



**EXPLANATION**

**UNIT CHARACTERISTICS**

**HOLOCENE**

**QUATERNARY**

**PLEISTOCENE**

**TERTIARY**

**PALEOCENE**

**GENERAL LOAD BEARING CAPACITY**

**CONTACTS**

**EXPOSED, APPROXIMATE, AND INFERRED**

**STRATIGRAPHIC CONTROL**

- Depth of test boring on or elevation to a section
- Location of test or auger boring by Herbert and Associates, Ltd., Virginia Beach
- Location of Virginia Department of Highways and Transportation boring
- Location of Soil Engineering Division, 5th Naval District Command boring
- Location of Hampton Roads Tunnel Commission boring

**DISCUSSION**

The Norfolk North 7.5-minute quadrangle area is approximately 60 square miles, about half of which is covered with water. Portions of the cities of Norfolk and Portsmouth on the south and Hampton in the northwest comprise the political subdivisions. Cities were examined to establish the stratigraphic framework, the distribution of geologic units, morphology, and geologic and economic factors affecting land modification.

The area is highly industrialized near the principle waterways and includes part of the largest naval facility in the world. The Elizabeth and Lafayette rivers, the main drainages, flow through Hampton Roads into the Chesapeake Bay. There is a well-developed transportation network. The area is served by the Norfolk and Western Railway which maintains a large coal-loading facility at Lambert's Point.

Field work was done between November 1973 and February 1974. Over 200 test-boring and hand-sung logs were obtained from Herbert and Associates, Ltd., Virginia Beach. Additional boring logs were obtained from the Virginia Department of Highways and Transportation, the Hampton Roads Tunnel Commission, and the 5th Naval District Command. All drilling consisted of conventional core borings with samples obtained at least every 5 feet of depth, using standard split-spools driven with 140-pound (63-kg) hammers having a 30-inch (76-cm) fall. Subsurface data were supplemented by natural and man-made exposures. Physical analyses, including sieve analyses, Atterberg limits, specific gravity, hydrometer, relative density, California Bearing Ratio, and confined consolidation tests, have been performed on samples from the Sand Bridge and Norfolk formations.

**MORPHOLOGY**

Four prominent geomorphic features are present in the Norfolk North quadrangle. The most prominent is Willoughby Spit, composed of storm deposited sand of Holocene age. Early navigational charts do not show the spit, therefore it is a relatively young feature (personal communication, Gerald Johnson).

The eastward-trending Diamond Springs scarp is located about 3.4 miles (5.5 km) south of Willoughby Spit, approximately coincident with the silt sand and clay facies contact of the Sand Bridge Formation. It is a narrow band of late Pleistocene high-energy sands bordered on the north by beach sediments of Holocene age. Tidal inlets, many of which have been filled, dissect the scarp and Holocene deposits. Without subsurface data the scarp is only faintly recognizable.

The small area on the north side of Hampton Roads in the northwest corner of the mapped area is part of the Hampton flat (Coch, 1971). The Hampton flat, underlain by the Lynnhaven Member of the Tabb Formation, is well described by Johnson (1976, p. 10; Figure 3).

**STRATIGRAPHY**

The stratigraphic framework of the Outer Coastal Plain has been established by Coch (1968, 1971), Oaks and Coch (1973), Johnson (1972, 1976), and Oaks and others (1974). In the Norfolk North quadrangle the Pleistocene Tabb and Sand Bridge formations are exposed at the surface in addition to the sediments of Holocene age. The Yorktown and Norfolk formations occur in the shallow subsurface but do not crop out.

**PLIOCENE SERIES**

**Yorktown Formation**

The Yorktown Formation occurs only in the subsurface. The depth to the top of the Yorktown Formation and the Elizabeth and Lafayette rivers (Figure 1). Its top has a maximum depth of about 150 feet (46 m) under Hampton Roads. Locally between Willoughby Spit and the Lafayette River the top is only 20 feet (6 m) below mean sea level.

The distinctive molluscan fauna, highly compact nature of the sediments, and the greenish-gray color are the major characteristics used to identify the formation from boring samples. Most of the formation is a massively bedded, compact, greenish-gray, fossiliferous, fine sand. Quartz comprises the bulk of the sand; enough glauconite, however, is present to impart a greenish-gray coloration to the formation. Layers of shaly material composed of snails (*Crepidula fornicata*) and attached barnacles (*Balanus*) and bryozoans (*Chelostomatia*), and thin silt clay layers are present.

**PLIOCENE SERIES**

**Tabb Formation**

The Tabb Formation occurs only in the subsurface. Locally it is absent and the overlying Sand Bridge Formation lies directly on the Yorktown Formation. Where the Norfolk overlies the Yorktown the contact is very distinctive. A sharp color change from gray to greenish-gray commonly marks the contact, although the greenish-gray Yorktown may be reddish orange locally. The reddish orange is believed to be the result of pre-Norfolk weathering (personal communication, B. L. Sutphin). Degree of consolidation changes across the contact, with the Norfolk being less compact. The Norfolk is sparsely fossiliferous in the Yorktown Formation, the Norfolk is absent to only a few inches thick. The Norfolk may be as much as 50 feet (15 m) thick where deposited in channels cut into the Yorktown.

**SAND BRIDGE FORMATION**

The Sand Bridge Formation is composed of a lower member and an upper member with three recognizable facies. Two of the facies are shown on the geologic map. The lower member is included with the facies of the upper member on the geologic map. The lower member, which is composed of clean coarse quartz sand, ranges from 0 to 8 feet (0.2 m) in thickness. Oaks and Coch (1973, p. 43) interpret the lower member as a beach sand.

**Silt-sand facies:** The sand facies underlies the Willoughby Spit area. It is composed of light-gray to tan, fine to coarse sand with some shell fragments and a trace of pebble gravel. To the south the sand facies intertongues with the clayey silt sand facies.

**Clayey silt sand facies:** South of the Willoughby Spit the sand facies is composed of the clayey silt sand facies, which is poorly sorted sand, clayey silt, and silt sand. The depositional environment is interpreted to have been fluvial-estuarine and brackish marine.

**Sand facies:** The sand facies underlies the Elizabeth River area. It is composed of light-gray to tan, fine to medium sand with some shell fragments and a trace of pebble gravel. To the south the sand facies intertongues with the clayey silt sand facies.

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