common. New trees or even shrubs are often removed or poisoned.

As well as being highly valued by people, estuaries are key habitats for many plants and animals, including threatened species. At high levels of the tide, there are few safe roosting areas for wading birds in Tairua and Whangamata. Mainland sites are frequently disturbed by human activity and particularly dogs. The serious invasive species salt water paspalum is present in all three harbours and quite extensive in some areas – particularly within Tairua and Whangamata Harbours. As well as ecological impacts, this species can extensively cover estuarine beaches, reducing amenity values.

### **4.2 Recommendations**

#### **General Strategy for Estuary Shorelines**

The following general strategy is recommended for managing the estuary shorelines of Tairua, Whangamata and Otahu estuaries:

- Coastal erosion can generally be managed with “soft” approaches, specifically beach nourishment and readjustment where necessary. Sites suitable for beach nourishment are discussed further below. As sediment becomes available, it can be directed to the site with the greatest need at the time. Careful sediment use will be necessarily to maximise beneficial outcomes and avoid adverse effects.
- Existing engineering structures often provide critical protection to narrow public reserves or nearshore infrastructure. However, where practical, the impact of these structures should be softened using beach nourishment. Unnecessary and unsound/unsafe structures should be removed over time.
- New protection structures should be used as a last resort and typically only where they are required to protect important public infrastructure or maintain narrow coastal reserves. Where shoreline armouring is judged to be necessary, the softest approach appropriate should be adopted and effects of the structures mitigated to the extent practical.
- Minimum floor levels (including appropriate provision for future sea level rise over the design life of the dwelling) should be adopted in areas subject to coastal inundation.
- Site specific strategies should be developed where coastal erosion and/or flooding issues are complex (e.g. Manaia Road, Tairua Estuary and parts of Beach Road, Whangamata). In the longer term, aggravation of erosion and flooding by projected sea level rise is likely to require more complex and difficult site specific strategies.
- Public access and recreational values should be enhanced through beach replenishment, removal of unnecessary structures, saltwater paspalum control, provision of access along estuary margins, greater shade where appropriate, and continued upgrade of valued recreation areas.
- Working groups indicated that the complete removal of stormwater outlets from the coastal environment is a long term aspiration at many sites. While this would eliminate adverse visual, amenity and erosion effects, it would also be very difficult and expensive in most situations as there is extensive infrastructure inland of each outlet that may need to be altered.
- When stormwater outlets and protection works ultimately require upgrade or replacement in the long term and there is no alternative to discharging to the coast, alternative options should be implemented that are more compatible with the natural and amenity values of the area. These could involve use of softer forms of hard protection such as geotextile containers. These are expensive structures but can be appropriate at high value sites. In some places it may also be possible to naturalise the outlets to more closely resemble natural stream entrances. This might involve for example replacing the outer culverts and outlet with a natural channel; with flaring of the channel to accommodate expected erosion. Once the erosion around the new entrance slows or stabilises, it might also be possible to appropriately vegetate the channel margin to create an even more natural appearance. This option would be complex and may not be appropriate at all sites.
- Opportunities to enhance ecological values should be taken where possible, including control of salt water paspalum and creation of high tide roosting areas. The District Council

should work with the Waikato Regional Council to ensure salt water paspalum is removed from harbour beaches to maintain ecological and amenity values...

These recommendations and their application to specific areas in each of the three harbours are discussed below. The various recommended options are also discussed in more detail in the following section on management approaches. .

## Tairua Harbour Shoreline

### *The Esplanade Beach:*

The beach fronting The Esplanade at the base of Mt Paku is an extremely popular swimming area for families, with sheltered beaches and toilet facilities. There has been a seawall at this location for a long time to protect the narrow grassed reserve between the road and the shoreline. Historical files indicate that coastal erosion has been observed here since at least 1970.

The beach has recently been nourished with material from the dredging of the adjacent marina, and this has greatly reduced the height of the existing seawall, improving the ease of access and increasing the width of beach for recreational use. **Beach amenity should be retained with occasional nourishment as required.**



Figure 15: Esplanade beach, Tairua Harbour. Recent beach nourishment has significantly raised the beach level and improved the amenity value of the area.

### *Paku Bay:*

Paku Bay is becoming increasingly popular for walking and recreational use and as an easily accessible safe location for families, particularly with recent beach nourishment. It is adjacent to ample parking, a toilet block and is an attractive and safe swimming location for small children.

Two culturally significant trees lie very close to the shoreline in this area (Figure 16), and important artefacts have been found in the sand dunes behind the shoreline in the past. Discussions with local iwi would aid in developing a plan for management and protection of these values. The area has received considerable beach nourishment material from the recent marina dredging, which has enhanced erosion protection for the trees and the adjacent bank.

There is a large storm water outlet close to the marina which is submerged at high levels of the tide, and community members expressed concern that is a hazard to bathers – particularly small children. There is a plan in place for this outlet to be relocated into the marina, which will address this concern. The Council also has plans to relocate another stormwater outlet in the bay to a location further offshore.

**Beach amenity should be retained through occasional nourishment** if required. This will help to maintain the existing amenity value and to protect the culturally significant Pohutukawa trees as well as the grassed bank and dunes behind the beach and associated cultural deposits.

The Council should continue ongoing work to **enhance native vegetation** along the margin and the high bank, working with adjacent owners to maintain views while preserving trees for biodiversity and shade.



Figure 16: Paku Bay showing enhancement of the natural and amenity values by recent beach nourishment. The large pohutukawa tree near the centre of the beach (arrowed) is culturally significant and the nourishment has also enhanced protection of this tree which had been undermined by erosion and collapsed across the beach.

### *Manaia Road:*

The beach and grassed reserve fronting the private properties along Manaia Road is a popular and important area for recreation (particularly walking) and is close to town.

The beach in this area is backed by low lying residential properties, which have been subject to occasional flooding from the sea and local stormwater runoff. A low stopbank provides some protection from coastal flooding but the properties remain vulnerable to extreme flooding events. It is also important to recognise that projected future sea level rise would dramatically increase the frequency and severity of flooding. Appropriate minimum flood levels should be implemented for new dwellings and renovations in this area to provide for this risk.

The grassed reserve behind the beach has experienced slow erosion in the past and prior to the recent nourishment from the marina posed an increasing threat to flood protection embankment (which also contains an important water main) and to some trees.

There are also several significant stormwater outlets located along the beach, with erosion aggravated in the vicinity of these outlets. The outlets are important for the release of stormwater and significant flooding can develop if they block. The outlets also allow the ingress of seawater which can aggravate flooding during severe events; though the tidal exchange also appears to be important to prevent blockage of some of the outlets. Erosion protection was required at a number

of the stormwater outlets prior to the recent nourishment but is now less of a concern – though this will need to be monitored.

Recent nourishment using sands dredged from the Tairua Marina in 2014 has enhanced the beach width and provided increased erosion protection for the grassed reserve and flood embankment along most of the shoreline (Figure 17). The nourishment has also enhanced beach amenity and has generally received very positive feedback from the community and owners of adjacent properties. The nourishment however did not extend to the eastern end of the beach because owners of the adjacent (and particularly low-lying) properties were concerned that it may aggravate blocking of public and private stormwater outlets in this area.



Figure 17: Manaia Road Beach following nourishment in 2014.

The existing and the potential future aggravation of flooding problems in this area is complex and is likely to require a **site specific coastal hazard strategy** addressing a number of matters, including minimum floor levels, management of the stormwater outlets, the adequacy of the existing coastal flood protection embankment, management of beach nourishment and other matters. This strategy would need to be developed in consultation with affected land owners and the wider community and would also need to give emphasis to maintaining the high amenity values of this area. The strategy could also address enhancement of amenity in the Grahams Stream bridge area at the eastern end of the beach.

