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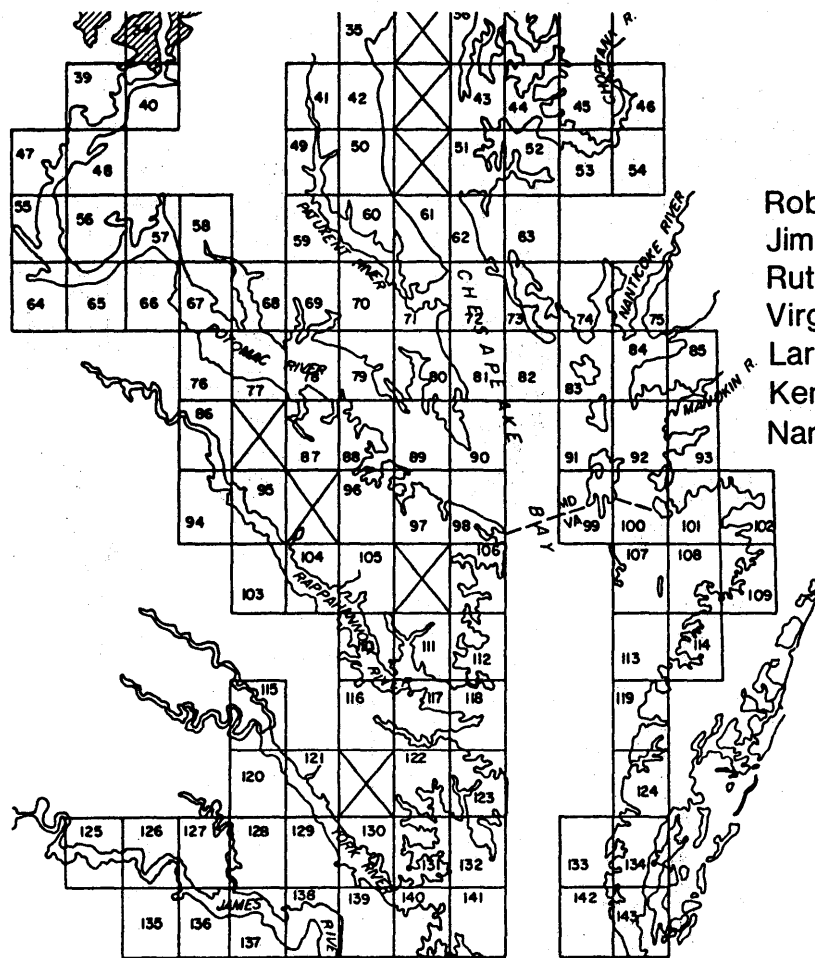
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Distribution of Submerged Aquatic Vegetation in
the Chesapeake Bay and Tributaries - 1984

by

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SECTION 1

INTRODUCTION

Communities of submerged aquatic vegetation (SAV) are an integral part of the Chesapeake Bay ecosystem. They provide an important habitat for many species which use SAV either as a food source or as protection from predators, e.g. a nursery. They reduce currents and baffle waves, allowing for deposition of suspended material. In addition, they bind sediments with their roots and rhizomes to prevent erosion of the underlying material. They are important in nutrient cycling both through the absorption and release of nitrogen and phosphorus (Thayer, et. al, 1975; Kemp, et. al., 1984; Orth, et. al., 1984; Ward, et. al., 1984).

Interest in Chesapeake Bay SAV communities by scientists, resource managers and the public has been very high because of the significant reductions of SAV in many areas compared to luxurious stands that once prevailed less than 20 years ago (Orth and Moore, 1981, 1983, 1984). The recently completed Chesapeake Bay Program, funded by the U.S. Environmental Protection Agency (EPA), focused research on SAV in the areas of distribution and abundance, role and value, and factors that may have caused the decline of SAV (U.S. EPA Synthesis Report, 1982). The research phase of the Chesapeake Bay Program was completed in 1983 and the implementation phase is currently in progress.

An early but important consideration in the distribution aspects was how to determine the abundance of SAV effectively on a baywide basis. Aerial photography was chosen as the most cost effective and efficient method of acquiring quantitative information. In 1978 all the shallow water areas of the bay were flown with medium scale photography (scale 1:24,000). This mapping study resulted in the publication of a series of topographic

quadrangles depicting the presence of SAV beds throughout the Chesapeake Bay region (Orth, et al., 1979; Anderson and Macomber, 1980). During subsequent years, selected areas of the bay were photographed and/or mapped for SAV but no complete baywide survey has been conducted since 1978.

Between 1978 and 1984, field surveys in different sections of the bay or rivers were conducted by the U.S. Geological Survey (USGS), Maryland Department of Natural Resources (Md.DNR), Northern Virginia Community College (NVCC) and the Virginia Institute of Marine Science (VIMS), to monitor the presence and/or absence of SAV in these particular areas. In addition, researchers at the Harford Community College and the University of Maryland's Horn Point Laboratories (UMdHPL) had been monitoring SAV populations in their respective study areas. Studies in the Choptank River by the UMdHPL have shown a decline in SAV since 1980. However, some surveys found SAV to be increasing in distribution and abundance in certain sections, especially in the Potomac River and Susquehanna Flats. Surveys first by the USGS and then by NVCC showed not only increases in natural species such as wild celery (Vallisneria americana) and sago pondweed (Potamogeton pectinatus) but also significant populations of two species never previously recorded in this area, water stargrass (Heteranthera dubia) and Hydrilla (Hydrilla verticillata). The latter species was of particular concern because of its potential rapid growth rate and its ability to spread and outcompete more desirable species of SAV.

During 1984, SAV beds in the bay were photographed and mapped under grants by the USEPA and the National Oceanographic and Atmospheric Administration (NOAA) to VIMS and EPA's Environmental Photographic Interpretation Center (EPIC). In addition, ground surveys for SAV were conducted in the Potomac River by the USGS and NVCC and in the entire

Maryland section of the bay by Md.DNR. This report draws upon not only information provided by the aerial photography but also data from the surveys conducted in the Potomac River (Allaire, et al., 1985; Carter, et al., 1985a; Rybicki, et al., 1985) and the multi-station survey conducted annually by the Md.DNR. Field observations made in the Susquehanna River and Flats (Stan Kollar, personal communication) and the Choptank River (Robert Twilley, personal communication) were used to corroborate and fill in areas missed by the aerial photography. Unlike the 1978 studies, this represents a unique effort to combine all the information into one baywide report of the 1984 status of SAV.

SECTION 2

SAV SPECIES

Ten species of submerged vegetation are abundant in the bay. Zostera marina (eelgrass) is dominant in the lower reaches. Myriophyllum spicatum (water milfoil), Potamogeton pectinatus (sago pondweed), P. perfoliatus (redhead grass), Zannichelia palustris (horned pondweed), Vallisneria americana (wild celery), Elodea canadensis (common elodea), Ceratophyllum demersum (coontail) and Najas quadalupensis (southern naiad) are less tolerant of high salinities and are found in the middle and upper reaches of the bay (Stevenson and Confer, 1978; Orth, et al., 1979; Orth and Moore, 1981, 1983). Ruppia maritima (widgeongrass) is tolerant of a wide range of salinities and is found from the bay mouth to the Susquehanna Flats. Approximately ten other species are found less commonly and are present primarily in the middle and upper reaches of the bay and the rivers (Appendix A). One species presently found in the Potomac River, Hydrilla verticillata (Hydrilla), has the potential for becoming one of the dominant species found here (Allaire, et al., 1985; Rybicki, et al., 1985).

SECTION 3

METHODS

Aerial Photography

Aerial photography was the principal method used to assess the distribution of SAV in the Chesapeake Bay and its tributaries in the 1984 study. Pre-determined flight lines for photography of areas that either had SAV or could potentially have SAV (that is all areas where water depths were less than 2 m at mean low water) were drawn on 1:25,000 scale USGS maps to ensure both complete coverage of SAV beds and inclusion of land features as control points for mapping accuracy (Fig. 1). Some areas were not included because of the known lack of SAV in those areas.

The general guidelines used for mission planning and execution are given in Table 1. These guidelines address tidal stage, plant growth, sun elevation, water transparency and atmospheric transparency, turbidity, wind, sensor operation and plotting and allowed for acquisition of photographs under near optimal conditions. The guidelines are critical because significant distortion of any one item could significantly decrease the ability to detect the SAV or to interpret the photography properly as to the presence or absence of SAV.

The camera used for aerial photography of SAV in Virginia was a Fairchild CA-8 cartographic camera with a 152 mm (6 1/2 inch) focal length Bausch and Lomb Metrogon lens. Film was Kodak 24 cm (9 1/2 inch) square positive Aerochrome MS type 2448. The camera was mounted in a camera port in the bottom fuselage of the VIMS single engine, fixed high wing De Havilland Beaver aircraft gelatine. A wratten 1A haze filter was used inside the cone of the camera to reduce the degrading effect of atmospheric haze on image quality. Flights were conducted at an altitude of

Figure 1. Flight lines used for acquisition of aerial photographs of SAV in 1984 for Virginia and Maryland (lines connecting gray squares represent flight lines used in this survey).

