Coastal Engineering Technical Note

OFFSHORE TIDE GAGE FOR OCEAN BAR DREDGING

PURPOSE: To describe the structure and the equipment of an offshore tidemeasuring station used for contract dredging work on ocean bars. Dredging by a contractor plant requires survey work to be as accurate as possible. An offshore tide gage may be employed to get more accurate surveys and, thus, more accurate dredging quantity estimates.

BACKGROUND: The Wilmington District, Corps of Engineers, became concerned several years ago over the fact that the tide level seaward of the beach line is often different from the level in the estuary where tide gages are usually located. The magnitude of that difference cannot be predicted or calculated using gages located in the estuary. Studies determined that cyclical differences of as much as 4 feet exist between tide gages in the estuary and 2 miles offshore.

With the advent of contractor-owned dredging equipment working in offshore entrance channels, the unpredictable datum from which surveys were made created a very undesirable situation for both the Government and the contractor (see Murden, 1980). This note describes a reliable offshore tide-measuring station (Fig. 1) which was developed by the Wilmington District in 1977 and is being operated for hydrographic survey work on the bar at Beaufort Inlet, Morehead City, North Carolina (Fig. 2).

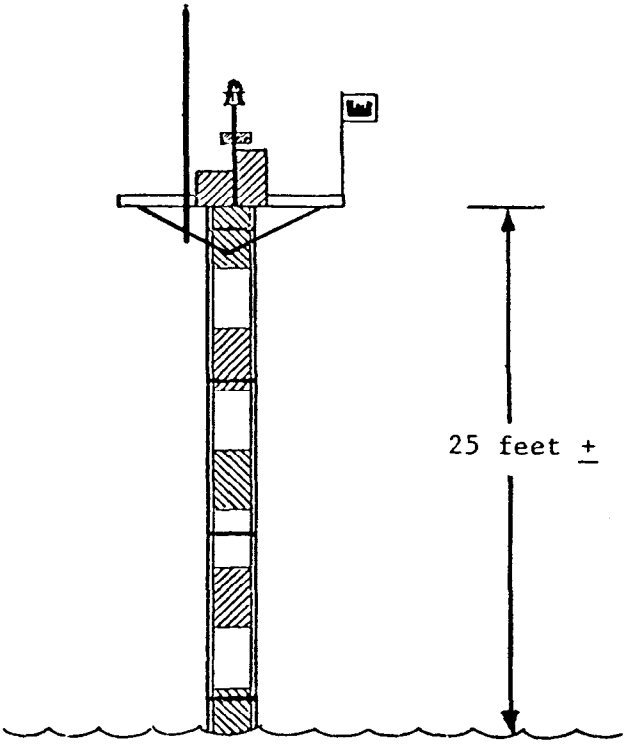

Figure 1. Morehead City Tide Gage

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Differences in elevations which may occur in the estuary and offshore are depicted in Figure 3. Note that overdredging may occur when the ocean tide, at the dredging location, is lower than the estuary, or datum, tide; and underdredging may occur when the ocean tide is higher than the estuary tide.