### *Pepe Estuary*

Public access along coastal margins is a high priority for coastal management. The Tairua working party indicated strong support for the community proposal to establish a **public walkway** from the town centre around the margin of the Pepe Estuary and back to the northern side of the SH bridge. This will significantly enhance recreational values and public access as well as providing a valuable connection between development around the Pepe Estuary and the town centre. Council is supportive and has allocated some funding towards this proposal in the 2015-2025 Long Term Plan,

though other funding will need to be raised by the community to enable the project to proceed. There are also various other issues that will need to be addressed for the project to proceed. As part of this walkway development, council will need to ensure that esplanade reserves are obtained during any beachfront subdivision in the area, to help complete and enhance the circuit around the estuary margin.

Currently there is no safe access for pedestrians across the state highway on the western side of the one lane bridge. Local residents are particularly concerned about the risk to children walking to and from Tairua School. We recommend that the Council **advocate with NZTA for an underpass** to be included in any future upgrade of the bridge.

### *Bay View Terrace to Mary Beach*

At the northern end of Bay View Terrace, beach nourishment has successfully created a wide sandy beach which is also currently protecting the road from erosion (Figure 18). The **beach nourishment should be maintained** as required to protect the road and maintain public amenity.

The beach is however being impacted by salt water paspalum which if left unchecked will eventually cover the beach. **Salt water paspalum should be controlled** to maintain and enhance amenity values of the beach.



**Figure 18: Shoreline at northern end of Bay View Terrace showing successful beach nourishment. Note that the beach is however gradually being covered by saltwater paspalum.**

Further south, this shoreline includes historic reclamation and there are a number of recent (Figure 19) and older protection structures built to prevent shoreline erosion. Some of the older structures include logs, pieces of concrete, waratahs, etc. These materials are a potential hazard, are unsightly and do little to prevent erosion. We recommend that **derelict structures** and associated materials lying on the beach are removed, with emphasis given to the use of beach nourishment as required.

The block wall is providing some protection to the reserve, though the rocks fronting the wall (presumably placed to prevent undermining of the blocks) negatively impact on the visual and recreational values of the beach and shoreline (Figure 19). These impacts could be reduced by the



use of beach nourishment in front of the block wall – with the rocks either removed or buried under the sand. It may however be difficult to establish a beach in front of the existing wall as it is currently located slightly seaward of the adjacent shoreline, and as a result may experience more severe erosion. If the wall was relocated landward it would be easier to create a beach using nourishment and would significantly improve the appearance and amenity values of the area.

In the area closer to Mary Beach, the shoreline contains various rocks and rubble which are currently serving little to no purpose and are unsightly and a potential safety hazard (Figure 20). We recommend that the rocks and rubble are removed and the area can be managed using beach nourishment if required. Some of this area will also be part of the upcoming redevelopment of Mary Beach wharf facilities.



Figure 19: Block seawall south of Bay View Terrace



Figure 20: Rocks and remains of structures near Mary Beach. Removal of these materials would improve public safety and amenity, as well as the general appearance of the area. It is likely that erosion in this area can be successfully managed using beach nourishment as required.

The low-lying shoreline, including the public reserve, footpath and lower areas of Bayview Terrace are occasionally inundated by sea flooding associated with periodic storm-elevated sea levels and occasional wave overtopping (e.g. due to longer period swell wave energy propagating through the entrance into the lower estuary, Figure 21). The flooding generally does not cause serious issues but can carry significant debris onto the road, footpath and grassed reserves. Over time, it may be practical to gradually lift the beach and back-beach areas with nourishment to reduce these sea flood episodes.



Figure 21: Recent (16 March 2015) flooding of Bayview Road.

### *Mary Beach Wharf*

At Mary Beach, Council is currently planning an upgrade of the reserve and Wharf - to enhance trailer boat access and improved wharf facilities for commercial operators and private use. The form of this upgrade will be determined through a process independent of this strategy.

There is also potential to significantly enhance the Mary Beach reserve areas for recreational use including elevating the area, with appropriate contouring and drainage to reduce wave overtopping and ponding. As noted above, most rubble and rock can probably be removed from the foreshore and erosion managed using beach nourishment. This work is all likely to be part of the redevelopment.

### *Petley Parade*

Further upstream at the eastern end of Petley Parade, there is a small area of private residential development immediately adjacent to the coast (Figure 22). In this area there is a private seawall and encroachment of private property onto public land. This area is close to the school and the current encroachment prevents access along the shoreline, particularly by school children.

In this area, the Council at some point in the future intends to improve public access, particularly as a safe walking area for school children travelling to and from the primary school. The best way to achieve this is likely to be through the development of a site specific management strategy, which

would be developed with the adjacent land owners and would need to cover a number of issues, including coastal erosion, encroachment, protection structures and public access.

Further upstream near the school there is a culturally significant pohutukawa tree. The toe of the bank has suffered slow erosion over time, and this can be managed by nourishment, which will also enhance recreational amenity and access.



**Figure 22: Shoreline at eastern end of Petley Parade. Note that the boundary of the public reserve is approximately where the white fence is in the foreground. The old block seawall was privately constructed, but lies on council reserve land.**

## **Pauanui - Estuary Shoreline**

### ***Royal Billy Boat Ramp to Pleasant Point***

The Royal Billy Boat ramp provides the main all tide public boat launching site in Pauanui, and the wharf is used to obtain ferry access to Tairua. The area is also very popular for swimming and other recreational use. While the parking facilities were upgraded in 2005, there is limited parking space for boat trailers. This will have to be addressed over time, and Council staff advise this is highlighted in the Council's ten year plan.

Ocean waves refracting through the entrance results in significant alongshore sediment transport from the entrance towards the boat ramp. A low groyne has been placed to help minimise sand encroachment over the ramp and plays a useful but limited role; with regular removal of sand required from the ramp. The shoreline immediately upstream (west) of the ramp appears to be slowly eroding (

Figure 23).



**Figure 23: Sediment accumulation on eastern side of Pauanui Wharf boat ramp (left), and eroding beaches to the west (right), where sediment should be placed. Arrows indicate dominant natural direction of sediment transport.**

Sediment removed from the boat ramp should be “bypassed” and placed on the western side of the ramp and used for estuary beach nourishment. As the dominant direction of sand transport is to the west, it is unlikely that most bypassed sand will return to the ramp. This approach will reinstate the natural pathway of sand transport that existed before the boat ramp was constructed, and should also help to reduce erosion of the reserve to the west (

Figure 23). Dredging and nourishment in this area of up to 2,000 m<sup>3</sup>/yr can be undertaken under an existing resource consent held by the District Council, which provides for the placement of harbour sediments on beaches between the boat ramp and Ajax Head. Further beach nourishment could be undertaken in the area if suitable sediment became available. Dredged sediments could also be used for dune restoration or reinstatement along the ocean beach. Placement of sediments in this area is permitted for volumes up to 100 m<sup>3</sup> but resource consent should be obtained from WRC allowing for greater volumes for such purposes.

The shoreline between Royal Billy Point and Pleasant Point is popular for families and recreational users, particularly for walking and running. The shoreline fluctuates but appears in places to be subject to very slow erosion; which may undermine trees over time.

Many of the pines in this area are coming near to their end of life, and succession planting is essential to ensure attractive reserves and ongoing shade for beach and reserve users. Local

residents wanting unobstructed views commonly remove young trees (e.g. pohutukawa) placed to provide succession. This is in violation of council bylaws but is difficult to enforce.

There is potential to improve access to and along the shoreline in this area with reshaping of the sloping reserve and removal of redundant structures, and potentially beach nourishment.

