ASSESSING THE SHALLOW GROUNDWATER SYSTEM AS A POTENTIAL FACTOR IN GENERATING STORM-WATER RUNOFF ON A NORTH CAROLINA BARRIER ISLAND

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The town of Emerald Isle, located in North Carolina's Outer Banks, experiences significant storm-water runoff and flooding problems during the fall and winter months. The topography of the island influences drainage patterns as well as the position of the water table. The goal of this study was to determine if the shallow groundwater system is responsible for storm-water runoff on the island. Two hypotheses were developed to test the relationship between the water table and storm-water runoff. The first hypothesis states: the water table rises above the land surface during periods of high precipitation, which leads to storm-water runoff in the town. The second hypothesis states: low infiltration rates in the swales of the island impede water from recharging the Surficial aquifer. The first hypothesis was tested by monitoring the position of the water table in the Surficial aquifer over a 12-month period using a network of 15 shallow groundwater monitoring wells. Potentiometric surface maps of the aquifer show that the water table does breach the land surface during storm events that produce at least 25 mm of precipitation. The second hypothesis was tested by conducting infiltrometer tests to determine if low infiltration rates were retarding natural recharge to the groundwater system. These tests reveal that the soils located in small portions of the swales have the lowest infiltration rates on

the island, making it more likely for storm-water runoff to be generated. A 3D finite-difference groundwater model was then used to determine if pumping water from the aquifer during extreme storm events (e.g., hurricanes) would alleviate an elevated water table. Numerical and analytical modeling results suggest that pumping water from the aquifer may be impractical for the town to employ because it is only a short-term solution to the storm-water problem. Therefore, several structural best management practices (BMP's) are presented as alternative measures to reduce storm-water runoff. These structural BMP's are ideal for the needs of the town, and they include bioretention, level spreader-vegetative filter strips, and infiltration basins/trenches.