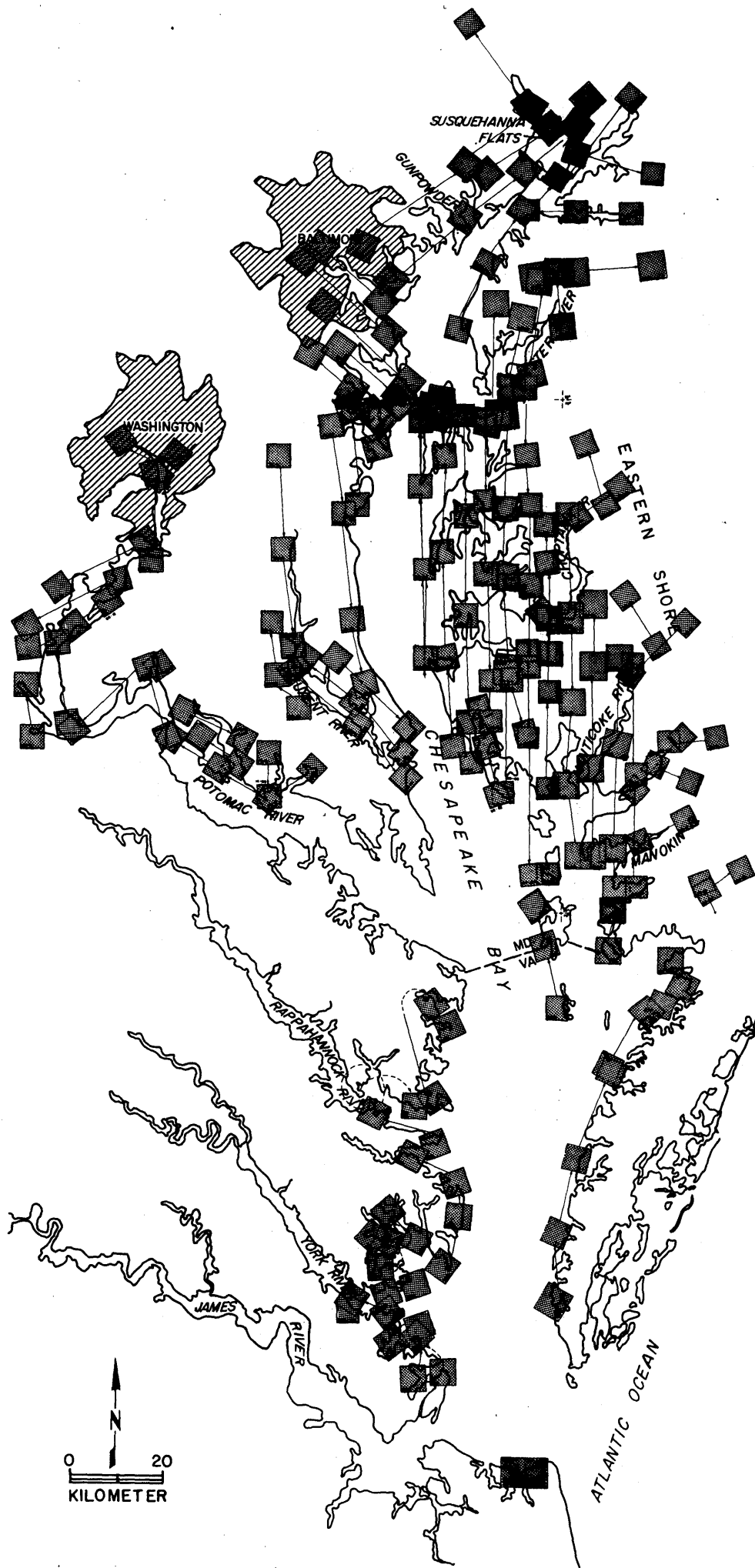


TABLE 1. GUIDELINES FOLLOWED DURING ACQUISITION OF AERIAL PHOTOGRAPHS.

1. Tidal Stage - Photography was acquired at low tide, +/- 0-1.5 ft., as predicted by the National Ocean Survey tables.
 2. Plant Growth - Imagery was acquired when growth stages ensured maximum delineation of SAV, and when phenologic stage overlap was greatest.
 3. Sun Angle - Photography was acquired when surface reflection from sun glint did not cover more than 30 percent of frame. Sun angle was generally between 20° and 40° to minimize water surface glitter. At least 60 percent line overlap and 20 percent side lap was used to minimize image degradation due to sun glint.
 4. Turbidity - Photography was acquired when clarity of water ensured complete delineation of grass beds.
 5. Wind - Photography was acquired during periods of no or low wind. Off-shore winds were preferred over on-shore winds when wind conditions could not be avoided.
 6. Atmospherics - Photography was acquired during periods of no or low haze and/or clouds below aircraft. There could be no more than scattered or thin broken clouds, or thin overcast above aircraft, to ensure maximum SAV to bottom contrast.
 7. Sensor Operation - Photography was acquired in the vertical mode with less than 5 degrees tilt. Scale/altitude/film/focal length combination permitted resolution and identification of one square meter area of SAV (surface).
 8. Plotting - Each flight line included sufficient identifiable land area to assure accurate plotting of grass beds.
-
-

approximately 12,000 ft yielding a scale of 1:24,000 for the photograph, approximating that of a standard U.S. topographic quadrangle.

The SAV photography for the Maryland waters was obtained by Aero Eco under contract to the Bionetics Corporation (onsite contractor for EPA/EPIC). The camera used by Aero Eco was a Zeiss Jena LMK 15/2323 with a 153 mm (6.02 inch) focal length Zeiss Jena Lamegon PI/C lens. The film used was Kodak 24 cm (9 1/2 inch) square positive Aerochrome MS type 2448. The camera was mounted in the bottom fuselage of Aero Eco's Partenavia P68 Observer, a twin engine high wing reconnaissance aircraft. An antivignetting filter was also used. The photography was also acquired at an approximate altitude of 12,000 feet.

Several problems were encountered during the acquisition of the 1984 aerial photography. Weather patterns consisting of high percentage of cloud cover and haze appeared to be greater than in past years. This effectively reduced the time available to collect the SAV imagery. Poor weather conditions in certain restricted areas, e.g., Dahlgren, Patuxent NAS or around Smith Island, compounded the problem since access to the airspace over these areas was limited to certain hours of each day or certain days only. Both camera and film processing malfunctions, which resulted in the loss of all or portions of some of the flight lines, occurred in 1984, but, where, possible, were supplemented with similar aerial photography acquired in 1983. These problems are further addressed in the next section.

Mapping Process

Fig. 2 gives the location of the topographic quadrangles in the study area. This area includes all regions with a potential for SAV growth. The quadrangles are sequentially numbered to allow for more efficient access to

Figure 2. Location of topographic quadrangles in the Chesapeake Bay and tributaries for determining distribution of SAV.

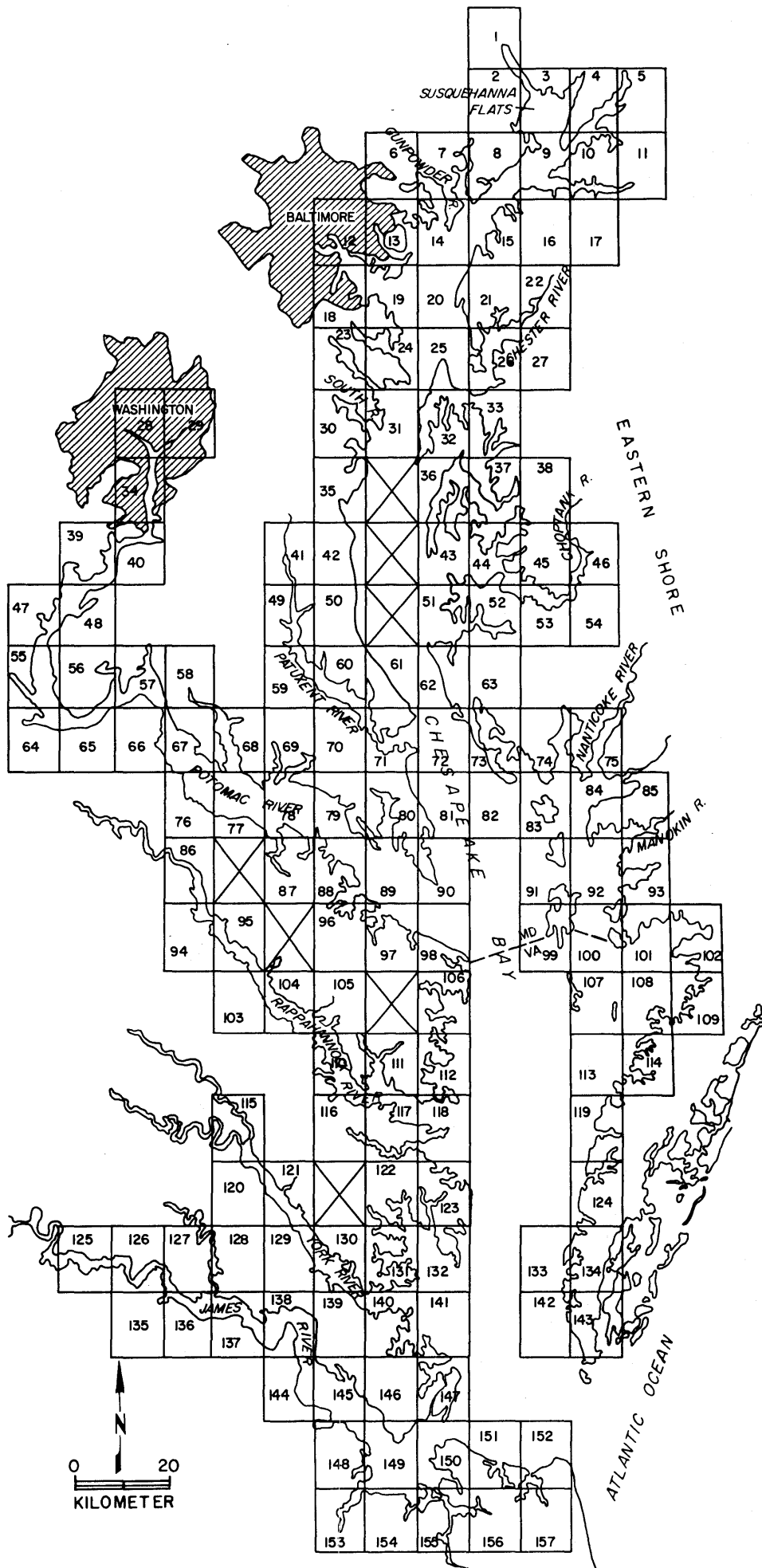


TABLE 2. LIST OF USGS 7.5-MINUTE QUADRANGLES IN CHESAPEAKE BAY SAV STUDY AREA AND CORRESPONDING CODE NUMBERS (SEE FIG. 2 FOR LOCATION OF QUADRANGLES. THOSE TOPOGRAPHIC QUADRANGLES WITH SAV BEDS CAN BE FOUND IN APPENDIX B).