### *Pleasant Point to Ajax Head*

This shoreline is naturally subject to very slow erosion over time, due to net northwards alongshore sediment transport by waves towards past Pleasant Point and into the estuary. This sediment transport has formed a spit-like feature extending northwards into the harbour off Pleasant Point.

Historically, groynes have been placed to intercept the alongshore transport; with shoreline accumulation evident on the southern side of these features (e.g. Figure 24). However, as is frequently the case with groynes, there is also evidence of accelerated erosion on the downdrift (northern) side.

In the northern area of the shoreline close to Pleasant Point there are large pine trees close to the shoreline which could be affected by erosion over time – though historical aerial photographs suggest the erosion rate is very slow. Historical files suggest there is a longstanding history of erosion south of Pleasant point. In 1976, residents petitioned for groynes and beach replenishment south of Pleasant Point.

Further upstream, slow erosion has been managed in the past with beach nourishment using sand from the Waterways development (Figure 25). This nourishment considerably enhanced the beach and offset earlier natural retreat. While the nourishment has slowly eroded over time, monitoring by WRC indicates that some ongoing benefits extended over 10-15 years and longer.

The erosion along the Pleasant Point to Ajax Head shoreline could generally be lived with due to the wide reserve and the relatively slow rate of the erosion. It could also be managed with occasional beach nourishment as sand becomes available. In general, community feedback suggests a preference for management using nourishment rather than accepting slow ongoing retreat.

Saltwater paspalum becomes common southwards along the shoreline towards Ajax Head and if left unmanaged, is likely to increasingly cover estuarine beaches, reducing amenity values. As noted in other sections, saltwater paspalum is a significant and increasing problem around the margins of the estuaries and will need to be managed to maintain and enhance amenity and natural values.



Figure 24: Minor beach erosion south of Pleasant Point. The shoreline here is partly impacted by the groyne shown in the left foreground, which has restricted northwards sediment supply to the reserve.



Figure 25: Area of past beach nourishment between Pleasant Point and Ajax Head. The sloping grassed reserve was constructed using dredged material from construction of the Waterways access channel in the 1990s. Monitoring indicates that the placed sediment performed well and much of the placed sediment is still present, even though slow erosion is occurring.

### *Ajax Head to Tangatarori*

This area incorporates the shoreline fronting the Pauanui Waterways and the estuarine wetland immediately upstream. No major issues were identified by the community in relation to this area. However, it was noted that the grassed reserve along the margin of the Waterways is a popular roosting area for waders and other birds, probably due to the relatively low levels of human use and disturbance.

Low natural sand and shelly ridges occur in places over the intertidal flats towards Tangatarori and there may be potential to enhance these features as bird roosts with minor sand placement. This option could be explored, initially with small placements that are well monitored.

Saltwater paspalum is also extensive along the shoreline towards and beyond Tangatarori and extends over beaches in this area, diminishing amenity values. It is also spreading into the wetlands and over time may diminish the natural values of these areas. This should be controlled.

### *Tangatarori*

At Tangatarori, slow erosion of the bank is undermining large pine trees on the Council reserve and private development (Figure 26). Historical aerial photographs suggest the erosion is very slow.



Figure 26: Erosion of the bank at Tangatarori.

Appropriate management would require further investigation and dialogue with key stakeholders.

Intervention to stop the erosion is likely to be expensive and further investigation would be required to decide the most appropriate approach if this was the community preference. It might be possible to reduce erosion at the toe with sand placement but access would be difficult and the sediment may erode relatively quickly. Otherwise, some form of engineering structure would be required at the toe of the bank. This would be expensive and require resource consent.

If the erosion is not threatening important cultural values, the best course of action in the short to medium term could be to just to accept and to live with erosion. However, there would be value in removing trees prior to undermining to prevent the toppling trees tearing out large sections of the bank. Stumps and their root mass could be left to aid in stabilising the upper bank areas. However, caution is required with this on high banks as experience at other sites indicates that continued erosion of the lower bank can create hazardous overhangs.

It was noted that the trees currently provide shelter from south-westerly winds. If land owners are concerned about gradually losing this shelter, succession planting landward of the existing trees could provide ongoing protection in the future. Ideally, these plantings should be kept well back from the bank or otherwise the ongoing slow erosion may similarly threaten the plantings in decades to come. The present trees were originally planted too close to the top of the slowly eroding bank and this is a common problem on cliffs and bluffs of this nature.

### **Whangamata Estuary**

The estuary beach extending from Whangamata Wharf along Beach Road is an extremely popular area for families, with sheltered beaches and nearby toilet facilities. The shoreline is close to the harbour entrance and periodically experiences low but relatively long period swell waves refracting through the harbour entrance. There is also active sediment transport in offshore areas due to tidal currents.

Accordingly, the shoreline is relatively dynamic and periodically experiences quite severe erosion in the area closest to the entrance; particularly between the wharf and Rutherford Road.

### **Whangamata Wharf to Rutherford Road**

During the periods of severe erosion in this area there is often a significant vertical erosion scarp along the edge of the grassed reserve. In the past, the top edge of the erosion scarp has often extended relatively close to Beach Road, particularly between Bond and Rutherford roads. Access from Beach Road down to the beach is often difficult during such periods of erosion.

In the past, erosion in this area has led to construction of wooden groynes in places along the shoreline in an attempt to protect the grassed reserve and Beach Road (Figure 27 and Figure 28). There is some limited evidence of sediment accumulation against the groynes at times, but in general it appears the groynes have only had minor beneficial effect. For instance, some of the groynes (especially nearer the wharf) are completely buried during pulses of accretion (e.g. Figure 27); this burial due to natural sediment pulses and not to sediment trapping by the groynes. Past experience also suggests the groynes are not adequate to protect the shoreline during the periods of most severe erosion. Nonetheless, we recommend that the **existing groynes** be left in the interim until it has been more firmly established that are of little use, at which time they could be removed.





Figure 27: The shoreline immediately upstream from the Whangamata Wharf. The beach is presently in an accreted condition with the groynes buried. This relates to a natural pulse of sand passing through the area and the groynes have not played a significant role.



Figure 28: The shoreline adjacent to Beach Road, between Bond and Rutherford Roads. Erosion in this area can be severe at times and may threaten Beach Road in the future.

Beach nourishment has also been placed along this shoreline on a number of occasions. These placements often persist for useful periods during normal conditions; but tend to be rapidly lost during the rare periods of severe erosion. Despite this, beach placements in the 1990s helped mitigate severe risk to Beach Road and avoided the need for engineering structures.

However, in recent years, there has been less sediment available for nourishment with increased emphasis on “lift and drift” approaches rather than dredging to maintain the marina access channel.

The shoreline along Beach Road could be reshaped to improve access. It would be relatively easy to re-contour the reserve to reduce the gradient and lower the bank close to the shoreline. This would also assist in managing future erosion. In the event of future periods of erosion sufficiently serious to threaten the road, it may be possible to manage the risk with nourishment as in the past. Otherwise, some form of coastal protection structure is likely to be required. This option would require detailed investigation but it is possible a geotextile container structure would be the most appropriate structure. This would have less adverse effect on visual and amenity values than a rock wall and would also better facilitate beach access. A structure is only likely to be necessary between Bond and Rutherford Roads, but possibly over a length of up to 80-90 m. Unfortunately, such structures are relatively expensive.

There is an old wooden retaining wall near the Wharf that is in a poor state of repair. There is no real reason to remove or interfere with this structure while the beach is in accreted state, but the wall is likely to require replacement during the next phase of shoreline erosion.

