Stabilization of the coastline at Sandy Beach Hotel

Summary of recommendations and outline design

Background

Erosion of the Finaunpes coastline on Kosrae stems back to the removal of large quantities of coral rubble and a number of reef flat islands during the development of the circumferential road. This significantly reduced the protection provided by the coral rubble on the reef flat allowing:

- Larger waves to travel over the reef flat and reach the coastline on what is the most exposed section of the Kosrae coastline.
- Changes the way the wave pass over the reef, and hence changing the way currents caused by the waves, flow over the reef. One consequence of this is a strong westerly flowing wave induced current running along the Sandy Beach coastline.

These two effects resulted in the severity of the erosion experienced at Finaunpes and has necessitated the building of various sea walls over the last 15 or so years. Each time the sea wall has been rebuilt it has had to be extended in length to the west (towards Sandy Beach) due to accelerated erosion at the western end of the seawall. This type of erosion is known as "downdrift erosion" and is a very common occurrence with sea walls or other defenses built along the coastline.

The current defense, a sloping rock revetment, was completed in 1998, stretching from the Catholic Church to the eastern end of the Sandy Beach property. During 1999, accelerated erosion occurred immediately to the western end of the rock revetment, undermining the Sandy Beach restaurant foundations and resulting in a net loss of beach. High tides during December 1999 resulted in further loss of beach along the Sandy Beach frontage.

At this time Mr Jonah, the proprietor of Sandy Beach Hotel, applied for a DRC permit to dump some rock on the beach along the erosion scarp to protect the restaurant. Given the severity of the erosion, the DRC granted the permit but advised Mr Jonah that dumping rock along the beach may well accelerate erosion at the end of the dumped rock (simply moves the erosion problem further along the beach).

Further high tides on 19-21 Feruary 2000 (combined with large swell and strong winds) resulted in a considerable loss of beach in front of Units 1 to 4 (west of the area where the rock was dumped).

Options and recommendations for stabilizing the coastline at Sandy Beach

Firstly, it must be appreciated that developing land so close to the beach on one of the most exposed sections of the coastline on Kosrae will result in a very high level of risk to the property from storm damage or coastal flooding. In the long term the only solution to reduce this risk is to ensure that private property is slowly moved back from the coastline and ensure that new development is located far enough back from the coastline to ensure coastal hazard risks are minimized.

However, the erosion problems at Finaunpes / Sandy Beach have been, and are going to be, a long term problem. In terms of engineering work to attempt to stabilize the coastline, there is no easy (or cheap) solution. It is **unlikely** that linear defenses, such as a sea wall or a sloping rock revetment along the beach, as is the normal coastal defense solution on Kosrae, will provide an effective solution. Whilst such a scheme would reduce the potential for damage to the Sandy Beach Hotel buildings **it would cause accelerated erosion further to the west (i.e. just move the problem to the west).**

To effectively stabilize this section of the coastline, minimize the potential for future erosion of the Sandy Beach coastline and ensure that problems are not created further to the west a **beach control structure** is proposed. This is an engineering structure such as a breakwater which attempts to:

- provide direct protection from waves (such as a seawall does)
- but more importantly, attempts to control and stabilize the sand beach by affecting the way the waves approach the beach.

The attached plan shows the proposed layout. A rock breakwater is proposed to extend out from the corner of the existing rock revetment for 60m (about 66 yards) at the same height as the existing rock revetment. The area behind the structure will be back-filled with sand as shown to form a bay-shaped beach.

The breakwater will control the shape of the sand bay, which has been designed to form a stable plan shape under the commonly experienced wave conditions affecting this coastline. This type of beach control structure can form a extremely stable coastline capable of In turn, the stability of the bay will help also stabilize the coast to the west along the remainder of the Sandy Beach coastline. The breakwater will also help to deflect the strong westerly flowing wave induced currents away from the coastline. The beach will experience occasional storm damage along the unprotected sections but this is a natural beach response. Some environmental impacts will occur in the loss of a small area of seagrass habitat.

An approximate estimate of the scheme suggests that approximately 2,600 cubic yards of sand, which would need to be sourced from a DRC permit site, and approximately 1,300 to 1,600 cubic yards of rock. Whether there is a suitable permit site capable of supplying this amount is questionable. To construct this scheme will be expensive ($30,000 to $50,000). Unfortunately the breakwater can not be constructed without the sand fill as this will result in substantial erosion of the beach at the western end of the Sandy Beach property. Less expensive solutions are unlikely to ensure that the erosion problems are storm damage risks are effectively mitigated.

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