1. Conowingo Dam, Md.-Pa.	39. Fort Belvoir, Va.-Md.
2. Aberdeen, Md.	40. Mt. Vernon, Va.-Md.
3. Havre de Grace, Md.	41. Lower Marlboro, Md.
4. North East, Md.	42. North Beach, Md.
5. Elkton, Md.	43. Tilghman, Md.
6. White Marsh, Md.	44. Oxford, Md.
7. Edgewood, Md.	45. Trappe, Md.
8. Perryman, Md.	46. Preston, Md.
9. Spesutie, Md.	47. Quantico, Va.-Md.
10. Earleville, Md.	48. Indian Head, Va.-Md.
11. Cecilton, Md.	49. Benedict, Md.
12. Baltimore East, Md.	50. Prince Frederick, Md.
13. Middle River, Md.	51. Sharps Island, Md.
14. Gunpowder Neck, Md.	52. Church Creek, Md.
15. Hanesville, Md.	53. Cambridge, Md.
16. Betterton, Md.	54. East New Market, Md.
17. Galena, Md.	55. Widewater, Va.-Md.
18. Curtis Bay, Md.	56. Nanjemoy, Md.
19. Sparrows Point, Md.	57. Mathias Point, Md.-Va.
20. Swan Point, Md.	58. Popes Creek, Md.
21. Rock Hall, Md.	59. Mechanicsville, Md.
22. Chestertown, Md.	60. Broomes Island, Md.
23. Round Bay, Md.	61. Cove Point, Md.
24. Gibson Island, Md.	62. Taylors Island, Md.
25. Love Point, Md.	63. Golden Hill, Md.
26. Langford Creek, Md.	64. Passapatanzy, Md.-Va.
27. Centreville, Md.	65. King George, Va.-Md.
28. Washington West, Md.-DC-Va.	66. Dahlgren, Va.-Md.
29. Washington East, DC-Md.	67. Colonial Beach North, Va.-Md.
30. South River, Md.	68. Rock Point, Md.
31. Annapolis, Md.	69. Leonardtown, Md.
32. Kent Island, Md.	70. Hollywood, Md.
33. Queenstown, Md.	71. Solomons Island, Md.
34. Alexandria, Va.-Md.	72. Barren Island, Md.
35. Deale, Md.	73. Honga, Md.
36. Claiborne, Md.	74. Wingate, Md.
37. St. Michaels, Md.	75. Nanticoke, Md.
38. Easton, Md.	76. Colonial Beach South, Va.-Md.

TABLE 2. (continued)

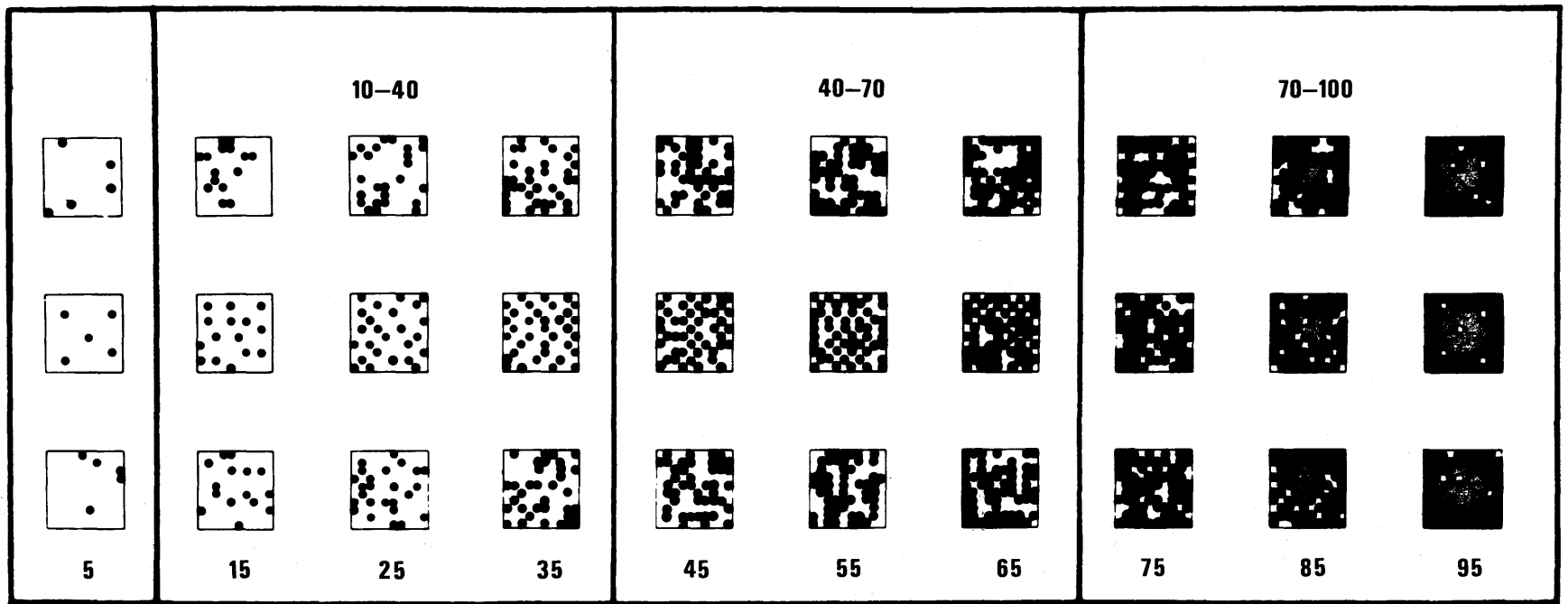
77. Stratford Hall, Va.-Md.	118. Deltaville, Va.
78. St. Clements Island, Va.-Md.	119. Jamesville, Va.
79. Piney Point, Va. Md.	120. Toano, Va.
80. St. Marys City, Md.	121. Gressitt, Va.
81. Point No Point, Md.	122. Ware Neck, Va.
82. Richland Point, Md.	123. Mathews, Va.
83. Bloodsworth Island, Md.	124. Franktown, Va.
84. Deal Island, Md.	125. Westover, Va.
85. Monie, Md.	126. Charles City, Va.
86. Champlain, Va.	127. Brandon, Va.
87. Machodoc, Va.	128. Norge, Va.
88. Kinsale, Va.-Md.	129. Williamsburg, Va.
89. St. George Island, Va.-Md.	130. Clay Bank, Va.
90. Point Lookout, Md.	131. Achilles, Va.
91. Kedges Straits, Md.	132. New Point Comfort, Va.
92. Terrapin Sand Point, Md.	133. Cape Charles, Va.
93. Marion, Md.	134. Cheriton, Va.
94. Mount Landing, Va.	135. Savedge, Va.
95. Tappahannock, Va.	136. Claremont, Va.
96. Lottsburg, Va.	137. Surry, Va.
97. Heathsville, Va.-Md.	138. Hog Island, Va.
98. Burgess, Va.-Md.	139. Yorktown, Va.
99. Ewell, Va.-Md.	140. Poquoson West, Va.
100. Great Fox Island, Va.-Md.	141. Poquoson East, Va.
101. Crisfield, Va.-Md.	142. Elliotts Creek, Va.
102. Saxis, Va.-Md.	143. Townsend, Va.
103. Dunnsville, Va.	144. Bacons Castle, Va.
104. Morattico, Va.	145. Mulberry Island, Va.
105. Lively, Va.	146. Newport News North, Va.
106. Reedville, Va.	147. Hampton, Va.
107. Tangier Island, Va.	148. Benns Church, Va.
108. Chesconessex, Va.	149. Newport News South, Va.
109. Parksley, Va.	150. Norfolk North, Va.
110. Urbanna, Va.	151. Little Creek, Va.
111. Irvington, Va.	152. Cape Henry, Va.
112. Fleets Bay, Va.	153. Chuckatuck, Va.
113. Nandua Creek	154. Bowers Hill, Va.
114. Pungoteague, Va.	155. Norfolk South, Va.
115. West Point, Va.	156. Kempsville, Va.
116. Saluda, Va.	157. Princess Anne, Va.
117. Wilton, Va.	

the data. Table 2 gives the corresponding names of the 157 quadrangles shown in Fig. 2.

SAV beds were identified on the photographs using all available information, including knowledge of aquatic grass signatures on the film, areas of grass coverage from previous flights, ground information, and aerial visual surveys. Mylar topographic quadrangles (1:24,000) were used in the mapping process. Delineation of SAV bed boundaries was facilitated by superimposing on a light table the appropriate mylar quadrangle with the transparent photograph. SAV boundaries were delineated on the mylar map with a pencil. Where minor scale differences were evident between the photograph and quadrangle or where significant shoreline erosion or accretion had occurred since production of the map, a best fit was obtained, or shoreline changes were noted on the quadrangle. Areas of SAV beds were derived from the 1:24,000 scale topographic quadrangle. Measurements were made on a Numonics Graphics Calculator, model 1224 for the lower bay. EPIC utilized a Calma Graphic Interactive Image Analysis System based on a Data General Eclipse S230 minicomputer for upper bay areas. Each SAV bed was digitized three times and the area reported as the average of the three. Each of the three measurements was generally within 5% of the mean.

In addition to the boundaries of the SAV bed, an estimate of percent cover within each bed was made visually in comparison with an enlarged Crown Density Scale, similar to those developed for estimating of forest tree crown cover from aerial photography (Fig. 3). Bed density was classified into one of four categories based on a subjective comparison with the density scale. These were: 1. very sparse; <10%, 2. sparse, 10 to 40%; 3. moderate, 40 to 70%; or 4. dense, 70-100%. Either the entire bed, or subsections within the bed, were assigned a number (1 to 4) corresponding to

Figure 3. Crown density scale used for determining density of SAV beds:
very sparse (1), 0-10%; sparse (2), 10-40%; moderate (3), 40-70%;
dense (4), 70-100%.



