3.7 COASTAL HAZARDS

3.7.1 STORM SURGE

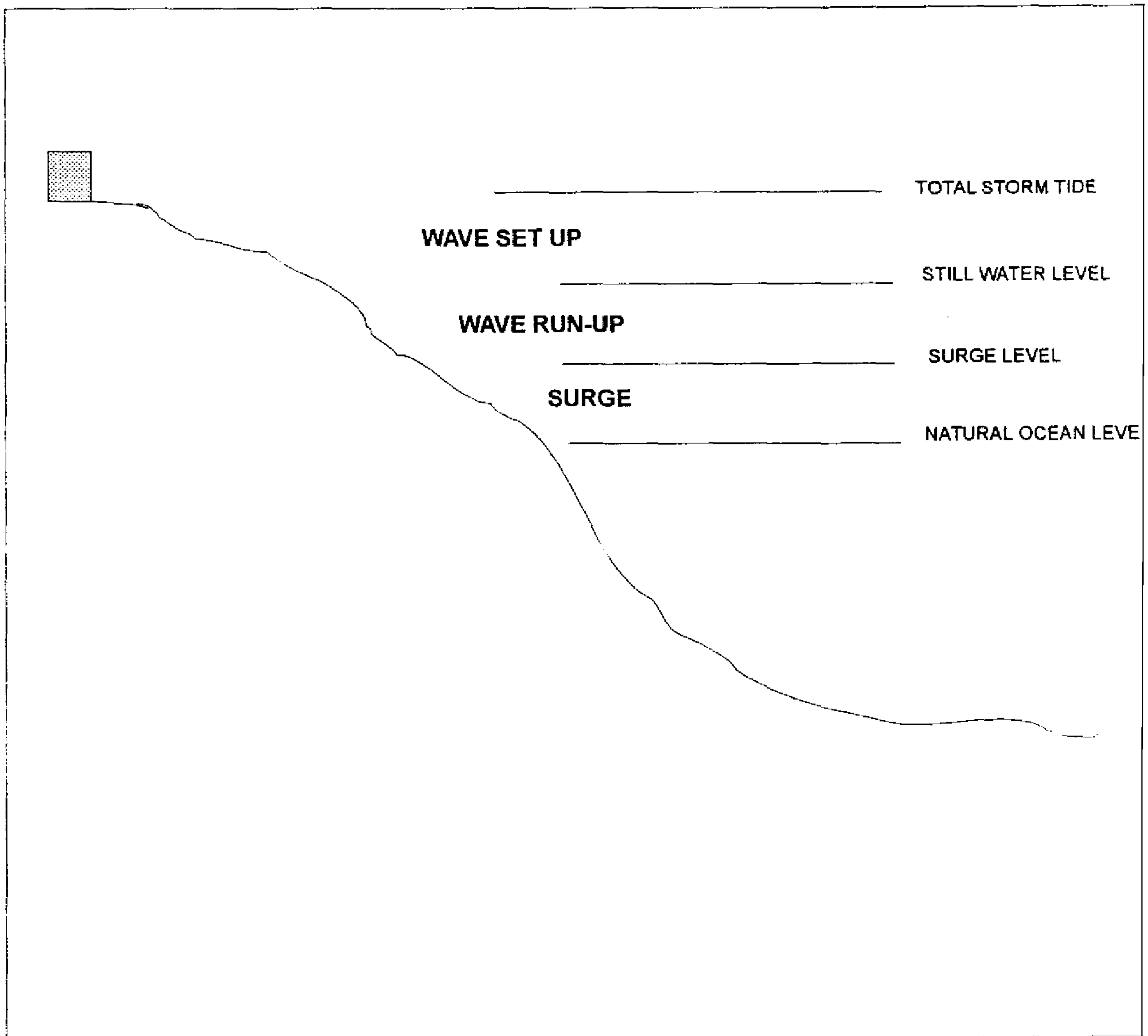
Storm surge can be described as a temporary rise in mean sea level along a coast due to the atmospheric and wind effects of hurricanes. The lowering of atmospheric pressure between the eye of the hurricane and the outer regions affects the position of mean sea level through the inverse barometric effect. The adjustment in mean sea level to changes in barometric pressure is slow, varying from 2-12 hours.

