Figure 3.4.1 present the results of the analysis of the hydraulic model in relationship to geomorphic process. The horizontal axis is the distance used in the model, from the confluence of Sugar Creek and the Withlacoochee River. The calculated water surface elevation for the 1.2-inch rain event is plotted along with the bed profile used in the model. The 1.2-inch rain event flow was chosen over other flow events since that water surface elevation most closely matches the elevation of indicators of the stream–forming flow.

3.4.1 Analysis of Water Surface Profile

For streams in dynamic equilibrium, the slope of the water surface is generally parallel to the bed so long as there is relatively continuous hydraulic resistance. If the applied shear is greater than the resisting shear the stream will erode the bed or banks, whichever is weaker, and deposit material in areas of lower applied shear until the slope of the water surface matches the bed. Areas of lower applied shear include the shadow of obstructions, the inside of bends and/or mechanically over widened reaches, and are not necessarily continuous across or along the bed. Several examples of diverging and converging water surface and bed slopes are obvious in Figure 3.4.1. The reaches from Browns Canal confluence to River Street and from Hightower Creek confluence and Lankford Drive are incising. The bed slope is steeper than the water surface slope. The reach from the Withlacoochee River to the Railroad crossing is meandering. Meandering is a normal process and in this case is not the rapid meander advance often observed in urbanized areas. The bed slope is flatter than the water surface slope as is the case near Browns Canal. Meandering occurs in reaches with sufficient or excess supplies of sediment, generally with deposition increasing from upstream to downstream. In Sugar Creek, frequent flows that are higher than the stream-forming flow are confined in the previously incised channel and disturb the sediment, thereby preventing consolidation and the establishment of persistent vegetation.

Sand bars are transient. During a flow event, sand is probably deposited then eroded and re-deposited at different times within the same event. Whenever the combination of hydraulic slope and depth of flow are sufficient, the sand is eroded. If either the slope flattens or the depth decreases, then sand is deposited. Washload sand may be deposited as the depth increases faster than the hydraulic slope at the beginning of a storm. This sand is then scoured as the slope increases. Generally at the peak of the flow, the slope will flatten and sand will deposit. As the flow recedes, the hydraulic slope increases, again scouring the sand. As the depth decreases, the sand is again deposited. This complex and transient pattern of sand deposition in each rainfall event is critically important and any effort to modify Sugar Creek must fully account for this dynamic occurance.