

Additional Shore Protection for the Fukrin to Kotfwa area, Malem

Summary of the current Malem coastal defense scheme

The proposed coastal defense project for the Malem village frontage covers part of the Fukrin to Kotfwa coastline, extending from the mouth of the Malem River to the ER store. This involves upgrading the existing rock defenses along this section to increase the level of protection provide to properties situated between the road and the shoreline.

The purpose of this defense is to provide **erosion** protection to the properties along this section of the coastline. However, it should be noted that under typhoon or severe storm conditions the defenses are unlikely to prevent property damage.

The proposed defenses will only provide minimal **flood** protection (i.e. due to the low elevation of the land, waves at high water levels will still result in overwashing (splash) over the defenses). The defenses will not provide any flood protection from extreme events that result in very high water levels.

It has been made clear to the State and Municipal Governments, and the local landowners, that the coast protection is not a long term solution. It potentially provides additional time for a planned retreat of property and infrastructure from the coastline.

The principal reasons for terminating the defenses in the location of the ER store were:

- This was effectively the last property situated between the road and the shoreline.
- More importantly it was a suitable location to try and avoid increased erosion caused by the defenses to the south (as has occurred at the Sandy Beach Hotel, the ends of the concrete sea wall at Leyot etc).
- Available budget.

Assessment of the Fukrin to Kotfwa shoreline

To the south of the Malem River, particularly the Fukrin to Kotfwa section, the storm ridge, upon which the road is situated is very narrow. Properties are located on the landward side of the storm ridge upon which the road is situated and on reclaimed swamp land. The floor elevations of many of these properties are lower than the elevation of the road. This elevation is about the same level as the natural beach crest (about 1 metre – approximately 3 feet) above the level of High Water Spring Tide level. Due to the very low level of the land overwashing of the road and flooding of property at the landward side of the road has the potential to occur on a frequent basis.

The coastline south of the ER store is marginally better protected from waves than the coastline further north due to the orientation of the coastline, the occurrence of a rubble crest on the outer reef flat and greater coverage of coral rubble over the reef flat. **However, the beach is suffering greatly from the amount of sand and cobble removal that is ongoing from this section of the coastline by local inhabitants. This has significantly decreased the level of protection to the**

road and property provided by the beach. This is the major erosion process occurring along this coastline and has directly:

- **resulted in an increase in the potential for overwashing of the road and flooding of the property;**
- **increased the risk of damage to the road and property during storms.**

Despite this, the nature of the storm ridge and hinterland swamp area indicates that this area will have experienced periodic flooding due to storms and high tides long before any properties were constructed.

In summary the main issues relating to the risk of flooding and erosion between Fukrin and Kotfwa are:

1. Erosion risk

- The properties are not as severely threatened by erosion as those properties situated between the road and the shoreline further north.
- The main threat to both the road and the property is from storm damage. The proximity of the road to the beach does not allow the beach to respond in a natural manner under storm wave conditions. Damage, or a breach in the roadway, is a high possibility under such conditions. It is unlikely that coastal defenses will have much impact in protecting the coastline, road or properties under severe storm or typhoon conditions (i.e. damage will occur to both the road and property with or without coastal protection along this section).

2. Flood risk

- The properties to the south of the Malem River are all at considerable risk from flooding due to waves overtopping of the roadway (which is acting as a low embankment) or from very high tidal levels. Most of the floor levels of these properties are at an elevation lower than the elevation of the crest of the natural beach.

Alternatives for alleviating the flooding problems

Providing engineered protection to reduce the erosion and flooding risk along the Fukrin to Kotfwa section of the coastline will be extremely difficult to achieve due to the low lying nature of the immediate hinterland. The following points outline the main problems:

- Constructing a defense, such as a rock revetment (sloping rock structure) to an elevation just above that of the roadway along the shoreline will not protect the properties landward of the road from flooding caused by extreme water levels. Such defenses may have a minor impact in reducing flood volume due to wave overtopping but will not reduce the risk significantly to be justifiable.
- Constructing a defense, such as a revetment to a higher elevation will be difficult due to the lack of land between the shoreline and the road. Reclaiming land seawards to facilitate this is not a feasible option due to the impact this would have on the adjacent coastline. Such a scheme would also cut off access to the coastline.

- Any coastal defenses along this section will provide a false sense of security to residents along a section of coastline that, even with substantial coastal defenses, will still be at a very high risk of storm damage and flooding.
- There is no suitable location to the south to end the defenses. Along this coastline this would result in an increased erosion risk at the end of any linear coastal defense (such as has occurred at Sandy Beach) and would simply increase the risk of damage to the road at that location.
- Structures on the reef flat seaward of the beach, such as the offshore breakwater structures proposed for the coastline north of the Malem River outlet will help in protecting the coastline from storm waves but will not reduce the flood risk significantly.
- There is insufficient beach material within the coastal system in this area of Malem to utilize beach control structures, such as groynes, breakwaters etc to help build up a beach to provide additional protection.
- Any coastal defenses constructed will have a high construction cost and potentially high maintenance (low cost structures will not provide any significant reduction in the risks). As with all coastal protection it will enter the Government of Kosrae into a long-term financial commitment to keep on maintaining such defenses.

People have contributed significantly to the problems now being experienced at this location through the extensive (ongoing) removal of beach material and through the siting of residential property in what would have been areas that were periodically flooded. In general, coastal defenses along this coastline are not an effective solution to the long term problems being experienced. In the long term, coastal defenses or not, infrastructure and property will need to be gradually moved landward away from the coastline. Economically, technically and environmentally this is the only effective solution if the flooding and storm risks being experienced by the properties and infrastructure are to be reduced. It would be advisable to begin to plan for this process now and to conduct it gradually rather than wait until being forced to in the wake of a typhoon or severe storm.

In summary, the problems experienced between Fukrin to Kotfwa are not going to be solved by constructing coastal defenses. The risks from storm damage and flooding, experienced by the infrastructure and residents of this area, will only be alleviated by moving away from the coastline to higher elevated land.

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