PERCENT CROWN COVER

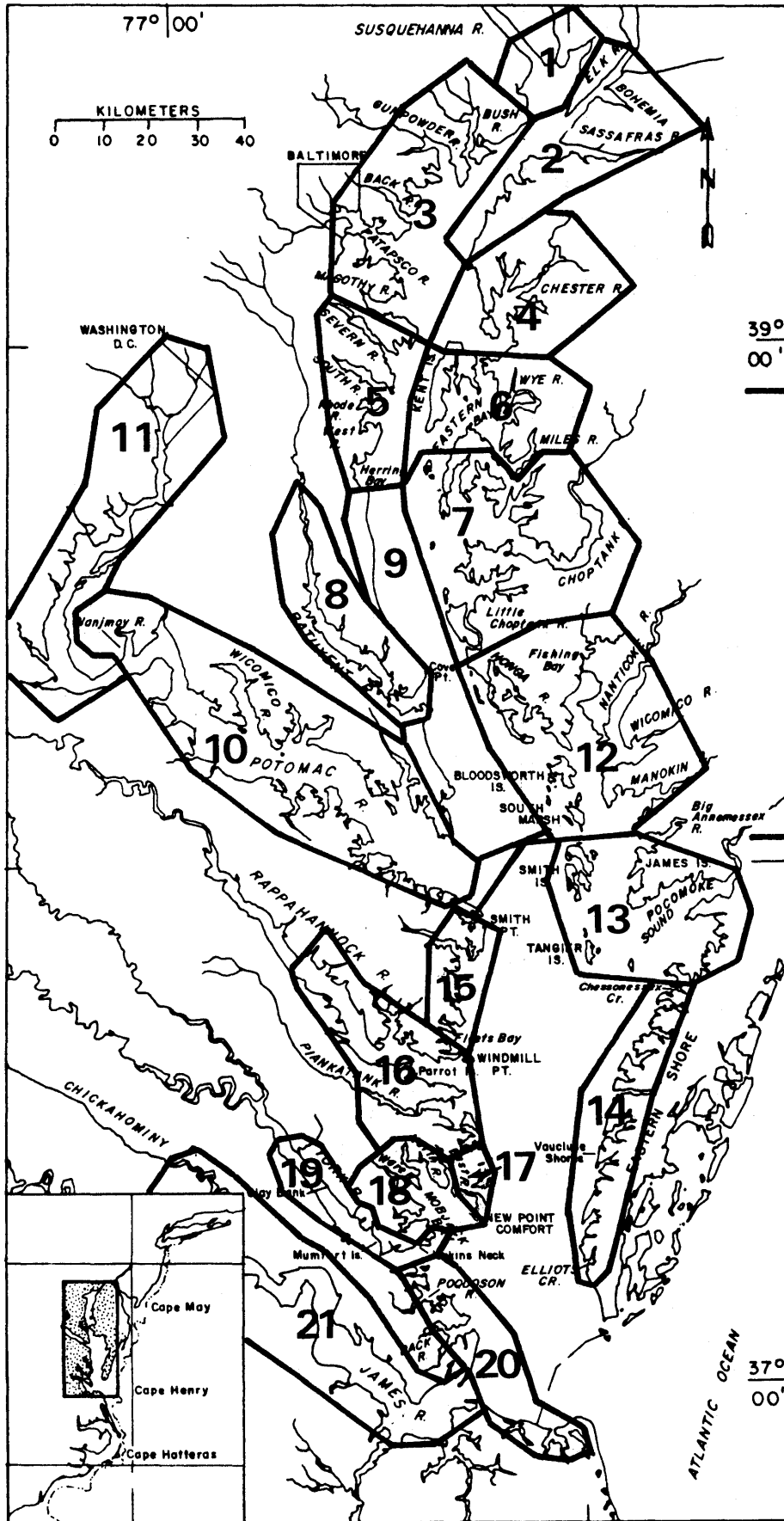
the above density categories. In addition to the density scale, each distinct SAV unit was given a letter designation for proper identification for future comparisons.

In order to reduce interobserver variability in both the mapping and digitizing process, steps were taken to insure quality assurance. Sections from several areas in both Maryland and Virginia containing SAV were independently mapped and assigned a density classification. Results were compared for comparability of mapping effort. In addition, mapped sections were independently digitized for similar comparisons.

The discussion of the distribution of SAV has been organized into three zones as established by Orth and Moore (1982). The area between the mouth of the bay to a line stretching from the mouth of the Potomac River at Smith Point in Virginia to just above Smith Island and extending across to the north shore at the mouth of the Big Annemessex River is referred to as the Lower Bay zone (Fig. 4). The area between the north shore of the Big Annemessex River and the south shore of the Potomac River to the Chesapeake Bay bridge at Kent Island is referred to as the Middle Bay zone. The area between the Chesapeake Bay bridge and the Susquehanna Flats is referred to as the Upper Bay zone. The salinity within each zone roughly coincides with the major salinity zones of estuaries; polyhaline ($18-25^{\circ}/\text{oo}$), Lower zone; mesohaline ($5-18^{\circ}/\text{oo}$), Middle zone; oligohaline ($0.5-5^{\circ}/\text{oo}$), Upper zone. Although the major rivers and smaller tributaries of the bay have their own salinity regimes, the distributions of SAV in each river are discussed within the zone where it connects to the bay proper.

In addition, twenty one major sections of the bay are identified for more detailed discussion of SAV distribution (Orth and Moore, 1982) (Fig. 4, Table 3). These sections denote relatively distinct parts of the bay that

Figure 4. Location of upper, middle and lower zones of the Chesapeake Bay and the 21 major sections used for delineation of SAV distribution patterns (see Table 3 and text for exact boundaries).



UPPER

MIDDLE

LOWER

TABLE 3. AREA DESCRIPTION FOR EACH OF 21 MAJOR SECTIONS IN THE CHESAPEAKE BAY HAVING SAV.

-
-
- Section 1. Susquehanna Flats - all areas between and including Spesutie Island and Turkey Point at the mouth of the Elk River to include the Northeast River.
- Section 2. Upper Eastern Shore - all areas in the Elk, Bohemia and Sassafras Rivers and SAV in areas on the eastern shore above the Swan Point quadrangle.
- Section 3. Upper Western Shore - all areas south of Spesutie Island and north of the bay bridge to include the Bush, Gunpowder, Middle, Patapsco and Magothy Rivers.
- Section 4. Chester River - includes all of the Chester River, Eastern Neck, areas north of the bay bridge on Kent Island and south of Swan Point but to include SAV on the Swan Pt. quadrangle.
- Section 5. Central Western Shore - all areas south of the bay bridge and north of Holland Point on Herring Bay to include the Severn, South and West Rivers and Herring Bay.
- Section 6. Eastern Bay - all areas south of the bay bridge on Kent Island and north of Tilghman Island from Green Marsh Point to include the Wye, East and Miles Rivers, Crab Alley Bay, Prospect Bay and Poplar, Jefferson and Coaches Islands.
- Section 7. Choptank River - all areas south of Tilghman Island from Green Marsh Point and north of Taylor Island to include the Choptank and Little Rivers.
- Section 8. Patuxent River - all areas in the Patuxent River.
- Section 9. Middle Western Shore - all areas south of Holland Point at Herring Bay and north of Point Lookout on the Potomac River but not the mouth of the Patuxent River.
- Section 10. Lower Potomac River - all areas between the mouth of the Potomac River to just above the 301 bridge at Nanjemoy Creek.
- Section 11. Upper Potomac River - all areas above Nanjemoy Creek to Washington D.C.
- Section 12. Middle Eastern Shore - all areas south of Taylor Island and north of but not including the Big Annemessex River to include the Honga, Nanticoke, Wicomico and Manokin Rivers, Fishing Bay, Bloodsworth and South Marsh Islands.

TABLE 3. (continued)

-
-
- Section 13. Tangier Island Complex - all areas south of and including the Big Annessex River and north of but including the northern shore of Chesconessex Creek to include Smith and Tangier Islands, Little Annessex River and Pocomoke Sound.
- Section 14. Lower Eastern Shore - all areas south of but including the southern shore of Chesconessex Creek and north of Elliots Creek to include Cherrystone Inlet, Hungars, Nassawadox, Occohannock, Nandua, Pungoteague and Onancock Creeks.
- Section 15. Reedville - includes the area between Windmill Point on the Rappahannock River and Smith Point at the mouth of the Potomac River.
- Section 16. Rappahannock River Complex - includes the entire Rappahannock River, Piankatank River and Milford Haven area.
- Section 17. New Point Comfort Region - includes the area fronting the bay from the lighthouse at New Point Comfort north to, but not including, the bay entrance to Milford Haven.
- Section 18. Mobjack Bay Complex - includes the East, North, Ware and Severn Rivers, the north shore of the Mobjack Bay from New Pt. Comfort lighthouse to the North River, and the area around Guinea Neck to include all the SAV around the Guinea Marsh area from the New Point Comfort quadrangle.
- Section 19. York River - all areas along the north shore from Clay Bank to the Guinea Marsh area and includes SAV from the Achilles quadrangle facing the York River and along the south shore to Goodwin Island.
- Section 20. Lower Western Shore - includes all areas south of Goodwin Island to Broad Bay off Lynnhaven Inlet, excluding the James River.
- Section 21. James River - all SAV in the James River including the Chickahominy River.
-
-

are readily identifiable from a map. Sections 1 through 4 are located in the Upper Bay zone. Sections 5 through 12 are located in the Middle Bay zone, and sections 13 through 21 are located in the Lower Bay zone. One additional section was added to the original 20 sections denoted by Orth and Moore (1982) to account for a resurgence of SAV in the tidal freshwater and transition zone of the Potomac River. This section had little SAV in 1978.

Orth, et al. (1979) chose six sites in the Lower Bay zone to determine changes in SAV distribution starting in 1937. These sites are Mumfort Island and Jenkins Neck in the York River, East River in the Mobjack Bay, Parrott Island in the Rappahannock River, Fleets Bay located between Windmill Point on the Rappahannock River and Smith Point on the Potomac River and Vaucluse Shores located on the bayside of the eastern shore just above Cape Charles (see Orth, et al. (1979) for further details of these historical sites). Detailed mapping of each historical site was completed in this study similar to the earlier work to provide a 1984 update.

