greater WELLINGTON
REGIONAL COUNCIL

Treatment Options for Coastal Erosion at Plimmerton Fire Station

The dunes in front of the Plimmerton Fire Station have experienced ongoing erosion over the past few years and the beach is now in a degraded state.

The sand dunes are relatively recent, having accreted largely since the fire station was constructed in 1955, which has provided a wind barrier for sand to accumulate. In order to construct the station, a small pocket beach and part of the rock shore platform on the point between Plimmerton Beach and Karehana Bay was reclaimed.

There are historical accounts that sand was present along the shore. This is supported by aerial photographs dating from 1942, but they do not indicate there was a dune system (aside from a few low sand hummocks) at this site prior to construction of the station (Figure 1).

In geomorphological terms therefore, the presence of the dunes can be partly attributed to human activities, rather than pure natural processes. Nevertheless, they form an aesthetic edge to what would otherwise be a concrete barrier.

Over time, the dunes and beach have formed around the edge of the station under the action of wind and waves transporting sand along and up the shore. A series of large storm tide events in the past 12-18 months have caused the beach to become heavily eroded. Old shore protection works have been exposed at the front of the station, testament to either previous responses to erosion or part of the original reclamation.

Presently, old clay and gravel basecoarse from construction of the road berm and building platform is present at the base of the dunes, interspersed with hardfill (concrete blocks, rocks and bricks) and old shore protection structures (filled concrete drums).

A vegetative cover of marram (Ammophila arenaria), South African ice plant (Carpobrotus edulis) and taupata (Coprosma repens) covers the degraded dunes. Also present is some spinifex (spinifex sericeus) planted at the southern edge of the site. This vegetation is insufficient to provide much holding capacity for the sand and the site will face ongoing erosion from high tides and storm events.

The most cost effective option will be to undertake a small beach renourishment and dune restoration programme.

A dune restoration needs as much room as possible to allow fluctuations in the beach from erosion. Because the site is narrow and perched on a rock shore platform, it doesn't have a large volume of sand, thus it is vulnerable to erosion from storm events. It also makes it harder for vegetation to recover from storm damage. The site can be broken down into 4 areas on the basis of its exposure and geomorphology; the southern edge; the western edge; the northwest corner and; the northeast corner. Each of these areas will require a slightly different approach and can be tackled one at a time to stage the project over a couple of seasons.

As a rule of thumb the minimum width need to maintain a dune is 10 m. The front western edge of the site has approximately this width available. The old drums should be removed and some sand renourishment undertaken to reshape the dune to make up for the loss of volume. As discussed on site, it would be desirable to remove part of the paved area in front of the firehouse to free up a bit more width and increase the resilience the beach and dune, however, this isn't essential. In doing this, some of the vegetation will also be removed, which will require replanting. The best choice will to plant with spinifex. Any remaining marram and ice plant should be sprayed. The reason for this is that marram does not recover well from storm erosion and exacerbates sand loss from the beach as it creates a vertical scarp that is easily undermined by wave activity. This is what is partly contributing to erosion at the site. Spinifex creates a more rounded dune form with creeping runners that grow over an erosion scarp and are better able to recover the beach (figure 2).

The northern and southern sides are a lot more squeezed. In particular, the northwest corner of the building has less than half the required distance for a dune restoration. It may not be possible to establish a functional dune at this pinch point. The best option is to renourish the backshore with sand to repair the blowout and rebuild the beach, and allow dunes to establish in adjacent areas. Any fill in here, such as the old clay basecoarse should be removed. Clay in particular is detrimental to a beach because it filters into the pore spaces between the sand and reduces its capacity to absorb wave runup. This in turn enhances scouring of the beach during storm conditions. The backshore can then be planted to stabilize the sand and provide some amenity plantings (Figure 3).

The northeastern corner is a natural point of sand accumulation as the reclamation acts as a groyne to sand transported southward during north and northwest conditions. There is enough width here to maintain the small beach and dune with some native plantings.

The southern edge of the site has had some spinifex planting, but it too has become degraded by storm wave activity. In general, the spinifex has performed well and is currently holding a reasonable volume of material. The best option is to renourish the toe with sand to give a foothold for the spinifex at the crest to grow into (Figure 4).

In summary, it is recommended that the restoration is undertaken with the following steps (a summary is provided in Figure 5):

1. Remove old fill (particularly old concrete blocks, rusting drums and clay material) as this inhibits plant growth and provides scour points for wave and current activity during storm events.

2. Replenish the beach and dunes with sand and reshape the eroded dune scarps. (A good source for the renourishment would be sand dredged from the marina).

