Extensive field investigations were carried out in the fifties for understanding salinity intrusion through direct (prototype) evidence, and to calibrate physical models such as the ones noted above. Reference may be made to the investigation by Sir Claude Inglis (Inglis and Allen, 1957) on the Thames in England, and by Prof. Pritchard (Pritchard, 1952) on the Chesapeake Bay. In both estuaries, as elsewhere, studies which began in the fifties (and earlier) have been of an ongoing nature, and have continued until the present time. The reason for this is both a continued interest in the basic aspects of the mechanism of mixing between salt water and fresh water in the real environment (see e.g. Dronkers and van de Kreeke, 1986), and also because new engineering problems continually arise and, therefore, must be examined afresh. Physical models of large estuarine systems such as the San Francisco Bay, Chesapeake Bay, the Mississippi and New York Harbor have been retained, and are used as needed by the Corps of Engineers and other agencies. As fresh input for modification and calibration of such models, prototype studies are conducted, although many now tend to be highly site-specific, given the costs involved in field work.

Computer technology has made it possible to develop sophisticated numerical models for handling estuarine hydrodynamics including salinity intrusion. The early models, in the sixties and early seventies, were typically one-dimensional, simulating cross-sectional average processes in the longitudinal direction (e.g., Harleman et al., 1974; Miles, 1977). These were followed by two-dimensional, depth-averaged models, e.g. such as the one incorporated in the TABS-2 system of estuarine numerical models used by the Waterways Experiment Station (Thomas and McAnally, 1985). More recently, fully three-dimensional models have been developed. These models have been applied to a study of New York Harbor[2].

9.3 PHYSICAL PRINCIPLES

Analytic approaches to solve the problem of salt water intrusion depend upon whether the estuary can be treated as stratified, or as partially mixed or fully mixed. Thus, for example, an estuary is classified as "well mixed"

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[2]Allen Teeter, Waterways Experiment Station, Vicksburg, Mississippi, personal communication.