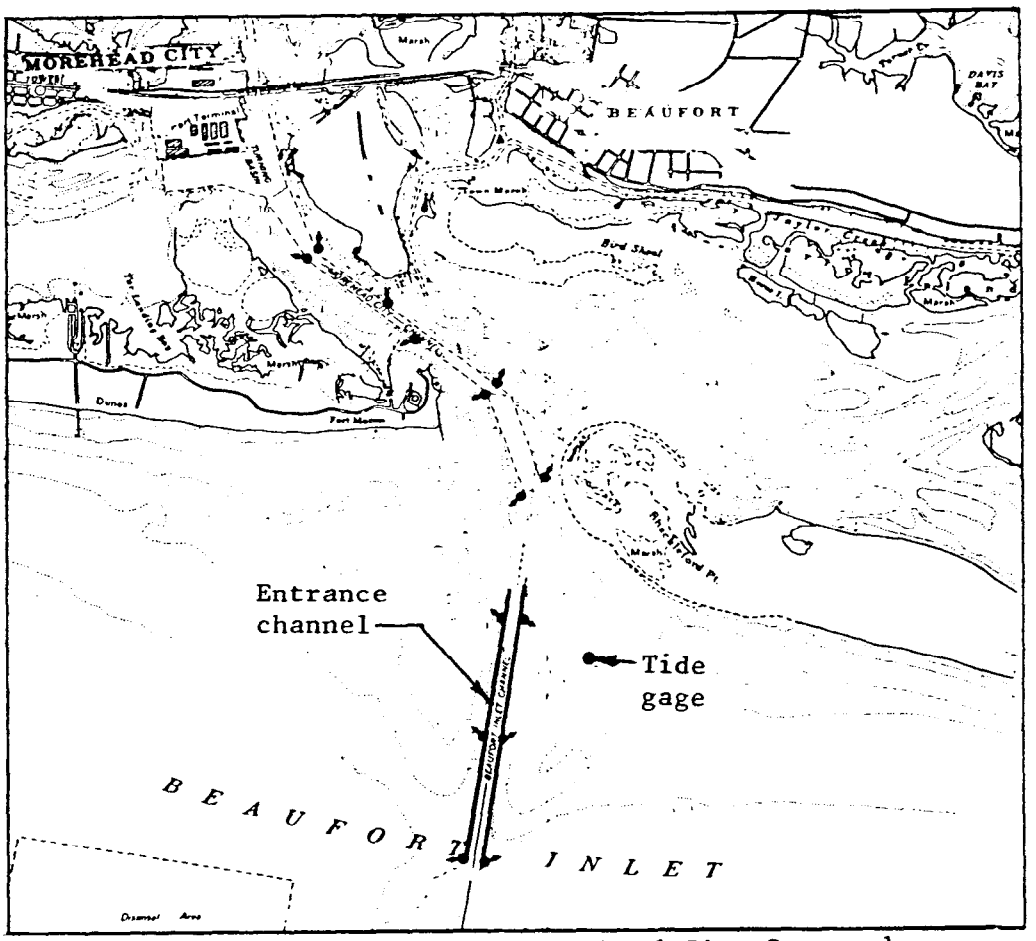

Figure 2. Location of Morehead City Gage and Beaufort Inlet Entrance Channel

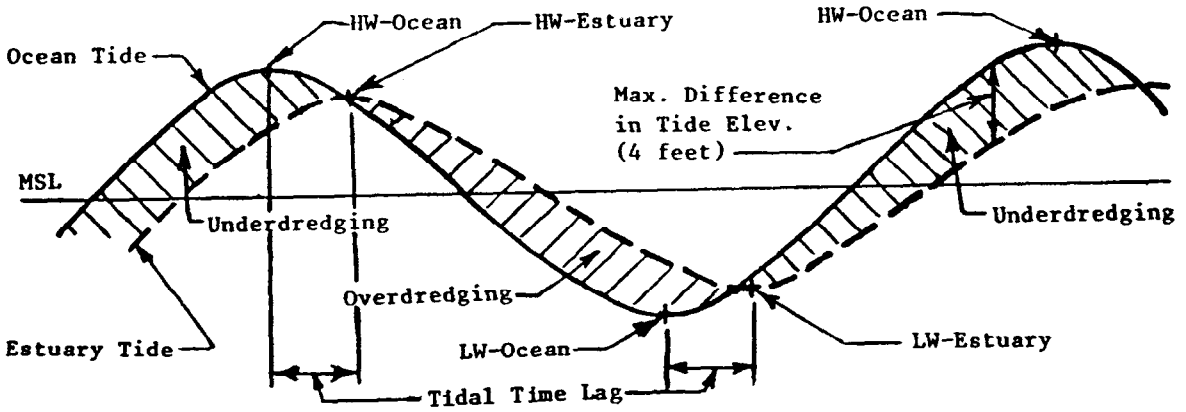

Figure 3. Sketch of Ocean and Estuary Tides (North Carolina Coast)

DESCRIPTION OF EQUIPMENT: The basic tide gage and support structure are similar to others which have been used in the Wilmington District; however, this gage is unique in that it is equipped with electronic telemetry equipment which acquires and transmits tide data by radio to a shore base or vessel equipped with the necessary telemetry equipment. The Morehead City Gage is discussed in detail in the Wilmington District report (1977) and summarized below. The gage consists of two elements: (1) tide measuring equipment and (2) central station.

1. Tide Measuring Equipment

The equipment utilizes a float and tape system and is equipped with a digital output. Data is recorded on a punched paper-tape and in an electronic memory. The tape provides a continuous record of tide data and is a valuable record for processing at a later date. The electronic memory retains only the last tide reading acquired. Tide data is transmitted to the central station by a VHF FM transceiver.

The gage support structure is constructed of a 60-foot, 12-inch diameter steel pipe with one-half-inch thickness, and an 84-inch by 26-inch steel platform bolted on top. The 60-foot pipe was jetted 20 feet into the sandy sub-bottom. The structure is located in about 15 feet of water. The deck is about 25 feet above the water level.

During daylight hours the structure is highly visible to mariners because of its large size. Also, it was painted with obstruction colors consisting of orange and white stripes. For warning to mariners at night, the structure is equipped with a flashing navigation light.

2. Central Station

This equipment, which includes a VHF FM transceiver similar to the unit in the telemetry package, is completely self-contained and easily portable. The data transmitted is electronically displayed in digital form on the central station equipment. The station's operational range is limited only by the range of the radio transceivers used, about 3 to 5 miles.

CONCLUSIONS: The tide gage operating at Morehead City is being used in hydrographic survey work to more accurately determine the quantity of material to be dredged from the bar channel. The data acquired was used to determine dredging pay items to the contractor. It was concluded that the equipment was adequately designed to operate in the offshore environment for extended periods. The Wilmington District has successfully used similar devices in other locations on the

North Carolina coast. With the assistance of the Wilmington District, two similar gages have been installed and about 10 others are planned by Savannah District.

ADDITIONAL INFORMATION: For additional information contact the Plant Branch, Construction-Operations Division, Wilmington District (919) 343-4820 or FTS 671-4820.

REFERENCES:

U.S. ARMY ENGINEER DISTRICT, WILMINGTON, "Morehead City Tide Gage," Corps of Engineers, Wilmington, N.C., 30 March 1977.

MURDEN, W. R., JR., "Initial and Maintenance Dredging," an unpublished speech before the National Academy of Sciences, Maritime Transportation Research Board, Committee on Reducing Tank Barge Pollution, Working Group on Operating Environment, U.S. Army, Corps of Engineers, Water Resources Support Center, Fort Belvoir, VA., April 1980.