For those areas currently known to contain some SAV where aerial photography could not be obtained in 1984 the quadrangles were noted and determination of SAV abundance from that area was made utilizing low level aerial reconnaissance, aerial photography of these areas in 1983 or 1984 from other sources, anecdotal information or other field surveys indicating the presence of SAV in 1984. In these particular situations, distribution of SAV will be assumed to match what was found in 1978.

Ground Truth and Other Data Bases

For those areas in Virginia where aerial photographic evidence of SAV beds was inconclusive, photoverification was accomplished by ground truthing these sites. This was done principally by small boats and divers snorkeling over the area indicated from the photograph. Since SAV beds in this region

contain primarily only one or two species that vary little from year to year, a great deal of ground truth information could be extrapolated from earlier studies (Orth, et al., 1979, 1982; Orth and Moore, 1982).

In Maryland, ground truth data were provided principally from three SAV surveys conducted in 1984, from an SAV transplanting project and an ongoing SAV research project. Two field surveys were conducted in the Potomac River. The first survey was conducted along the transition zone by the NVCC (Allaire, et al., 1985). The area covered consisted of 150 miles of shoreline from Quantico Creek and Chicamuxen Creek in the north to the 301 bridge in the south (Fig. 5). The second survey was conducted by the USGS (Carter, et al., 1985a; Rybicki, et al., 1985) and included the area from the Chain Bridge at Washington, D.C. to the Wicomico River just below the 301 bridge (Fig. 6). Earlier surveys of the Potomac River by the USGS included sections of the river south of the Wicomico River to the mouth of the Potomac River (Carter, et al., 1985b; Haramis and Carter, 1983). Methods used in these two surveys were similar: either sampling along pre determined transects or marked grids using modified oyster tongs to estimate species presence and their standing crop. Visual observations were also used for species identification. Additional information of these surveys is available in the above-mentioned reports.

The third survey is the annual large scale multi-station survey conducted by the Md.DNR. This survey, conducted from June through August, samples 600+ randomly selected stations in certain areas of the bay from the Susquehanna Flats to Smith Island. At each station, samples are also collected with modified oyster tongs and species presence or absence, as well as standing crop, recorded.

Figure 5. Location diagram and USGS 1:24,000 quadrangle index for NVCC Potomac River SAV shoreline study. Numbers under quadrangle name indicate number of vegetated grids and the total number of grids located in that quadrangle (from Allaire, et al., 1985).

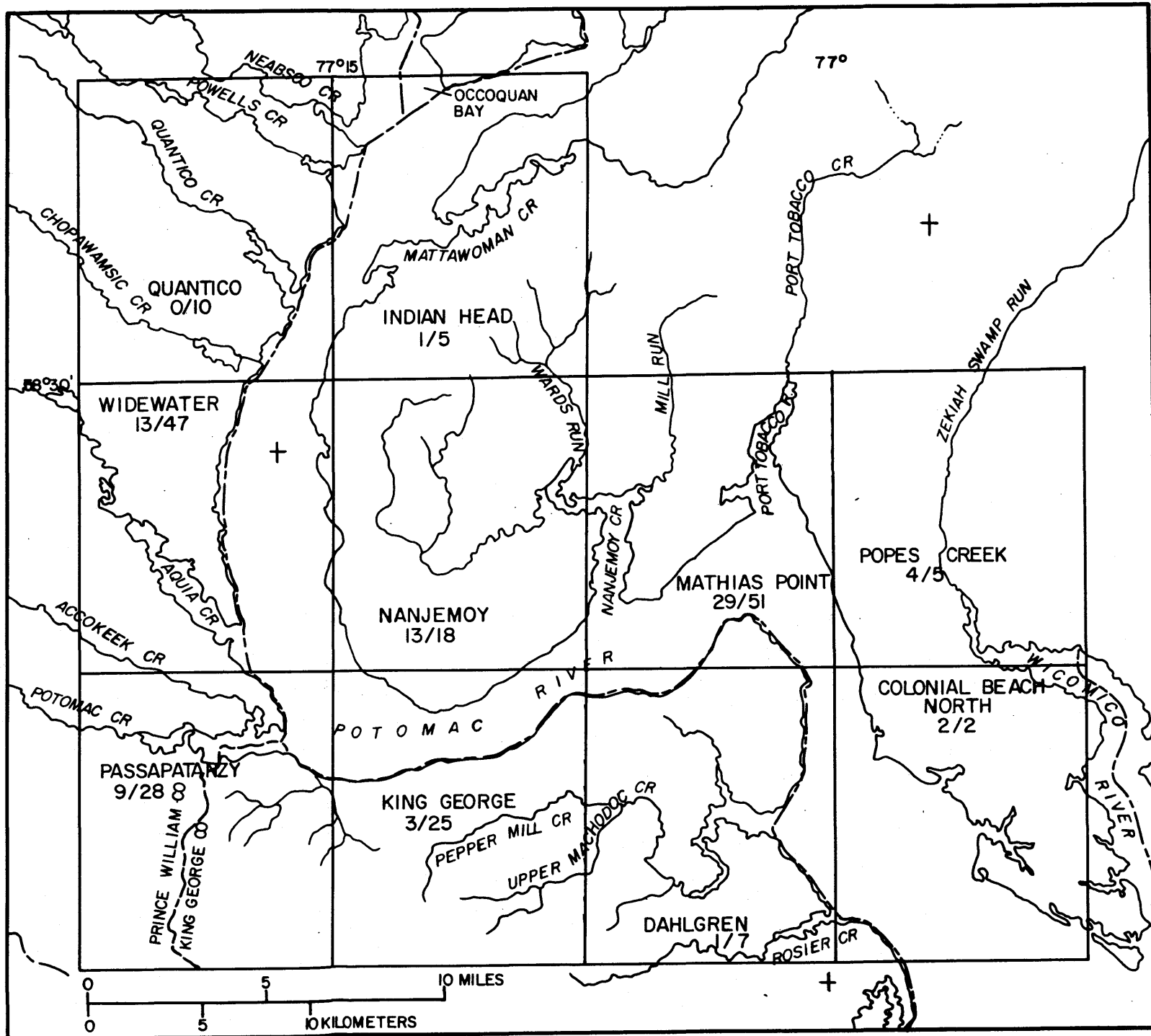
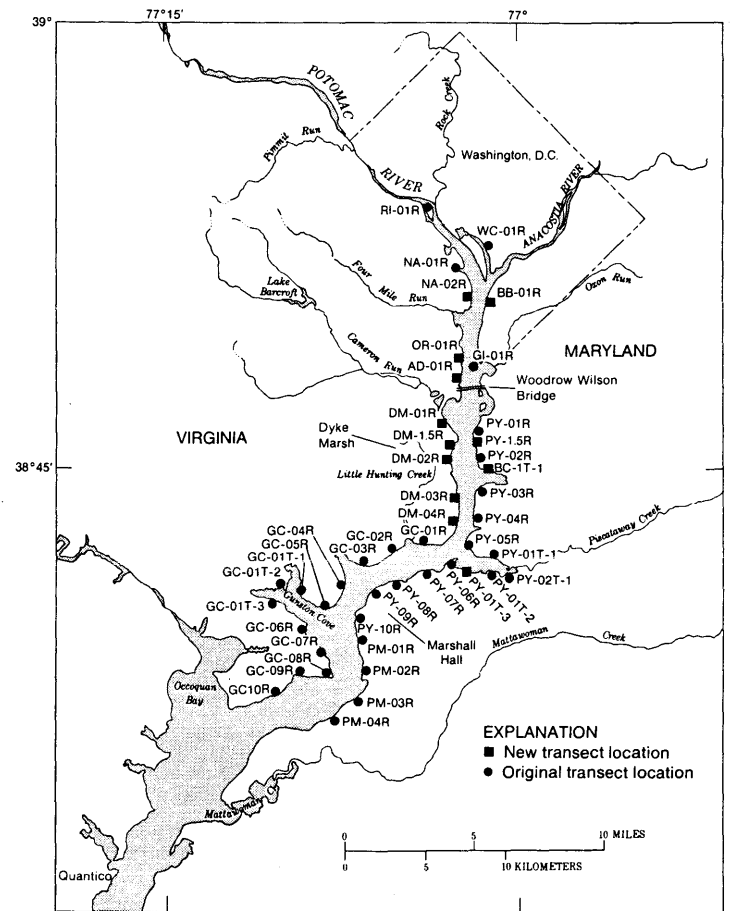
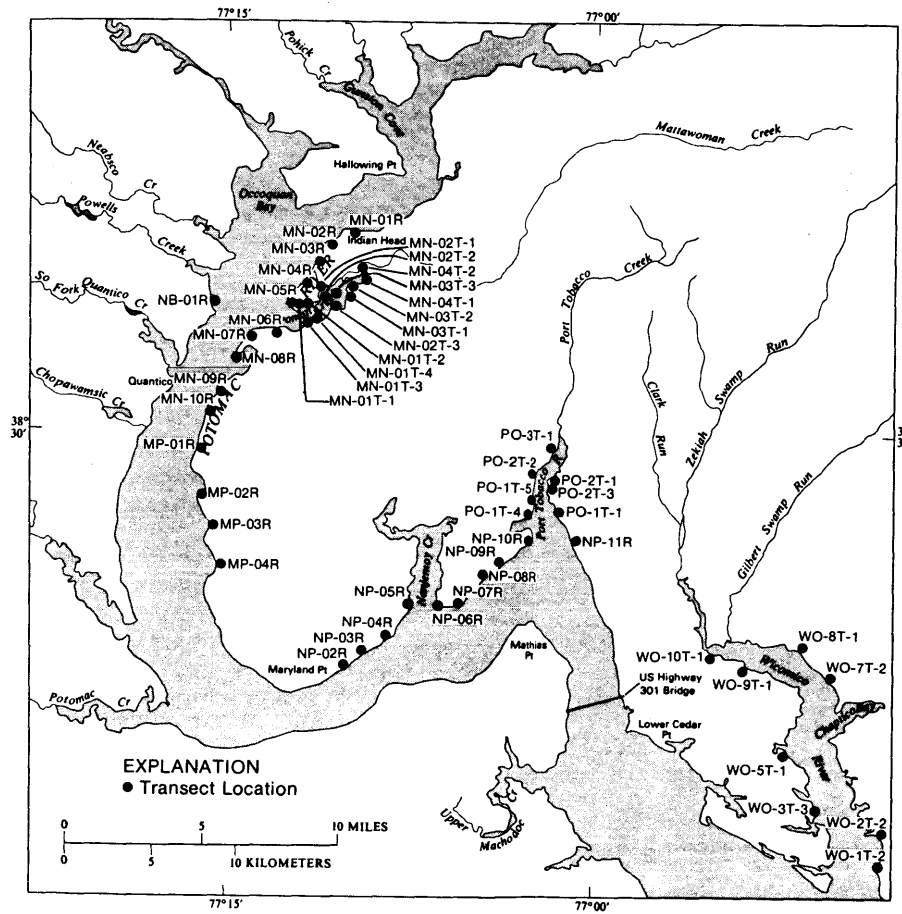


Figure 6. Location of vegetation sampling transects in the tidal and transition portion of the Potomac River used by the U. S. Geological Survey for determining SAV distribution patterns (from Carter, et al., 1985a).



