SEDIMENT BYPASSING AT TIDAL INLETS

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Tidal inlets on open ocean coastlines represent a significant potential sediment sink for littoral cells. Inlets provide conduits for sand movement into backbarrier bays, flood tidal deltas, marshes and channel point bars, thereby removing sediment from the longshore drift. Dean (1988a) estimated as much as 80% of coastal erosion on parts of the Atlantic coast of North America results from the interruption of longshore sediment transport at tidal inlets. However, natural inlets in equilibrium may develop methods that allow a major fraction of the longshore transport to bypass around the inlet to the down drift shoreline (e.g. Bruun & Gerritsen, 1959). The manner by which tidal inlets accomplish this process controls the location and rate of sand nourishment to the down drift beaches. Some researchers attribute much of the coastal erosion on the south shore of Long Island to the presence of Moriches Inlet, and requests have been made for the development of an artificial sediment bypassing system. However, the natural rate of sediment bypassing, and the pathways in which this bypassing occurs, are presently unknown.

Current theories associated with natural bypassing of tidal inlets involve the use of continuous or discontinuous transport mechanisms. Dean (1988b) has associated continuous "natural" bypassing with the ebb tidal shoals. In this system the littoral drift is maintained, as waves and tidal currents drive the longshore transport around the peripheral edge of the ebb tidal delta, thus assuring the competency of down drift shorelines. FitzGerald (1988) classified discontinuous methods for inlet sediment bypassing along mixed energy shorelines. Two of these mechanisms, stable inlet processes and ebb tidal delta breaching, are based upon the migration of large bar complexes formed on the downdrift side of the ebb tidal delta. A third method, inlet migration and spit breaching, is less applicable to the present situation at Moriches Inlet and will not be discussed. Unlike the continuous bypassing mechanism described by Dean (1988b), both stable inlet processes and ebb tidal delta breaching, result in the bypassing of discrete packets of sediment.

Moriches Inlet provides an interesting combination of natural and artificially maintained tidal inlets. Moriches Inlet opened in 1931 and continued to widen rapidly and migrate westward until the reopening of Shinnicock Inlet in 1938. This effectively changed the tidal hydraulics of Shinnicock Bay and the interconnecting waterway with Moriches Bay. As a result Moriches Inlet gradually shoaled until closing in 1951 (Czerniak, 1976). Moriches Inlet was artificially opened in 1953 after an attempt was made to stabilize the inlet by constructing jetties on either side. Until recently the inlet had not been dredged since the 1953 opening, even though additional dredging along the bay side of the channel leading to the inlet occurred in 1958, 1966, and 1969. Presently the inlet is not artificially maintained but has a geometry which is partially controlled by human engineering. The presence of Moriches Inlet and the "lack" of bypassing at the inlet have been cited as critical factors controlling the erosion of downdrift barrier beaches (e.g. McCormick et al, 1984). Artificial bypassing may alleviate this situation, but when considering the significant public expenditure associated with developing such a system, it is imperative to understand the present state of natural sediment bypassing.

In the absence of a massive field study, the most reasonable method for attaining a greater understanding of sediment bypassing processes at tidal inlets is the utilization of a numerical surf zone transport model which includes all relevant forcing parameters for the system. An extension of the Briand & Kamphuis (1993a; 1993b) PC based, quasi 3-D nearshore sediment transport model is being developed, to include diffraction in the wave transformation calculations, and the effects of a tidily varying sea surface. Once the modifications are complete, the amount of sediment presently being bypassed around

Moriches Inlet will be estimated, and the role of tidal flow in this bypassing will be explored. Further investigations should provide a greater understanding of the pathways of bypassed sediment and how sensitive this bypassing is to the geometry of these pathways.

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