While the pressure component of storm surge is significant the main component for hurricanes is the wind effect. The wind stress component, which can be up to 10 times greater than the pressure component, is created by the wind stresses generated by the high velocity converging winds of the hurricane. Sea water is pushed forward by the wind field over the continental shelf and piles up along the coast of landmasses affected by the hurricane force winds. Waves generated by the hurricane winds cause a further increase in mean sea level at the coast known as wave-setup. The overall storm surge at the coast is the sum of the pressure component, wind stress component, and the wave set-up, **Figure 3.6**.

The Saffir-Simpson scale provides a general relationship between wind speed, atmospheric pressure, and the range of storm surge to be expected. The actual storm surge at any given site is determined by a number of factors including the radius of maximum wind velocities, the forward speed of the system, the configuration of the foreshore bathymetry, the shape of the coastline, and the elevation of land near the coastline. Other factors which can cause localised increases in mean sea level if they coincide with hurricane storm surge conditions are high tides and outflow of storm runoff through drainage channels into the sea.

The effects of storm surge results from flooding associated with higher sea levels and the increased penetration of sea water inland, as well as the increased coastal erosion from wave action occurring closer to the coast. Due to the salinity of sea water, flooding by storm surge can be more damaging than riverine floods. Because of the increased water depth closer to

FIGURE 3.6 STORM SURGE COMPONENTS

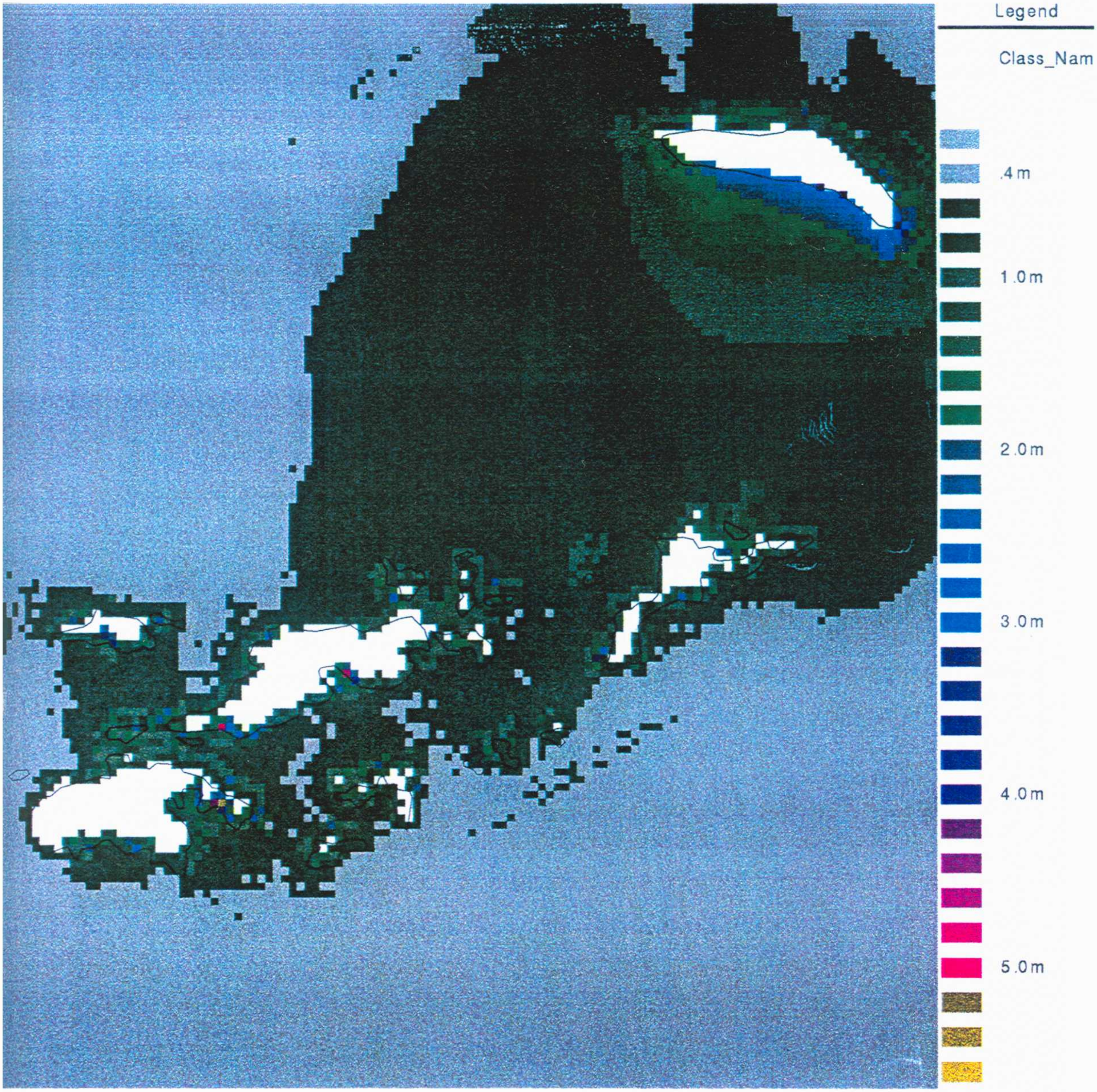


the coast associated with storm surges, large wind generated waves can approach the coast more closely before breaking. Damage is caused by the direct impact of waves and the wetting of objects in the splash zone. In addition the increased turbulence undermines foundations exposed to the sea and causes significant beach erosion. There is no extensive continental shelf associated with the islands of the BVI. While the water depth between the islands is relatively shallow, the depth increases very sharply around the Virgin Island Platform. This decreases the ability of the wind to push water over the ocean floor and limits the 'pile up' of water along the coast. In addition the presence of fringing reefs around the islands of the BVI tends to further decreases the storm surge effects at the coast.