### *Rutherford Road to Marina*

The reserve widens upstream from Rutherford Street, with several small bulges of sediment along the edge of the grassed reserve. Over time there is a slow movement of sediment from the upstream (i.e. northern) side of these features to the downstream. Accordingly, the “bulges” tend to move very slowly downstream over time – with very slow erosion on the upstream side and deposition and accretion on the downstream side. In the field the depositional areas are often composed of very soft sand.

However, notwithstanding this apparent alongshore migration of the bulges towards the entrance, historical aerial photography suggests that grassed reserve seaward of Beach Road has been relatively stable over the last 50-60 years. Any erosion along this shoreline is very slow and can readily be lived with. Ideally, picnic tables and other facilities should be moved if ever threatened. Any tree plantings should be kept back from the shore, particularly on the upstream side of the grassed reserves.

In the unlikely event that more significant intervention was required, small beach nourishment placements would be sufficient to manage periods of erosion. If there is no sand source, it would also be possible to simply transfer sand from the areas of accumulation and/or push sand up from the lower shores.

### *Otahu Estuary*

The coastal reserves of the outer Otahu Estuary (particularly from the entrance to Kotuku Road) are highly utilised for recreational activities. These beaches provide safe and sheltered swimming spaces for young families, and the adjacent reserves have space and shade.

At the downstream end of the estuary, the shoreline adjacent to the Otahu Point historic reserve experienced erosion in the early 2000s threatening an area significant to Maori – being the site of various historic battles and also containing urupa. The area also contains some early European graves. A wooden wall was constructed to protect this area in 2005 (Figure 29). The wooden wall has protected the urupa to date and should continue to provide adequate protection with

appropriate maintenance. While there is minor erosion further upstream, there is no need to extend the wall at this point in time.

The area extending some 300-340 m upstream from the wooden wall has experienced periods of erosion in the distant past (evidenced by old erosion scarps), probably associated with periods when the estuary channels were located close to the shoreline. However, the area is currently fronted by a beach and wide intertidal flat. In the event that periods of erosion occur again in this area, the erosion can simply be lived with, as the rate of erosion is likely to be slow and there is a wide reserve landward of the shoreline.

Further upstream, in the embayment which extends either side of Kotuku Road, there are channels close to shore and the shoreline in this area has experienced slow erosion for the last few decades. This has led to the construction of a wide range of shoreline protection structures including groynes and gabion seawalls (Figure 30). The seawalls are currently protecting the shoreline from erosion but are unsightly. It is not clear whether these structures were really required, as the erosion rate over time was relatively slow and there are wide reserves in this area. The groynes are presently having only minor beneficial effect and the shoreline around these features continues to slowly erode. This erosion scarp formed in the area made access and use difficult in recent years, particularly for older folk who frequently use the area to swim in the nearshore channel at higher stages of the tide.

The erosion could be managed by placement of shoreline armouring similar to the existing gabion structures. However, this would be very expensive and would also further degrade the natural and amenity values of the shoreline. Given that the rate of erosion is extremely slow and there is a wide grassed reserve landward of the shoreline, we believe that reshaping and contouring a short length of bank would be preferable; realigning (retreating) the shoreline sufficiently over a short length to form a beach, combined with contouring the bank (including lowering the bank near the shore) to provide easy access. The removal or (ideally) relocation of one or two trees may be required. This landward realignment would only require a small proportion of the reserve width and would avoid the need for coastal protection works while providing a high tide sandy beach for recreational use. This option would significantly enhance access and amenity for much less cost than a sea wall. The groynes could be left in the meantime with minor upgrade to improve their effectiveness.

In the longer term, the approach of living with erosion in Otahu Estuary could also be applied. For instance, as the existing sea walls degrade over time and come due for replacement, consideration should be given to the consequences of simply removing these structures and living with erosion.

It may also be possible to reduce the adverse effects of the various stormwater outlets with attempts at more innovative approaches. For instance, in the area immediately upstream of Kotuku Street two significant stormwater outlets extend into the estuary. These structures are unsightly and are flanked by hard protection structures (Figure 31). The working group also noted unsightly rocks and potentially contaminated deposits of mud in the vicinity of the outlet.

In the longer term, when the local stormwater outlets and protection works ultimately require upgrade or replacement, alternative options should be sought that are more compatible with the natural and amenity values of the area, as discussed in the general strategy for estuary beaches above.



Figure 29: Wooden wall protecting the estuary shoreline of Otahu Point historic reserve at the entrance to Otahu estuary.



Figure 30: Shoreline protection works in Otahu Estuary, east of Kotuku Street. The gabion basket wall in the background is beginning to deteriorate.



Figure 31: Stormwater outlets in Otahu Estuary near Kotuku Road

## Management Approaches

### *Beach Nourishment*

Beach nourishment works more closely with nature by increasing the volume of sand on the beach and providing improved hazard protection to the shoreline. On ocean coasts, the approach requires very large volumes of sand and is usually not cost-effective or practical. However, on estuarine shorelines, very low volumes are typically required and the low wave energy means that the sediments are not quickly washed away and the approach can usefully mitigate erosion for lengthy periods. Moreover, the Waikato Regional Coastal Plan requires dredged sand to be returned to the coastal marine area, meaning that nourishment can often be conducted for little to no cost as part of other consented activities.

Most nourishment projects require some maintenance over time as some of the material is slowly moved away from the beach by waves and currents. However, on estuary beaches, the rate of loss is often very slow.

Historically (since the 1990s), several small scale beach nourishment projects have been successfully implemented for erosion control in Tairua and Whangamata estuaries. The benefit of beach nourishment is that it enhances the public use values of the beach while providing erosion protection to the assets behind. Care needs to be taken to ensure appropriate sediment is used, which is similar to the natural environment, and to avoid smothering of near shore seagrass beds.

For instance, a number of beaches around Tairua Harbour have recently been enhanced with sediment taken from the Tairua Marina dredging (Figure 32). The cost of this work was largely covered by the marina developer. The general feedback from adjacent residents and the wider community has been very positive. This nourishment has provided wide beaches for recreational use, has improved the general appearance of the shoreline and has provided improved protection against coastal erosion and flooding.

As discussed above, most estuary beaches in Tairua can be managed successfully using the ongoing supply of suitable sandy sediment from maintenance dredging. The same approach could be used at sites in Whangamata and Otahu estuaries, but the supply of suitable sand is likely to be much less.



Figure 32: Sediments from the Tairua Marina development have been used successfully to enhance the beach at Manaia Road.

### *Adjustment*

In some locations, it may be appropriate to live with erosion and/or relocate development so that it is no longer threatened by coastal hazards. This can be a useful option where the value of the assets is relatively low, there is plenty of space and/or where nearshore assets can be readily moved.

Coastal development setbacks are a widely applied approach to adjustment, particularly on open coast beaches. Setbacks are used to identify areas at risk from erosion or other hazards, and restrict development within this area to gradually reduce risk over time. Development setbacks are a key form of coastal erosion hazard management on Coromandel ocean beaches.

Adjustment can also be an effective and relatively low cost approach to managing shorelines where there is a wide public reserve and erosion is temporary, or very slow. In these situations, adjusting and/or reshaping the shoreline to better reflect the local natural processes can be enough to greatly improve natural character and public amenity values without major cost or significant loss of land.

### *Coastal Inundation*

Where there is a risk from coastal inundation, minimum floor levels provide a way to avoid damage to dwellings while accepting that the property itself may be occasionally inundated. Alternatively, flood defences such as stop banks can be constructed, but these need to be carefully designed so they don't impact on views or generate problems with storm water management. Both of these approaches are likely to be part flood management at places like Manaia Road, Tairua.