The SAV transplanting project is being conducted on the Susquehanna Flats by Stan Kollar of Harford Community College. Information provided by his work is in the form of species presence by percentage, primarily by visual estimates.

An SAV research group at UMdHPL headed by Mike Kemp also provided ground truth data. Robert Twilley of their group annotated maps of their six study sites on the Choptank River, indicating status of SAV from 1980 to 1984 at each site. No information on percent cover was available.

In addition to 1984 collateral data, a visual aerial survey of the Susquehanna River, the Northeast River and the upper Bush River was conducted in 1982 by Dr. Richard Anderson, under contract to Martin Marietta. SAV data were annotated onto USGS 7.5-minute quadrangles from low level (300-500 feet) observations. Species information was provided, but no percent cover values were obtained.

SECTION 4

RESULTS AND DISCUSSION

The results of the 1984 SAV aerial and ground surveys of the entire bay and its tributaries showed the presence of extensive stands of vegetation in a number of locations throughout the bay as well as the continued absence of SAV beds in areas where they were once abundant.

Table 4 presents hectares of SAV for those quadrangles where vegetation was observed in 1984 and 1978. Table 5 presents the total hectares of SAV for each of the 21 sections and the 3 zones for both 1984 and 1978. Table 6 presents the total square meters of SAV in those topographic quadrangles found in each of the 21 sections. Table 7 presents the square meters of SAV in each of the four density classes (1-4) for those quadrangles having SAV only.

Given the constraints of the 1984 data set (see methods and succeeding sections where problems occurred), it was estimated that there were 15,400 hectares of SAV in 1984 compared to 16,637 found in 1978. Increases of SAV were observed in the following sections: Susquehanna Flats, Upper Eastern Shore, Upper Potomac River, Tangier Island Complex, Lower Eastern Shore, New Point Comfort, Lower Western Shore and York River. Decreases were observed in the Upper Western Shore, Chester River, Central Western Shore, Eastern Bay, Choptank River, Patuxent River, Middle Western Shore, Lower Potomac River, Middle Eastern Shore, Reedville, Rappahannock River, Mobjack Bay and James River sections. The Lower Bay zone showed an 18% increase in SAV abundance from 1978 to 1984 with 9400 hectares mapped in 1978 and 11,116 hectares mapped in 1984. The Middle Bay zone showed a reduction in SAV of 77% in this time period (4,446 to 984 hectares) while SAV in the Upper Bay zone increased 13% (792 to 3168 hectares).

TABLE 4. TOTAL AREA OF SAV IN HECTARES BY TOPOGRAPHIC QUADRANGLES FOR 1978 AND 1984.

QUADRANGLE	1978	1984
1. Conowingo Dam, Md.-Pa.	-	-
2. Aberdeen, Md.	-	0
3. Havre de Grace, Md.	803.67	1741.85
4. North East, Md.	5.62	13.31
5. Elkton, Md.	.75	0
6. White Marsh, Md.	-	0
7. Edgewood, Md.	10.48	49.81+
8. Perryman, Md.	-	2.01
9. Spesutie, Md.	.84	411.38
10. Earleville, Md.	4.67	3.47
11. Cecilton, Md.	-	0
12. Baltimore East, Md.	-	0
13. Middle River, Md.	90.06	0
14. Gunpowder Neck, Md.	200.71	183.99+
15. Hanesville, Md.	9.31	5.48
16. Betterton, Md.	6.40	5.74
17. Galena, Md.	1.46	11.88
18. Curtis Bay, Md.	33.40	0
19. Sparrows Pt., Md.	10.52	0
20. Swan Point, Md.	29.86	18.65
21. Rock Hall, Md.	127.25	30.13
22. Chestertown, Md.	12.31	0
23. Round Bay, Md.	137.15	0
24. Gibson Island, Md.	139.45	7.61
25. Love Point, Md.	11.81	0
26. Langford Creek, Md.	1255.20	599.72
27. Centreville, Md.	38.75	0
28. Washington West, Md.-DC-Va.	-	0++
29. Washington East, DC-Md.	-	0
30. South River, Md.	15.14	0
31. Annapolis, Md.	27.15	0
32. Kent Island, Md.	513.68	26.28
33. Queenstown, Md.	492.10	89.45
34. Alexandria, Va.-Md.	-	160.40
35. Deale, Md.	61.51	0
36. Claiborne, Md.	421.08	52.25
37. St. Michaels, Md.	366.09	11.14
38. Easton, Md.	1.19	0
39. Fort Belvoir, Va.-Md.	-	.91
40. Mt. Vernon, Va.-Md.	-	420.34
41. Lower Marlboro, Md.	-	0
42. North Beach, Md.	-	0

continued

TABLE 4. (continued)

43.	Tilghman, Md.	478.15	6.87
44.	Oxford, Md.	562.96	23.25
45.	Trappe, Md.	64.75	0
46.	Preston, Md.	-	0
47.	Quantico, Va.-Md.	-	0
48.	Indian Head, Va.-Md.	-	0++
49.	Benedict, Md.	1.58	0
50.	Prince Frederick, Md.	-	0
51.	Sharps Island, Md.	377.08	4.42
52.	Church Creek, Md.	208.94	9.00
53.	Cambridge, Md.	48.96	0
54.	East New Market, Md.	-	0
55.	Widewater, Va.-Md.	-	4.59
56.	Nanjemoy, Md.	28.03	30.92
57.	Mathias Pt., Md.-Va.	194.12	121.11
58.	Popes Creek, Md.	-	0
59.	Mechanicsville, Md.	13.62	0
60.	Broomes Island, Md.	4.94	4.37
61.	Cove Pt., Md.	2.97	3.75
62.	Taylor's Island, Md.	-	8.55
63.	Golden Hill, Md.	-	.42
64.	Passapatanzy, Md.-Va.	-	0
65.	King George, Va.-Md.	2.25	13.44
66.	Dahlgren, Va.-Md.	8.32	2.67
67.	Colonial Beach North, Va.-Md.	87.44	25.63
68.	Rock Pt., Md.	22.85	0
69.	Leonardtwn, Md.	2.44	0
70.	Hollywood, Md.	-	0
71.	Solomons Island, Md.	10.54	.76
72.	Barren Island, Md.	-	0
73.	Honga, Md.	126.94	5.05
74.	Wingate, Md.	2.64	8.81
75.	Nanticoke, Md.	-	0
76.	Colonial Beach South, Va.-Md.	61.95	11.26
77.	Stratford Hall, Va.-Md.	5.53	2.16
78.	St. Clements Island, Va.-Md.	.13	0
79.	Piney Point, Va.-Md.	-	-
80.	St. Marys City, Md.	-	-
81.	Point-No-Point, Md.	-	-
82.	Richland Pt., Md.	.73	.38
83.	Bloodsworth Island, Md.	66.07	18.29
84.	Deal Island, Md.	3.01	0
85.	Monie, Md.	9.15	0
86.	Champlain, Va.	-	-
87.	Machodoc, Va.	-	-
88.	Kinsale, Va.-Md.	-	-

continued

TABLE 4. (continued)

89.	St. George Island, Va.-Md.	-	-
90.	Point Lookout, Md.	-	-
91.	Kedges Straits, Md.	156.09	366.42
92.	Terrapin Sand Point, Md.	314.48	187.00
93.	Marion, Md.	289.33	0
94.	Mount Landing, Va.	-	-
95.	Tappahannock, Va.	-	-
96.	Lottsburg, Va.	-	-
97.	Heathsville, Va.-Md.	-	-
98.	Burgess, Va.-Md.	-	-
99.	Ewell, Va.-Md.	1483.30	2308.58
100.	Great Fox Island, Va.-Md.	540.65	807.81
101.	Crisfield, Va.-Md.	7.48	113.01
102.	Saxis, Va.-Md.	-	-
103.	Dunnsville, Va.	-	-
104.	Morattico, Va.	-	-
105.	Lively, Va.	-	-
106.	Reedville, Va.	230.40	108.56
107.	Tangier Island, Va.	405.06	614.44
108.	Chesconessex, Va.	482.54	808.61
109.	Parksley, Va.	80.35	264.80
110.	Urbanna, Va.	-	-
111.	Irrington, Va.	5.31	9.33
112.	Fleets Bay, Va.	133.23	155.45
113.	Nandua Creek, Va.	184.86	345.10
114.	Pungoteague, Va.	401.63	716.76
115.	West Point, Va.	-	-
116.	Saluda, Va.	-	-
117.	Wilton, Va.	10.43	0
118.	Deltaville, Va.	59.43	6.62
119.	Jamesville, Va.	406.04	367.36
120.	Toano, Va.	-	-
121.	Gressitt, Va.	-	-
122.	Ware Neck, Va.	256.00	203.15
123.	Mathews, Va.	63.88	30.32
124.	Franktown, Va.	504.49	395.26
125.	Westover, Va.	-	-
126.	Charles City, Va.	-	-
127.	Brandon, Va.	-	-
128.	Norge, Va.	46.48	46.48**
129.	Williamsburg, Va.	-	-
130.	Clay Bank, Va.	-	-
131.	Achilles, Va.	797.92	741.50
132.	New Point Comfort, Va.	1096.31	1092.71
133.	Cape Charles, Va.	321.42	308.32
134.	Cheriton, Va.	85.20	55.99

continued

TABLE 4. (continued)

