Beach-front battles - repelling tides at Amberley

By GREGORY BENNETT, engineering officer, Hurunui District Council, Amberley

Throughout history people have been attracted to the sea. They built their homes close to it and in the process altered the natural character of the shore in order to gain better access or a better view. This has resulted in destruction of indigenous vegetation and the removal of protective dunes.

In 1994 the New Zealand Coastal Policy Statement was issued to guide Local Authorities in their day-to-day management of the coastal environment. Policy 1.1.4(a) states: It is a national priority for the preservation of natural character of the coastal environment to protect the integrity, functioning, and resilience of the coastal environment in terms of the dynamic processes and features arising from the natural movement of sediments, water and air.

Engineers have attempted to hold the sea back with various types of barriers. This difficult task can be achieved at great financial cost. Once the barriers are in place, more money is required to keep these assets in good working order, as the sea continues its relentless onslaught.

Throughout New Zealand there are many examples of these structures built with various materials, such as concrete, timber, tyres and railway irons. These structures tend to be aesthetic eyesores, completely destroying the natural character of the beach. They often also result in changes to natural sediment movement and exacerbate erosion elsewhere along the shoreline.

In recent years engineers have realised that there are better solutions for dealing with coastal erosion than utilising these "hard" structures. Those "soft" options, more consistent with the Coastal Policy Statement include utilising sand-binding plants such as spinifex and pingao to catch wind driven sediment, or nourishing with similar material to replace eroded material.

Background

Amberley Beach, approximately 5km east of Amberley township and 50km north of Christchurch, was first settled in the 1950s. The area is low-lying, being only 3-4m above Mean Sea Level (MSL). The predominant vegetation is marram grass and iceplant with mature pine trees on the back-shore.

The beach is an open, high-energy coast composed of mixed sand and gravel sediments, with mean grain size of 2mm in the swash zone and 5.5mm on the upper foreshore. It has a steep beach gradient and there is often swash cusps formed in the gravels typical of reflective gravel beach morphology.

Amberley Beach lies at the northern end of an extensive progradational coastal plain along the fringes of Pegasus Bay. The plain is at its widest (6km) where it joins Banks Peninsula and tapers to less than 1km wide at Amberley Beach. This wedge of sand and gravel has been laid down in the last 6500 years, giving an average rate of shoreline advance at Amberley of around 0.15m/yr over this period (Flatman, 1998).

The Waimakariri, Ashley, Kowai, and Waipara rivers draining into Pegasus Bay are believed to be the primary source of sediment for this progradation. The steeper slopes of the lower plains north of the Ashley River result in the Kowai and Waipara Rivers delivering gravel to the coast - hence the coarse gravel material found at Amberley Beach. The Ashley and Waimakariri Rivers, being in flatter country, only deliver sand to the coast, hence the transition within Pegasus Bay from a mixed sand/gravel coastline in the north to a sandy coastline in the south.

Studies have shown that Amberley Beach has been growing in size and accumulating gravel at rates of between 0.18 and 0.46m/yr since the 1860s and entered into its erosional phase in the late 1960s and early 1970s.

The increased vegetation density in the catchments (exotic forestry) and river corridors (willow, gorse and broom) of the Waipara and Kowai rivers over the last 50 years has resulted in reduced volumes of gravel flushed to the coast during floods. In some places the main channel of the Waipara has narrowed in width by 50-70% and the river is now tending to become anastamosing rather than braided. Ironically this trend seems to be re-establishing a river environment similar to that existing pre European settlement, i.e. the first settlers cleared the land of most of the natural vegetation allowing unrestricted flows during floods causing the coastline to accrete. The river corridors are now re-vegetating, albeit with exotic plants, and the coast is eroding

Erosion at South Crescent...rough seas take a toll on the beach front at Amberley.

as a result of that process.

During 1992 Pegasus Bay was subjected to three significant coastal storms, with the most intense being in August when snow was recorded at sea level in Christchurch. The waves at Amberley Beach inundated parts of the settlement and a civil defence emergency was declared. Parts of the beach settlement were evacuated. The beach profile survey conducted after the storm showed a 5m retreat of the beach crest.

At the request of property owners, the Hurunui District Council decided to build the beach crest up to 5m above MSL along the shore in front of South Crescent. A total volume of 4,800m3 of material was sourced from a nearby gravel pit. This re-nourishment has been successful in preventing further inundation, however, the erosion continued.

Between July 2001 and April 2002 three significant storms hit the Canterbury coast:

A number of options were considered and a decision in favour of another re-nourishment was chosen.

Sediment supply

When investigating possible sources of suitable material, Christchurch Ready Mix Ltd, who operate a sand mining operation from pits located approximately 800m from the beach, generously offered their tailings, with a size range of 6–40mm, at cost. This material was ideal as the quarry is where the coastline was, possibly 2000 years ago. So in effect old beach material is being recycled back onto the beach. The imported gravels were indistinguishable from the existing, once the waves reworked them. Ready Mix hold a 35-year consent to mine this area so it is expected that there will be plenty of material for ongoing re-nourishment.