### *Engineering Structures*

Historically the most common approach to managing coastal erosion has been to construct shoreline protection works – engineering structures designed to prevent mitigate or erosion such as groynes and shoreline armoring works (i.e. sea walls). If well designed and constructed, these structures can

provide effective protection to the shoreline in the short to medium term. However, they are typically relatively expensive and can generate undesirable environmental effects, including visual effects, impacts on public access and loss of beach width.

Due to adverse effects, national and regional policies now generally discourage these measures – so that they are the last choice rather than the first. The NZCPS directs councils to limit the use of “hard” coastal protection structures to where they are necessary to protect regionally significant public assets/infrastructure. The national policy also directs councils to ensure that any structures built to protect private property from erosion should be located on private land unless there is significant public or environmental benefit to locating it on public land.

In some situations where significant assets (e.g. roads) are under serious threat from erosion, there may be little choice but to use a structure. However, in many situations, particularly around estuarine shorelines there are often far more cost-effective and appropriate options to manage erosion.



Figure 33: Coastal protection structures in Otahu Estuary.

### *Site Specific Strategies*

In some situations, coastal hazard risk can be quite complicated to manage and requires a suite of approaches. In these areas, the best approach is usually for the Council and property owners (and often the wider community) to work together to develop a site specific strategy. These strategies need to consider the range of affected parties and impacts of different approaches. A site specific strategy will usually comprise a range of methods to manage coastal hazards and preserve other important values. Details of these strategies vary, but can include development setbacks, protection



structures, adjustment/realignment and the restoration of natural physical and ecological environments.

### *Ecological Values*

There are very few safe roosting areas for wading birds at high tide in Tairua and Whangamata. Mainland sites are frequently disturbed by human activity and particularly dogs. There is potential to create more high tide roosting areas in the form of low chenier (sand and shell) islands within the estuaries, such as those created in Paku Bay as part of the Tairua marina development (Figure 34). This can be achieved by slightly increasing the elevation of existing sand/chenier ridges so that they remain exposed at high tide.



**Figure 34: High tide bird roosting island in Paku Bay.**

Some areas on the estuary margins are becoming covered by salt water paspalum. If left unmanaged, this plant will completely cover these estuarine beaches, reducing amenity values. In other places the paspalum is encroaching on dotterel nesting areas. The Waikato Regional Council undertakes some salt water paspalum control by spraying with herbicide, but resources are limited, and not all areas can be addressed by the Regional programme.

### *Public Access and Recreational Values*

Coastal protection structures and storm water outlets can often impact on the width and accessibility of beaches for the public. Where structures are in a poor condition or are badly designed they can also be a hazard to beach users. Beach nourishment can be a useful method to provide coastal erosion protection while also enhancing the value of the beach by widening the beach and in some cases burying coastal protection structures.

In many areas of the estuary margin, shade is limited or is currently provided by large trees that are nearing the end of their life (e.g. Pauanui). Succession planting is critical to providing ongoing shade for reserve users. Often there can be conflicts with land owners who seek to maintain (or increase) uninterrupted views of the water. Ongoing negotiation and succession planting is therefore essential

to maintain the amenity value of the coastal reserves. In some cases, existing trees can be pruned in a manner that maintains or enhances views. For example, mature pohutukawa trees can have lower limbs removed or thinned to allow views underneath and through the tree.

## 5 TSUNAMI

Like most of the northeast coast of New Zealand, the eastern coast of the Coromandel Peninsula is vulnerable to the effects of tsunami events. These events can be generated from nearby sources (local or regional faults) or can be distantly generated (e.g. from South America or Japan).

The Waikato Regional Council has been working with Thames Coromandel District Council since 2011 to plan for future management of tsunami risks at beachside communities. The project has included scientific research and modelling and consultation with local communities to discuss evacuation, public awareness and planning. Community consultation and planning work has been completed at Tairua and Pauanui in 2013/14 and at the time of writing is underway in Whangamata.

As part of this project, summary reports have been prepared for each township which outline tsunami hazards, the issues and options for managing tsunami risk, and the process for deciding how best to manage those risks. Communities are considering improvements to education, signage, evacuation planning and the identification of easily accessible “safe” locations.

A draft tsunami risk management plan has been developed for Tairua and Pauanui and has been endorsed by the local community board. The plan identifies future actions in three categories – evacuation, public education/awareness and land use planning/building standards. Actions are prioritised into urgent and important, with urgent actions proposed for the first year of implementation (2014/15). The tsunami working group has identified a number of suggestions for ongoing risk management, which are summarised below and in Appendix G.

The project has highlighted the need for ongoing and increased education and signage to improve tsunami awareness and understanding of evacuation routes and planning. Local modelling of tsunami risk will be used to encourage people to have a personal evacuation plan for home and public spaces and buildings (e.g. schools). The tsunami working group has suggested that local safe areas should also be publicised, in case of a large near source tsunami when there is no time to evacuate to high ground. This project has also highlighted the need to consider tsunami risk when locating public and critical service buildings in the future, as well as reviewing design standards for new buildings in high risk areas. The risk management plan also highlights the importance of dune conservation and beach care in maintaining natural buffers that provide protection to inland areas.