135.	Savedge, Va.	-	-
136.	Claremont, Va.	-	-
137.	Surry, Va.	-	-
138.	Hog Island, Va.	-	-
139.	Yorktown, Va.	1.92	0.23
140.	Poquoson West, Va.	210.44	216.93
141.	Poquoson East, Va.	516.63	687.16
142.	Elliot's Creek, Va.	44.58	14.48
143.	Townsend, Va.	42.70	4.80
144.	Bacons Castle, Va.	-	-
145.	Mulberry Island, Va.	-	-
146.	Newport News North, Va.	-	-
147.	Hampton, Va.	218.25	233.15
148.	Benns Church, Va.	-	-
149.	Newport News South, Va.	1.87	0
150.	Norfolk North, Va.	-	-
151.	Little Creek, Va.	-	0
152.	Cape Henry, Va.	*	37.87
153.	Chuckatuck, Va.	-	-
154.	Bowers Hill, Va.	-	-
155.	Norfolk South, Va.	-	-
156.	Kempsville, Va.	-	-
157.	Princess Anne, Va.	-	-
	TOTAL	<u>16,636.39</u>	<u>15,399.70</u>

NOTES: - indicates quadrangle not photographed and assumed to have no SAV
0 indicates quadrangle photographed and no SAV noted
* area not flown in 1978 but most likely had SAV in 1978 based on data collected in subsequent years
** area not photographed in 1984. Area known to still have SAV. We made the assumption that the 1984 distribution would be similar to the 1978 distribution.
+ Information on SAV distribution taken from 1983 aerial photographs provided by Willie Burton of Martin Marietta Corp.
++ Presence of SAV beds not detected from 1984 aerial photography. Information provided by Virginia Carter of the USGS for the 1984 Potomac River Shoreline Survey indicated presence of SAV.

TABLE 5. NUMBERS OF HECTARES OF BOTTOM COVERED WITH SUBMERGED AQUATIC VEGETATION IN 1978 AND 1984 FOR DIFFERENT SECTIONS WITHIN THE THREE ZONES IN THE CHESAPEAKE BAY (DATA FOR 1978 FROM ORTH, et al., 1979 AND ANDERSON AND MACOMBER, 1980.

Section	1978		1984	
	Hectares	Zone	Hectares	Zone
1. Susquehanna Flats	804+		2150	
2. Upper Eastern Shore	29	Upper	43	Upper
3. Upper Western Shore	484	2792	244	3168
4. Chester River	1475	hectares	731	hectares
5. Central Western Shore	241		0	
6. Eastern Bay	1800		66	
7. Choptank River	1740	Middle	82	Middle
8. Patuxent River	34	4446	9	984
9. Middle Western Shore	11	hectares	0	hectares
10. Lower Potomac River	410		194	
11. Upper Potomac River	0*		600	
12. Middle Eastern Shore	210		33	
13. Tangier Island Complex	3759		5447	
14. Lower Eastern Shore	1991		2232	
15. Reedville	364		264	
16. Rappahannock River Complex	93	Lower	23	Lower
17. New Point Comfort Region	271	9399	299	11,248
18. Mobjack Bay Complex	1785	hectares	1550	hectares
19. York River	157		238	
20. Lower Western Shore	925		1149	
21. James River	54		46	
TOTAL	16,637		15,400	

+1978 data for Susquehanna Flats remapped and digitized to allow for greater compatibility to 1984 data.

*No aerial photography was taken of this area in 1978 and that the absence of SAV is based on ground survey observations by the USGS.

TABLE 6. NUMBER OF SQUARE METERS OF SAV IN EACH QUADRANGLE CONTAINED WITHIN THE 21 SECTIONS FOR 1984

<u>SECTION</u>	<u>QUADRANGLE</u>	<u>AREA</u>
Susquehanna Flats - 1	Conowingo Dam (1)	0
	Aberdeen (2)	0
	Havre de Grace (3)	17,418,496
	North East (4)	0
	Perryman (8)	0
	Spesutie (9)	<u>4,082,974</u>
		21,501,470 sq.m = 2150.15 hectares = 5310.86 acres
Upper Eastern Shore - 2	North East (4)	133,146
	Elkton (5)	0
	Perryman (8)	0
	Spesutie (9)	22,526
	Earleville (10)	34,703
	Cecilton (11)	0
	Gunpowder Neck (14)	0
	Hanesville (15)	54,798
	Betterton (16)	57,422
	Galena (17)	118,828
	Swan Point (20)	0
	Rock Hall (21)	<u>10,002</u>
	431,425 sq.m = 43.14 hectares 106.56 acres	
Upper Western Shore - 3	White Marsh (6)	0
	Edgewood (7)	498,100
	Perryman (8)	20,136
	Spesutie (9)	8,325
	Baltimore East (12)	0
	Middle River (13)	0
	Gunpowder Neck (14)	1,839,900
	Hanesville (15)	0
	Curtis Bay (18)	0
	Sparrows Point (19)	0
	Round Bay (23)	0
Gibson Island (24)	<u>76,075</u>	
	2,442,536 sq.m = 244.25 hectares 603.31 acres	

TABLE 6. (continued)

Chester River - 4	Swan Point (20)	186,456	
	Rock Hall (21)	291,300	
	Chestertown (22)	0	
	Love Point (25)	0	
	Langford Creek (26)	5,997,246	
	Centreville (27)	0	
	Kent Island (32)	77,356	
	Queenstown (33)	<u>756,388</u>	
		7,308,746 sq.m =	
		730.87 hectares	
		1805.25 acres	
Central Western Shore - 5	Round Bay (23)	0	
	Gibson Island (24)	0	
	South River (30)	0	
	Annapolis (31)	0	
	Deale (35)	0	
	North Beach (42)	<u>0</u>	
		0	
Eastern Bay - 6	Love Point (25)	0	
	Annapolis (31)	0	
	Kent Island (32)	185,439	
	Queenstown (33)	138,088	
	Claiborne (36)	222,031	
	St. Michaels (37)	111,365	
	Easton (38)	<u>0</u>	
			656,923 sq.m =
		65.69 hectares =	
		162.25 acres	
Choptank River - 7	Claiborne (36)	300,482	
	St. Michaels (37)	0	
	Easton (38)	0	
	Tilghman (43)	68,699	
	Oxford (44)	232,542	
	Trappe (45)	0	
	Preston (46)	0	
	Sharps Island (51)	44,176	
	Church Creek (52)	90,017	
	Cambridge (53)	0	
	East New Market (54)	0	
	Taylors Island (62)	<u>85,512</u>	
			821,428 sq.m =
		82.14 hectares	
		202.89 acres	

TABLE 6. (continued)

Patuxent River - 8	Lower Marlboro (41)	0
	Benedict (49)	0
	Mechanicsville (59)	0
	Broomes Island (60)	43,692
	Cove Point (61)	37,518
	Hollywood (70)	0
	Solomons Island (71)	<u>7,616</u>
		88,826 sq.m = 8.88 hectares 21.93 acres
Middle Western Shore - 9	North Beach (42)	0
	Prince Frederick (50)	0
	Broomes Island (60)	0
	Cove Point (61)	0
	Solomons Island (71)	0
	St. Marys City (80)	np
	Point No Point (81)	np
	Point Lookout (90)	<u>np</u> 0
Lower Potomac River - 10	Nanjemoy (56)	309,243
	Mathias Point (57)	1,211,162
	Popes Creek (58)	0
	Dahlgren (66)	26,712
	Colonial Beach North (67)	256,316
	Rock Point (68)	0
	Leonardtwn (69)	0
	Colonial Beach South (76)	112,561
	Stratford Hall (77)	21,600
	St. Clements Island (78)	0
	Piney Point (79)	np
	St. Marys City (80)	np
	Machodoc (87)	0
	Kinsale (88)	0
	St. George Island (89)	np
	Point Lookout (90)	np
	Lottsburg (96)	np
	Heathsville (97)	np
	Burgess (98)	<u>np</u>
		1,937,594 sq.m = 193.76 hectares 478.59 acres

TABLE 6. (continued)

Upper Potomac River - 11	Washington West (28)	0
	Washington East (29)	0
	Alexandria (34)	1,603,981
	Fort Belvoir (39)	9,072
	Mt. Vernon (40)	4,203,406
	Quantico (47)	0
	Indian Head (48)	0
	Widewater (55)	45,864
	Passapatanzy (64)	0
	King George (65)	<u>134,413</u>
	5,996,736 sq.m =	
	599.67 hectares	
	1481.19 acres	
Middle Eastern Shore - 12	Taylors Island (62)	0
	Golden Hill (63)	4,218
	Barren Island (72)	0
	Honga (73)	50,478
	Wingate (74)	88,146
	Nanticoke (75)	0
	Richland Point (82)	3,840
	Bloodsworth Island (83)	182,910
	Deal Island (84)	0
	Monie (85)	0
	Kedges Straits (91)	0
	Terrapin Sand Point (92)	0
	Marion (93)	<u>0</u>
		329,592 sq.m =
	32.96 hectares	
	81.41 acres	
Tangier Island Complex - 13	Chesconessex (108)	7,846,491
	Parksley (109)	2,648,039
	Tangier Island (107)	6,144,418
	Ewell (99)	23,085,834
	Great Fox Island(100)	8,078,128
	Kedges Straits (91)	3,664,153
	Terrapin Sand Point (92)	1,869,984
	Crisfield (101)	1,130,088
	Marion (93)	0
	Saxis (102)	<u>0</u>
	54,467,135 sq.m =	
	5,446.71 hectares =	
	13,453.37 acres	