Resource consent was applied for in December 2002 and granted by Environment Canterbury in February 2003. The consent is valid for 20 years with 20 conditions, including one that states that the re-nourishment is to be maintained with additional gravel, up to 6,000m3, at least every five years.

Has re-nourishment worked?

During October 2003 there was a southerly storm that gave the re-nourishment a real test with waves washing right on top of the crest. The Banks Peninsula wave buoy, at the time, measured waves at 8m. If the foreshore were not increased in height the waves would have washed over, flooding the lower areas of the back-shore and possibly the road. The storm exposed some of the old beach scarp near the northern end of the beach. This led to scouring as the energy of the waves being reflected by the scarp caused the beach material to be eroded and washed away. The existing marram grass contributed to this problem because its tight matted root structure was stabilising the old beach material. This phenomenon is typical of the problems caused by sea walls. Where the old scarp was not exposed, the re-nourished material coped well, with the loose nature of the gravel dissipating the energy of the wave.

Repairing damage...a regular exercise at Amberley Beach over the years.

The re-nourishment has now been exposed to periodic high swells and the sea has naturally shaped the foreshore. The front slope is now ranging between 1:2.5 and 1:3.8 Environment Canterbury carried out surveys in September and November 2003. Their

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findings indicate that the sea has reworked the re-nourishment material and moved some from above the 3m contour to the toe of the re-nourishment. They calculated that there was an increase of approximately 11,780 cubic metres of material.

Conclusions

If Amberley Beach were to have suffered these erosion problems before RMA times one cannot help wondering what sort of solutions would have been implemented at the time. Would seawalls have been built? Would the shore now be covered with ugly broken concrete? Certainly past erosion works undertaken around the country suggest it probable. Knowledge and understanding of natural coastal processes is essential when planning erosion mitigation works.

The natural values and character of Amberley Beach have not been compromised. The material used to nourish the beach is essentially identical to the existing gravels. The invasive marram grass and dead pine trees have been cleared. A native planting programme has been instituted which aims to establish a coastal bush corridor along the foreshore.

The erosion phenomenon has highlighted the need for taking a long-term view when planning developments near the coast, and also to consider that coastal erosion is a real possibility when making changes to catchments of rivers that supply sediment to the coast.

This project has been a good example of positive co-operation and communication between the local community, local business and the local and regional councils, and has raised the awareness and understanding of the coastal environment for all those involved. ■

An exposed scarp and extensive scouring of the beach after the October 1993 storm.

(This article is an edited version of the 2004 Ingenium Hynds Paper of the Year. Ingenium is a technical group of the Institution of Professional Engineers of New Zealand (IPENZ). Its members are engineers who work in the local government sector or who have provided public asset engineering and management services in New Zealand. The original paper can be viewed at www.ingenium.org.nz Annual conference).

Looking good...Amberley Beach facing south from the carpark. A fence and a planting programme of native iceplants are among the improvements made.

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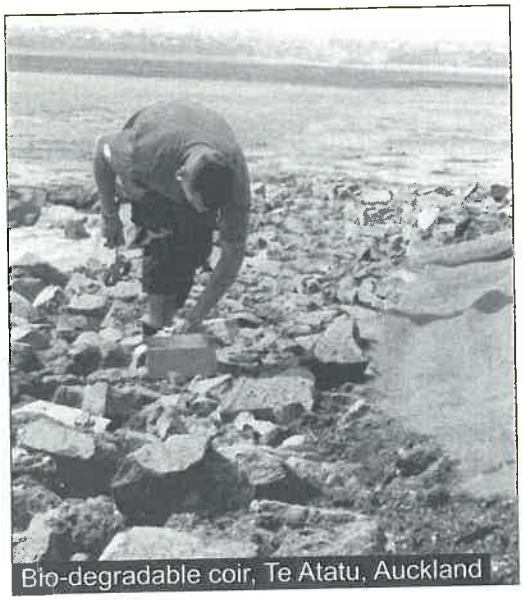

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New boardwalk adds to green network cycleway

North Shore City Council is set to start construction of a new coastal boardwalk in Takapuna as part of its planned 'green network' cycleway that will eventually link Devonport and Bayswater with Takapuna and beyond.

The project will see a 2.5 metre-wide boardwalk built through regenerating native bush and mangroves in Northboro Park, replacing an existing boardwalk. New footpaths will also be built linking the boardwalk to Francis Street, opening the area to cyclists and those with limited mobility.

The chair of the council's community services and parks committee, Margaret Miles, says the boardwalk is a key link in the planned 'Green Cycle Route' project.