The south coast of Tortola, especially Road Town, is further protected from storm surge by the islands lying to the south such as Peter Island. However the storm surge which does occur will be amplified at many locations around the islands by the presence of numerous coves with steep slopes near to the coast. This situation is particularly true of Road Harbour. The extensive shallow foreshore to the south of Anegada increases the surge height to be expected along the south coast significantly.

Storm surge associated with hurricanes that might affect the BVI were the main component of the tropical cyclone study. The TAOS model was used to determine the storm surge that would be produced by hurricanes of different intensity with different paths. A total of 15 storm surge maps were generated by TAOS showing the Maximum Envelope Of Water (MEOW) at the shoreline for hurricanes which may pass over the British Virgin Islands. The MEOW represents the worst case scenario, ie highest water level that can be expected, for any hurricane of a given strength and direction. An example of the data produced from the model is shown here as **Maps 3.3.** The full set of (15) MEOW maps are provided in the Tropical Cyclone Study final report.

The maps represent hurricanes with three directions of motion; Westbound, Northwest-bound and Northbound belonging to each of the five Saffir/Simpson categories. The MEOWS were produced by developing a set of parallel tracks, at a resolution of 500 meters per cell, for each direction of approach so that when combined the maximum water level along the coastline for any storm of similar strength was established. The results of all the



Category 2 North West Bound MEOW

972mb, 45m/s Max Wind, fwd speed 22kph.
RMax 40km

Projection: UTM-20N

Storm Surge at Coastline, Including Wave Setup.
Wave Runup and Overland Flow not shown.

British Virgin Islands Storm Hazard Assessment

The Arbiter of Storms (TAOS) Output System, Version 2.1
Watson Technical Consulting
110 Deerwood Court
Rincon, GA, USA 31326

Scale

10 0 Kilometers

MAP 3.3