## Appendix A: Areas Covered by the Strategy

### Tairua & Pauanui



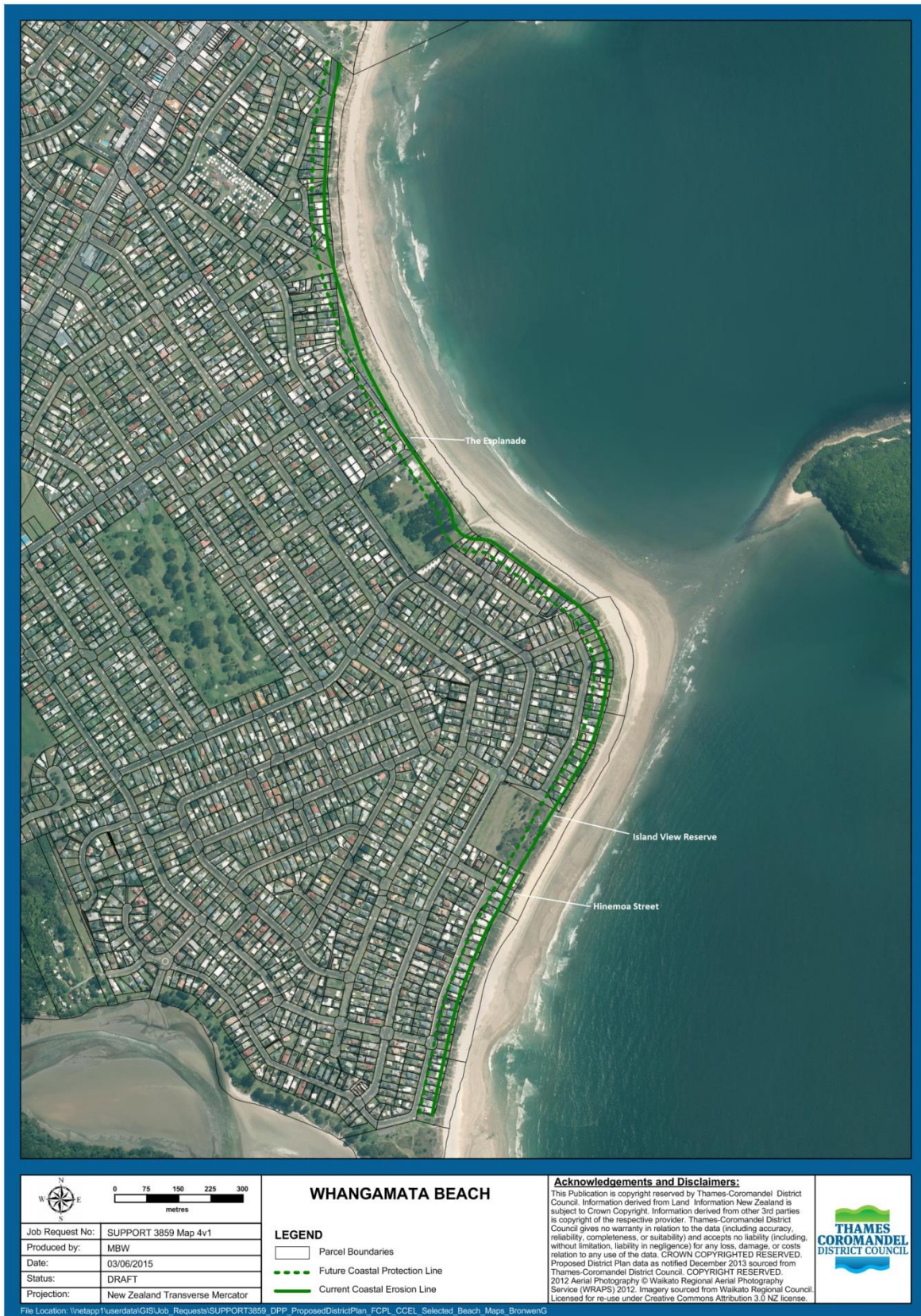
### Whangamata



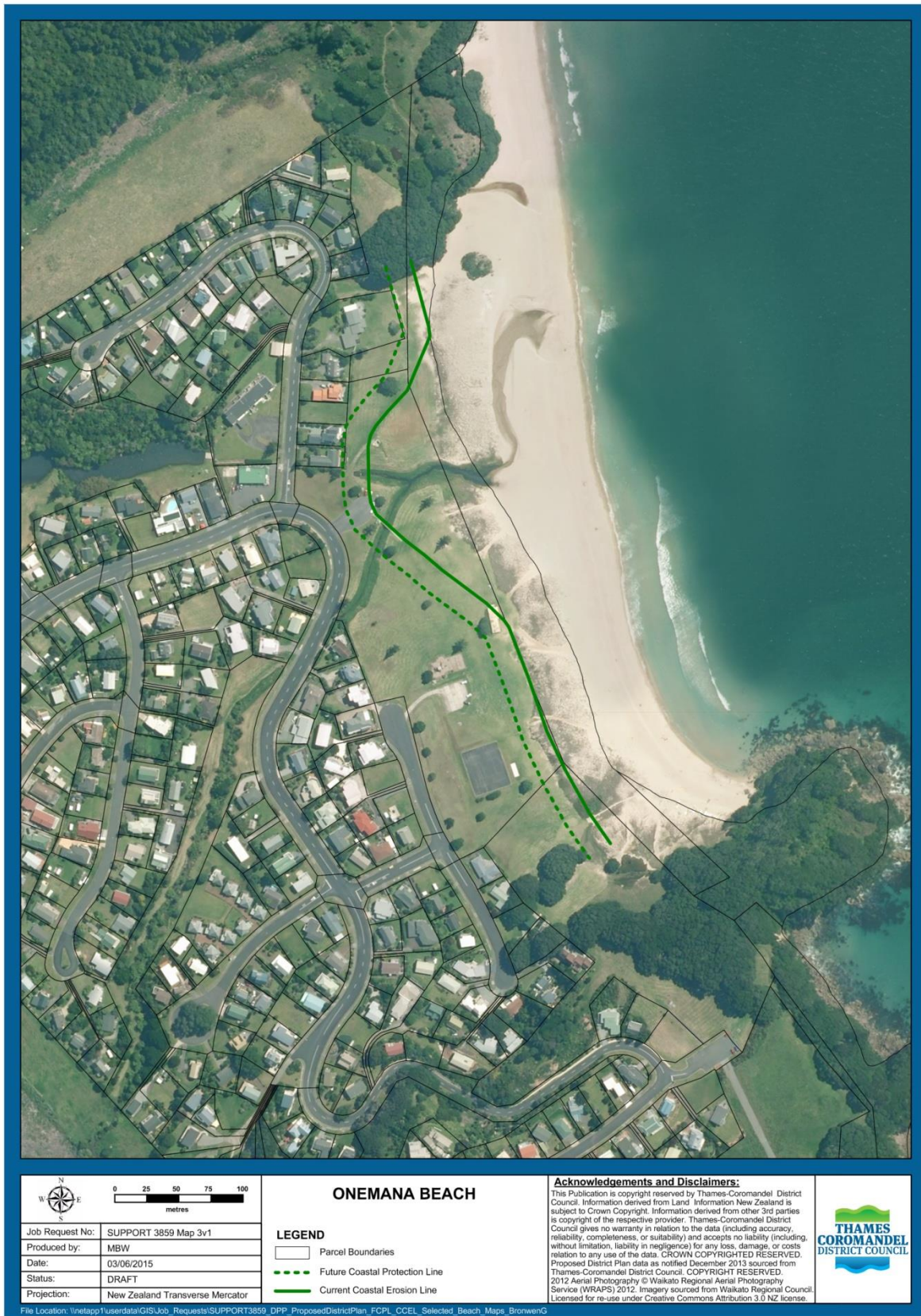
The general recommendations for ocean beaches also apply to Opoutere and Onemana ocean beaches, even though detailed site-specific recommendations were not developed for these sites.

Similarly, the general guidelines for management of estuarine shorelines will also be broadly applicable to Wharekawa Estuary (Opoutere) – though some elements are less applicable. For instance, beach nourishment is not likely to be as readily applicable to this site as other harbours where periodic dredging provides suitable sand.