"Ultimately we hope to see a network of cycle ways across the length and breadth of our city," she says.

"By offering these alternative routes through parks and reserves and along quiet roads away from heavily used arterial routes, we hope to create more pleasant conditions for cyclists and pedestrians and encourage more people to use alternative means of transport around our city."

Councillor Miles says the route was already used by cyclists undeterred by steep gradients, steps and the existing narrow boardwalk.

"We are removing steps, improving the gradient and widening the boardwalk, making it safer and easier for cyclists and pedestrians to use.

The boardwalk will be closed to pedestrians and cyclists during construction, and regular users are advised to instead take an alternative route from Northboro Park to Northboro Rd.

As a bonus the new boardwalk will also offer views across the water towards the Auckland Harbour Bridge.

Further improvements planned for later this year include signage indicating the recommended cycle route and improvements to footpaths to better accommodate cyclists and pedestrians.

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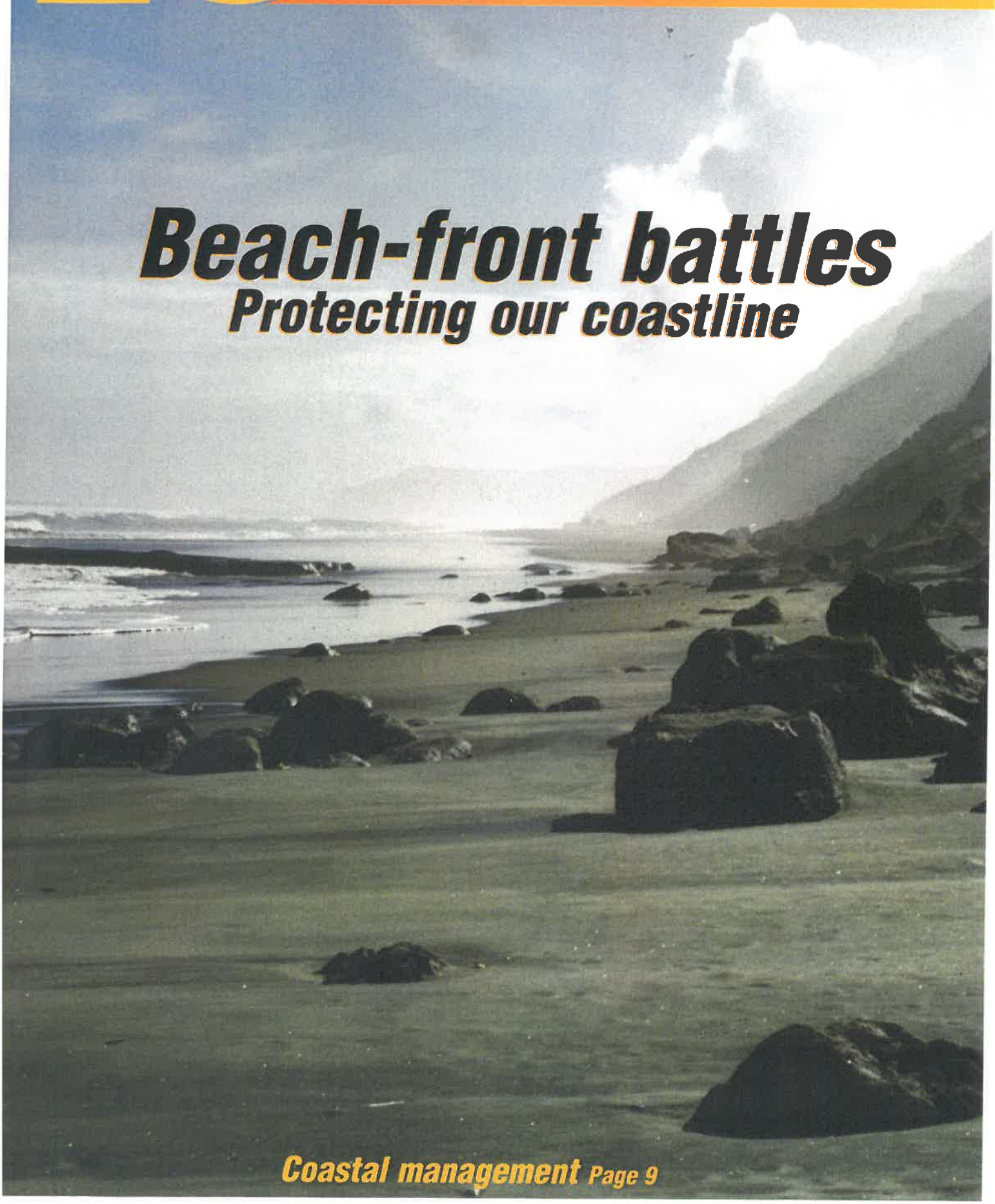
Protecting our coastline



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