3. Spray out the remaining invasive exotic plants, especially the marram and ice plant that will outcompete native sand binders, but leave in place to hold the sand until native plants become established.

4. Bulk plant with spinifex above MHWS at approx. 0.75 m spacings to get a plant cover established. This is best achieved in April to May after the March equinox winds and prior to winter rainfall.

5. Could also add in some pingao (Ficinia spiralis) (best in clustered groups) and sand tussock (Poa billardierei was Austrofestuca littoralis) for a bit of plant variety at the crest.

6. Replenish periodically with sand to top up the beach and provide material for spinifex to help grow the dunes and provide a buffer to the station.

Such a project is not without risk. There is always the possibility that a storm event causes damage to the restoration while it is becoming established. In addition, there will be ongoing periods of erosion from time to time. In the long term, this will be exacerbated by sea level rise. But these risks are outweighed by the benefits, which is to restore a beach asset for the community whilst at the same time provide a soft engineered shore protection solution for the fire station.

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Figure 1: 1942 Aerial photograph showing location of present day fire station which was constructed on the beach and shore platform on the point between Plimmerton Beach and Karehana Bay.

Figure 2: Western edge (front) of the site

Figure 3: Northwest corner of the site

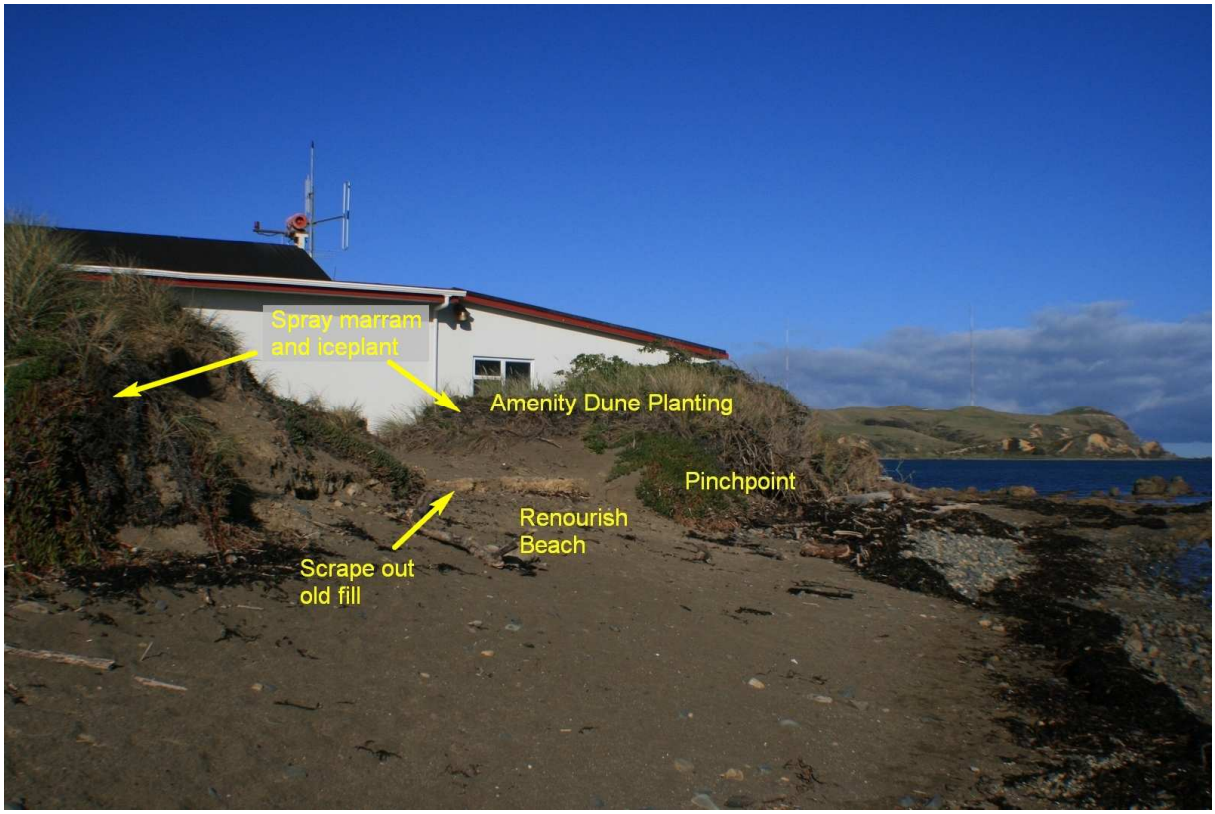

Figure 4: Southern edge of the site

Figure 5: Summary of the beach and dune restoration project