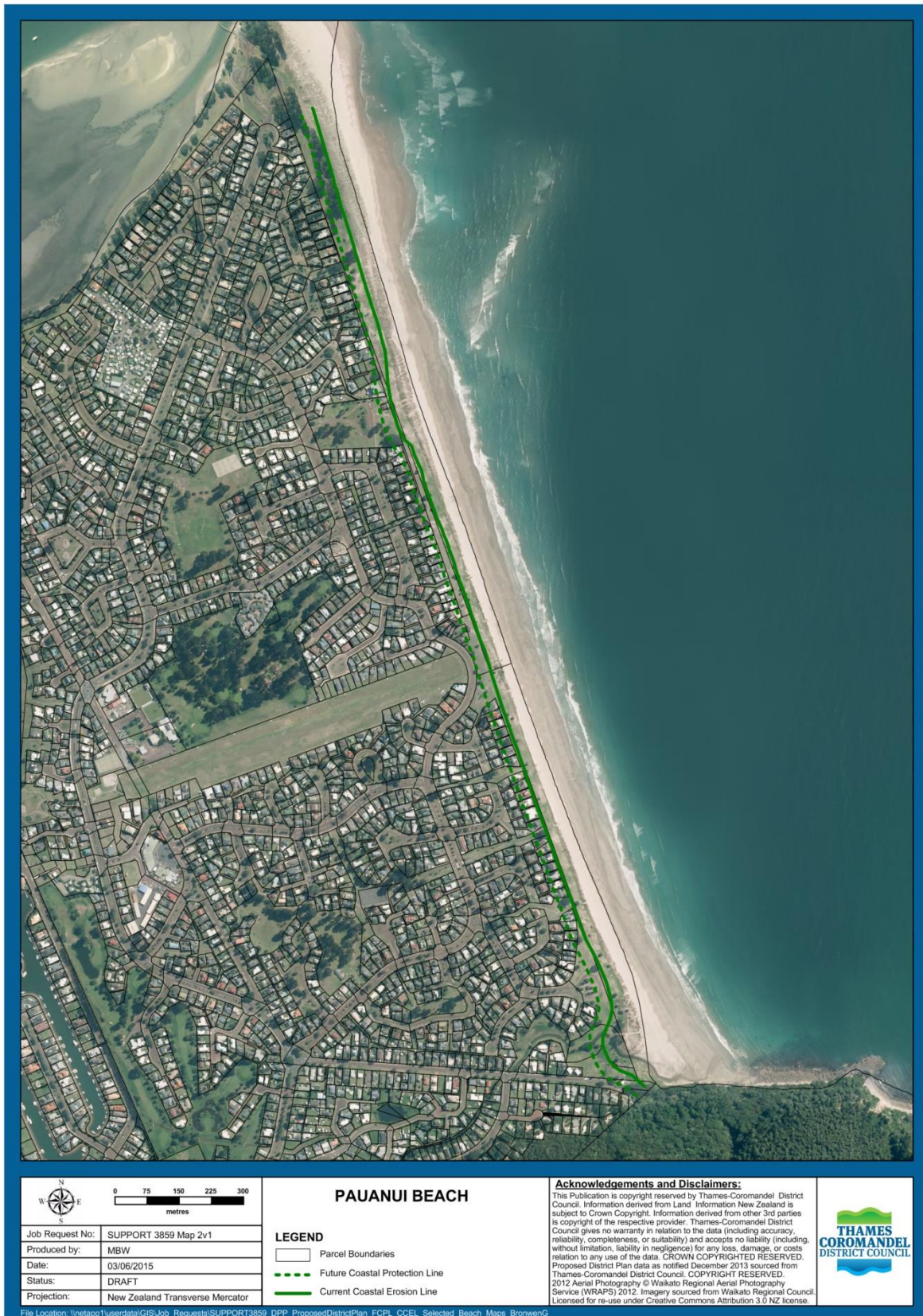
# APPENDIX B: COASTAL HAZARD RISK AREAS – WHANGAMATA



# APPENDIX C: COASTAL HAZARD RISK AREAS – ONEMANA



# APPENDIX D: COASTAL HAZARD RISK AREAS – PAUANUI



# APPENDIX E: COASTAL HAZARD RISK AREAS - TAIRUA



## APPENDIX F: COUNCIL BYLAWS

**Thames-Coromandel District Council  
Consolidated Bylaw 2004  
Part 17 Parks and Reserves 2008**

### **1703 ACCESS TO RESERVES**

#### **1703.1**

Subject to the provisions of this Bylaw and the Reserves Act 1977, all reserves will be open to the public.

#### **1703.2**

The Council may determine the times during which a reserve, or any part of a reserve, will be closed to the public.

#### **1703.3**

No person, other than a Custodian, may enter or remain in a reserve, or any part of a reserve, while it is closed to the public.

### **1704 LEASED OR LICENSED PREMISES IN RESERVES**

#### **1704.1**

Subject to the provisions of the Reserves Act 1977, the Council may lease premises in a reserve to any organization or member of the public, or license any organisation or member of the public to use premises in a reserve, upon any conditions the Council considers appropriate.

#### **1704.2**

No person may enter or use any premises in a reserve that are subject to a lease or a licence other than the Custodian or any other person in accordance with a lease or licence.

### **1705 NO ENTRY INTO RESTRICTED AREAS OR PLACES IN RESERVES**

#### **1705.1**

The Council may specify any area or place in a reserve to be a restricted area or place.

#### **1705.2**

No person may enter a restricted area or place without the prior written permission of Council.

#### **1705.3**

Every person to whom the Council grants permission under clause 1705.2 must comply with any conditions imposed by the Council in that written permission.

### **1706 PROHIBITED AND RESTRICTED ACTIVITIES IN RESERVES**

#### **1706.1**

Every person commits a breach of this bylaw who without the prior permission of the Council:

- (a) removes, destroys damages, defaces, obstructs, disturbs, or otherwise interferes with any thing, or any part of any thing, in or enclosing a reserve, including any:
  - (i) structure



- (ii) sign, notice, label, inscription, billboard, or placard
- (iii) path, track, lawn, step, gravel, sand, soil or border
- (iv) tree, shrub, or plant of any kind, including hedges flowers or flowerbeds
- (v) area prepared for any sport or game
- (b) removes, destroys, injures, disturbs, shoots, snares, traps or otherwise interfere with any animal in a reserve, unless using a firearm in accordance with permission granted under clause 1712.2 of this Part of this bylaw.
- (c) plants any tree, shrub, or plant of any kind, or sows or scatters the seed of any tree shrub, or plant of any kind in a reserve.
- (d) pollutes or renders unfit for any purpose any water in a reserve.
- (e) swims, wades or washes in any ornamental water in a reserve.
- (f) erects, constructs, makes, or places in a reserve, without the prior written permission of the Council, any structure, walking track, cycling track or other cycling facility, dam, tree-fort, sign, notice, label, inscription, billboard or placard.
- (g) scatters the ashes of a deceased person in any reserve.

#### **1706.2**

Every person to whom the Council grants permission under clause 1706.1 must comply with any conditions imposed by the Council in that written permission.

### **1707 VEHICLES IN RESERVES**

#### **1707.1**

Every person commits a breach of this bylaw who without the prior permission of the Council:

- (a) drives, rides or otherwise brings any vehicle into a reserve except on any part of the reserve set aside by the Council for vehicular traffic; or
- (b) parks any vehicle in or adjacent to a reserve except in a place set aside by the Council for the parking of vehicles, and unless the person in control of the vehicle intends to remain in the reserve while the vehicle is parked; or
- (c) abandons or dumps any vehicle in a reserve.

#### **1707.2**

No person shall without the consent of Council or an authorised officer on any public place:

- (a) Fly from or land any helicopter, aircraft or similar thing except for emergency purposes.

### **1708 ANIMALS IN RESERVES (OTHER THAN DOGS AND HORSES)**

#### **1708.1**

No person may take ride or drive any animal (other than a dog or a horse) into or in a reserve, or allow any animal (other than a dog or a horse) in the person's custody or charge or under the person's control to be in a reserve, without the prior written permission of the Council.

#### **1708.2**

Every person to whom the Council grants permission under clause 1708.1 must comply with any conditions imposed by the Council in that written permission.

### **1709 HORSES IN RESERVES**

#### **1709.1**

## APPENDIX G: TSUNAMI MANAGEMENT ACTIONS

<b>1. Evacuation</b>			
<b>Actions</b>	<b>Comments</b>	<b>Priority</b>	
		<b>Urgent</b>	<b>Important</b>
1a. Confirm evacuation: <ul style="list-style-type: none"> <li>• Assumptions</li> <li>• Routes</li> <li>• Safe areas</li> </ul>	New inundation information indicates that primary evacuation route is in worst affected area	✓	
1b. Update evacuation procedures	Procedures may change based on assumptions, routes and safe areas	✓	
1c. Confirm warning procedures in support of updated evacuation procedures. Ensure linkages to siren testing and evacuation drills.	Ensure appropriate response to events is clear (such as no land threat from distant events)	✓	
1d. Confirm signage – what type and where	Ideas include maps, evacuation signs, ‘blue lines’, elevation markers etc.	✓	
<b>2. Public education/awareness</b>			
<b>Actions</b>	<b>Comments</b>	<b>Priority</b>	
		<b>Urgent</b>	<b>Important</b>
2a. Regular awareness raising through local media on natural warning signs, evacuation work/procedures and personal preparedness  Emphasise awareness efforts increased at holiday times	Identify all possible methods such as regular radio updates, posters, information centre and other methods on an ongoing basis	✓	
2b. Work with businesses to raise awareness	Can provide information packs to business owners, work with Bachcare hostesses and owners, push messages through tourism managers	✓	
2c. Identify opportunities to raise awareness locally via community events and local community groups throughout the year	Target existing events/local groups and develop information as an add-on tool. Methods could include guest speakers, annual open days,		✓

	evacuation drills, siren testing, information packs etc.		
2d. Support development of evacuation plans from public buildings/spaces and businesses	Proactive facilitation of evacuation planning – such as informing businesses about safe areas		✓
2e. Support dune conservation and beach care work	Help to raise profile of the importance of dune care via tsunami work		✓
<b>3. Land use planning/building standards</b>			
Actions	Comments	Priority	
		Urgent	Important
3a. Help to promote land use planning rules for critical facilities	District Plan changes will drive this. Community Response Committee can help support rules locally		✓
3b. Design standards for buildings in tsunami hazard areas	Review possible building designs and champion changes to buildings		✓

