

### **Location 1: On Southlands beach near base of access steps. An introduction to the geology and beach dynamics of this section of the Warwick coastline**

Note the hard “Belmont formation” basement rock just above sea level on which the beach lies. Note that the beaches along this part of the coastline are ephemeral or transitory, varying from no beach at all after storms to as much as four feet of sand over the bedrock during periods of milder on-shore winds.

- Note the un-cemented protosoil (a weak sandy soil layer near base of cliff that is un-cemented due to organic coatings on the sand grains that repel water. Note the fossil Poecilozonites land snails (now extinct) in that soil layer.
- Note the Southampton aeolianite (wind deposited) dune above the soil layer that was laid down on a falling sea level about 80,000 years ago and not yet old enough to become cemented into stone by the action of carbonic acids in rain water percolating down through the dune. This rock has the same character as the S.A.L. Southampton quarry and is easily eroded by the wind as well as by wave action.
- Note the visible evidence of increased erosion in recent decades as a result of global warming, rising sea level and increased hurricane intensity. Note where the tarmac road and the beach house at base of steps has been destroyed by recent cliff erosion.
- Note the dead casuarinas that formerly grew in cliff fall talus at the base of the cliff in the 1970’s and 1980’s, since killed by hurricane wave action and sea level rise.
- Note the fact that the Southlands property is still a natural coastline with room to erode back naturally towards the road as long as no man-made structures are built south of the road. This naturally pro-grading erosion maintains the beautiful and chaotic character of our coastline with many erosional niches for Longtail nests.

### **Location 2: Around the corner eastward at west end of Grand Atlantic beach approximately where the new seawall terminates at the Southlands property boundary**

Note that the same geological features prevail here but, in this case, all the cliff fall rock talus at the base of cliff has been removed and all the rock outcrops sticking up through the beach have been cut off by bulldozer – both actions facilitating wave erosion of the cliff. Also, all the native coastal vegetation, as well as the casuarinas have been removed, even on the top of the cliff. Note the

- whiter colour of the cliff indicating accelerated erosion as a result. (On more slowly eroding cliffs the sand grains are colonized by a blue green algae giving the surface a darker gray colour).
- Note the condominiums at the top of this 65-foot high vertical cliff. The nearest have only a 50-foot setback from the cliff but the cliff here has been eroding at a rate of 1 to 3 meters per decade since the 1980's and current predictions of sealevel rise and increased hurricane intensity with global warming imply that the rate of erosion will continue to accelerate.
- Note the seawall that has just been built at the base of the cliff in an attempt to arrest cliff erosion. Because it is a solid concrete structure abutting a very soft rock cliff the turbulence caused by waves hitting and over-topping it will actually accelerate erosion, especially at the western end where it terminates abruptly; and hurricane wave action can be guaranteed to over top the seawall because of the storm surge phenomenon which raises the sea level anywhere from 4 to 12 feet depending on the intensity and proximity of the hurricane and the wind direction.
- Note that although wind alone is slowly wearing back this cliff by abrasion the main erosion is caused by wave action in brief stochastic storm/hurricane events. A direct hit category 3 or 4 hurricane with onshore winds here would raise sea level above the level of the seawall with the full impact of the waves hitting the cliff face above it. Such an event could erode the cliff back by several meters, possibly even to the nearest condominium in a matter of hours.
- Note the access road to the beach what was cut by bulldozer only seven months ago. Note that the sides of the cut have already eroded back by wind alone since it was cut. In a worst case hurricane event as described above the seas might breach over the crest of this cut and flood south road. At the very least, moderate storm seas will cliff into it making it un-useable to access the beach unless constantly maintained with new fill or futile attempts to pave or concrete it.

### **Location 3: Near the base of the steps leading up to the Tribe road**

- Note the abundant evidence of former stairways to the beach and entire beach facility structures from the 1960's and 1970's era of tourism (Banana Beach, Bermudiana Beach Club and Sapphire Bay ) which have been totally destroyed and reduced to rubble or completely eroded away by hurricane events since the 1980's.

See BEST website [[www.best.org.bm](http://www.best.org.bm)] for photos of those facilities as they once were along with the un-eroded cliff talus and coastal vegetation rooted in it, all now washed

away except for one or two dead casuarinas. Nothing better illustrates the incredible rate of cliff erosion going on in this section of Warwick coastline since the late 1980's.

**Location 4: On South road verge just west of Terceira's Service Station**

Note the obvious degraded character of the area and the lack of space left for any upscale hotel that was once promised for this area. It would have to be wedged between the back of Terceira's garage and the rapidly eroding coastal cliff and between the Tribe road to the east and the encroaching "low cost" condominiums to the west.

- Note the obvious evidence of a major sand quarrying operation here. This quarrying has significantly lowered the height of the dune ridge in this area. Did the sand quarrying operation have a permit from Planning?
- Note that there was also an illegal excavation of a deep pit in this area to bury building demolition waste trucked in from another site as reported in the press, thus further loosening the already poorly cemented dune formation in this area. The combined effect of those two activities greatly increases the risk of accelerated erosion if hurricane seas should breach through at the site of the access road to the beach that was recently excavated.

**Location 5: On South road verge around the corner to the west near the east boundary of the Southlands property**

Note the sheer density of the condominium units and their close proximity to South Road without any set-back for vegetation screening. In fact, the pre-existing natural vegetation and a remnant of the original dune ridge here was quarried away increasing their exposure. Also there is too little space between the units for significant landscaping.

- Note how the coastal condominium units block any view of the sea from the inland units, thus belying the promotional claims in the advertising for their sale.
- Note the potential of the promised Southlands Park just opposite, which could increase the value of the condos, but which is not yet confirmed by Government.

**WE HOPE YOU HAVE ENJOYED THIS WALK AND LEARNED MORE ABOUT THE ENVIRONMENTAL ISSUES RAISED BY THE SDO THAT PERMITTED THE GRAND ATLANTIC DEVELOPMENT IN ITS PRESENT FORM WITHOUT BENEFIT OF A PROPER ENVIRONMENTAL IMPACT STUDY.**

# BEST

Bermuda Environmental & Sustainability Taskforce