### Additional Suggested Actions Proposed by Working Group

Current emergency management arrangements work well, and there are some things that could be improved:

- More evacuation signs especially at beach and harbour access points where there is a risk. Signs will be on display at the open days, plus a map of where the evacuation routes are located.
- Using tsunami awareness blue lines on low lying roads to identify the 20 metre contour line, as used in Wellington's 'Blue Lines' Project. The blue lines would also be an ongoing reminder to encourage people to plan their evacuation routes before they need to use them.
- Evacuation maps posted on Surf Club buildings.

Emergency planning will also be enhanced by using the local modelling information to:

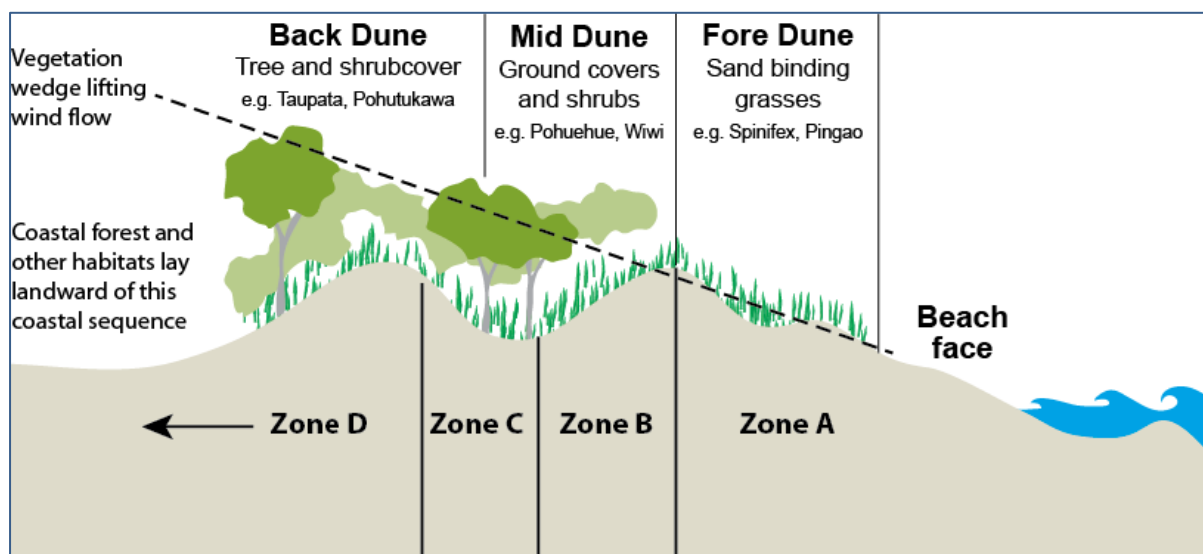
- Encourage everyone to have and review a personal plan - including a plan for when they are not at home.
- Raise public awareness of plans for evacuation from public spaces and buildings they frequent such as schools.
- Identify other safe areas that are easily accessible that could be used as a last-resort refuge in the event of a large near source tsunami.
- Change the rules regarding the location of future public and critical service buildings to avoid future risk.
- Review design standards for new buildings in risk areas.

Raise support for and public awareness of the importance of dune conservation and beach care in protecting coastal land.

## APPENDIX H: NATIVE DUNE PLANT SPECIES

The figure below shows a typical native dune sequence of vegetation from sand trapping vegetation on the frontal dune through to backdune shrubland and forests. It is now rare to find the full sequence of this vegetation.

This section identifies some of the key species occurring in these various zones on the eastern Coromandel. The list is not exhaustive but covers most of the more common species that can be observed and which should be used in restoration work where appropriate.



### Key Native Frontal Fore Dune (Zone A) Species

Spinifex (*Spinifex sericeus*)

Pingao (*Ficinia spiralis*)

Sand convolvulus (*Calystegia soldanella*)

*Carex pumila* – generally limited to low-lying damp areas or near stream entrances (e.g. Onemana)

Sand tussock (*Poa billardiarei*) - rare but occurs in limited areas at Tairua and elsewhere

### Key Native Mid Dune (Zone B-C) Species (Vineland/rushland)

Knobby club rush (*Ficinia nodosa*)

Pohuehue (*Muehlenbeckia complexa*)

Sand wind grass (*Lachnagrostis ammobia*)

*Carex testacea*

Sand coprosma (*Coprosma acerosa*) – rare

Native spinach (*Tetragonia trigyna* and *Tetragonia tetragonioides*) – primarily in shade

Sand pimelea (*pimelea villosa*) – very rare

Sand Tussock

**Back Dune (Zone D) shrubland and trees**

Karo (*Pittosporum crassifolium*)

Coastal five finger (*Pseudopanax lessonii*)

Taupata (*Coprosma repens*)

Akeake (*Dodonaea viscosa*)

Flax (*Phormium tenax* and *Phormium cookianum*)

Toetoe (*Austroderia splendens* and sometimes *Austroderia fulvida*)

Mahoe (*Meliccytus novaezealandiae*) – often also an early shrub emerging in vineland

Pohutukawa (*Metrosideros excelsa*)

Karaka (*Corynocarpus laevigatus*)

Puriri (*Vitex lucens*)

Once coastal shrubland gets established many other species also occur. Similarly, in coastal forest – but there are presently no areas of coastal forest left on eastern Coromandel dunes)

## APPENDIX I: UNDESIRABLE EXOTIC AND WEED SPECIES

A wide range of exotic vegetation now occurs on eastern Coromandel dunes and planting of any exotic species should ideally be avoided on Council's dune reserves. Many of these exotic species can be very weedy on dunes and significantly displace native species impacting on ecological values and natural dune function.

An exhaustive list is not practical but at present the key problematic weed species at the urban dune sites covered by this strategy include:

- Gazanias – extremely serious weed on coastal dunes in strategy area, pretty flowers but gradually inhibits and displaces natives.
- Agapanthus – spreads over time and extensively displaces native vegetation
- Kikuyu (*Pennisetum clandestinum*) – invades seaward from lawns and reserves and displaces native sand binding grasses.
- Buffalo grass
- Bushy asparagus (*Asparagus aethiopicus*) – very serious weed once established, occurs at Whangamata but still rare. Requires early control to prevent widespread problems.
- Arctotis (various species) – spreads and smothers natives
- South African ice plant (*Carpobrotus edulis*) -
- Most cacti, aloe, agave and yucca species are also problematic and can become serious weeds over time

The planting of these species on dune reserves should be strictly avoided and the species progressively eliminated as practicable.

It is very important to also avoid dumping garden waste on coastal dune reserves as this activity is a major source of weed invasion on dunes and associated degradation of ecological values.

Hares tail is an exotic species which is relatively widespread but which does not tend to seriously displace natives and is therefore less problematic. Accordingly, control of this species is not a priority.