TABLE 6. (continued)

Lower Eastern Shore - 14	Elliot's Creek (142)	144,822
	Townsend (143)	48,042
	Cape Charles (133)	3,083,185
	Cheriton (134)	559,874
	Franktown (124)	3,952,565
	Jamesville (119)	3,673,577
	Nandua Creek (113)	3,451,033
	Pungoteague (114)	7,167,565
	Chesconessex (108)	<u>239,628</u>
		22,320,291 sq.m =
		2,232.03 hectares =
		5,513.11 acres
Reedville - 15	Fleets Bay (112)	1,554,487
	Reedville (106)	1,085,642
	Burgess (98)	<u>0</u>
		264.01 hectares =
		652.10 acres
Rappahannock River Complex - 16	Mathews (123)	72,588
	Wilton (117)	0
	Deltaville (118)	66,241
	Irvington (111)	93,276
	Urbanna (110)	0
	Champlain (86)	0
	Mount Landing (94)	0
	Tappahannock (95)	0
	Dunnsville (103)	0
	Morattico (104)	0
	Lively (105)	0
Saluda (116)	<u>0</u>	
		232,105 sq.m =
		23.21 hectares =
		57.33 acres
New Point Comfort Region - 17	Mathews (123)	0
	New Point Comfort (132)	<u>2,985,042</u>
		298.50 hectares =
		737.30 acres

TABLE 6. (continued)

Mobjack Bay Complex - 18	Achilles (131)	5,297,298
	New Point	
	Comfort (132)	7,942,019
	Ware Neck (112)	2,031,475
	Mathews (123)	<u>230,562</u>
		15,501,354 sq.m = 1,550.14 hectares = 3,828.82 acres
York River - 19	Poquoson West (140)	257,028
	Yorktown (139)	2,340
	Clay Bank (130)	0
	Achilles (131)	2,117,660
	West Point (115)	0
	Toano (120)	0
	Gressitt (121)	0
	Williamsburg (129)	<u>0</u>
		2,377,046 sq.m = 237.70 hectares = 587.12 acres
Lower Western Shore - 20	Cape Henry (152)	378,714
	Hampton (147)	2,331,495
	Poquoson East (141)	6,871,628
	Poquoson West (140)	1,912,278
	Norfolk North (150)	0
	Little Creek (151)	0
	Kempsville (156)	0
	Princess Anne (157)	<u>0</u>
		11,494,115 sq.m = 1,149.41 hectares = 2,839.04 acres
James River - 21	Hampton (147)	0
	Newport News	
	South (149)	0
	Norge (128)	464,766
	Savage (135)	0
	Claremont (136)	0
	Surry (135)	0
	Hog Island (138)	0
	Yorktown (139)	0
	Bacons Castle (144)	0
	Mulberry Island (145)	0

TABLE 7. NUMBER OF SQUARE METERS OF SAV IN EACH OF THE DENSITY CLASSES FOR ONLY THOSE QUADRANGLES CONTAINING SAV IN 1984.

<u>Quadrangle</u>	<u>No.</u>	<u>Density 1</u>	<u>Density 2</u>	<u>Density 3</u>	<u>Density 4</u>	<u>Total Sq m</u>	<u>Total Hectares</u>	<u>Total Acres</u>
Havre de Grace	3	16,457,549	490,635	206,630	263,772	17,418,586	1741.86	4302.39
North East	4	78,096	55,050	0	0	133,146	13.31	32.86
Edgewood	7	212,672	83,846	171,943	29,676	498,137	49.81	123.04
Perryman	8	0	7,842	12,294	0	20,136	2.01	4.96
Spesutie	9	4,082,974	6,144	0	24,709	4,113,827	411.38	1016.11
Earleville	10	0	16,227	2,579	15,897	34,703	3.47	8.57
Gunpowder Neck	14	384,413	374,696	685,668	395,101	1,839,878	83.99	454.45
Hanesville	15	0	0	54,798	0	54,798	5.48	13.54
Belterton	16	0	16,768	40,654	0	57,422	5.74	14.18
Galena	17	0	0	61,558	57,270	118,828	11.88	29.34
Swan Point	20	22,686	19,164	59,124	85,482	186,456	18.65	46.01
Rock Hall	21	106,626	6,594	15,852	172,230	301,302	30.13	74.42
Gibson Island	24	0	40,604	31,666	3,805	76,075	7.61	18.80
Langford Creek	26	3,240	959,910	1,322,466	3,711,630	5,997,246	599.72	1481.31
Kent Island	32	0	25,000	91,716	146,079	262,795	26.28	64.91
Queenstown	33	30,686	74,634	677,455	111,701	894,476	89.45	220.94
Alexandria	34	266,938	866,632	91,545	378,866	1,603,981	160.40	396.19
Claiborne	36	12,658	176,275	331,762	1,818	522,513	52.25	129.06
St. Michaels	37	0	16,471	94,894	0	111,365	11.14	27.52
Fort Belvoir	39	9,072	0	0	0	9,072	.91	2.25
Mt. Vernon	40	214,950	1,932,984	904,756	1,150,716	4,203,406	420.34	1038.24
Tilghman	43	0	8,790	25,545	34,364	68,699	6.87	16.97
Oxford	44	44,116	82,949	94,921	10,556	232,542	23.25	57.43
Sharps Island	51	2,653	18,492	18,430	4,601	44,176	4.42	10.92
Church Creek	52	0	24,648	31,502	35,267	91,417	9.14	22.58
Widewater	55	6,168	28,146	6,726	4,824	45,864	4.59	11.34
Nanjemoy	56	23,012	123,935	162,296	0	309,243	30.92	76.37
Mathias Point	57	117,762	252,165	503,748	337,487	1,211,162	121.12	299.16
Broomes Island	60	0	0	0	43,692	43,692	4.37	10.79
Cove Point	61	0	6,312	14,424	16,782	37,518	3.75	9.26

continued

TABLE 7. (continued)

<u>Quadrangle</u>	<u>No.</u>	<u>Density 1</u>	<u>Density 2</u>	<u>Density 3</u>	<u>Density 4</u>	<u>Total Sq m</u>	<u>Total Hectares</u>	<u>Total Acres</u>
Taylor's Island	62	34,758	16,428	20,178	14,148	85,512	8.55	21.12
Golden Hill	63	0	0	4,218	0	4,218	.42	1.04
King George	65	15,780	53,431	65,202	0	134,413	13.44	33.10
Dahlgren	66	26,712	0	0	0	26,712	2.67	6.59
Colonial Beach North	67	0	69,535	171,254	15,527	256,316	25.63	63.31
Solomons Island	71	0	0	7,616	0	7,616	.76	1.88
Honga	73	0	36,642	13,836	0	50,478	5.05	12.47
Wingate	74	0	8,718	79,428	0	88,146	8.81	21.76
Colonial Beach South	76	0	0	64,436	48,125	112,561	11.26	27.81
Stratford Hall	77	0	0	21,600	0	21,600	2.16	5.34
Richland Point	82	0	0	3,840	0	3,840	.38	.94
Bloodsworth Is.	83	38,868	141,936	2,106	0	182,910	18.29	45.18
Kedges Straits	91	59,376	397,620	680,736	2,526,421	3,664,153	366.42	905.05
Terrapin Sand Pt.	92	81,834	145,296	1,327,392	315,462	1,869,984	187.00	461.89
Ewell	99	24,408	2,078,240	7,276,464	13,706,722	23,085,834	2,308.58	5,702.19
Great Fox Island	100	356,088	368,928	1,863,902	5,489,210	8,078,128	807.81	1,995.29
Crisfield	101	0	351,174	414,324	364,590	1,130,088	113.01	279.13
Reedville	106	280,356	634,067	167,067	4,134	1,085,642	108.56	268.14
Tangier Island	107	178,710	549,738	1,820,094	3,595,876	6,144,418	614.44	1,517.67
Chesconessex	108	777,781	2,481,026	2,980,668	1,846,674	8,086,149	808.61	1,997.28
Parksley	109	0	353,484	2,034,690	259,865	2,648,039	264.80	654.06
Irvington	111	0	93,276	0	0	93,276	9.33	23.05
Fleets Bay	112	251,178	1,160,654	128,099	14,556	1,554,487	155.45	383.96
Nandua Creek	113	1,434,216	912,985	513,756	590,076	3,451,033	345.10	852.40
Pungoteague	114	456,450	3,072,667	1,187,760	2,450,688	7,167,565	716.76	1,770.39

continued

TABLE 7. (continued)

<u>Quadrangle</u>	<u>No.</u>	<u>Density 1</u>	<u>Density 2</u>	<u>Density 3</u>	<u>Density 4</u>	<u>Total Sq m</u>	<u>Total Hectares</u>	<u>Total Acres</u>
Deltaville	118	5,298	42,745	18,198	0	66,241	6.62	16.35
Jamesville	119	0	1,915,436	749,871	1,008,270	3,673,577	367.36	907.37
Ware Neck	122	496,445	739,836	706,736	88,458	2,031,475	203.15	501.78
Mathews	123	0	15,552	222,540	65,058	303,150	30.32	74.89
Franktown	124	61,830	649,415	1,190,676	2,050,644	3,952,565	395.26	976.28
Achilles	131	145,608	912,584	4,910,598	1,446,168	7,414,958	741.50	1,831.51
New Point Comfort	132	699,361	2,397,546	2,455,134	5,375,020	10,927,061	1,092.71	2,698.99
Cape Charles	133	132,174	1,313,101	960,288	677,622	3,083,185	308.32	761.50
Cheriton	134	0	40,722	49,518	469,634	559,874	55.99	148.17
Yorktown	139	0	2,340	0	0	2,340	0.23	0.57
Poquoson West	140	485,766	627,408	525,870	530,262	2,169,306	216.93	535.82
Poquoson East	141	365,772	824,124	3,258,523	2,423,209	6,871,628	687.16	1,697.99
Elliot's Creek	142	144,822	0	0	0	144,822	14.48	35.77
Townsend	143	0	0	0	48,042	48,042	4.80	11.86
Hampton	147	154,596	302,478	323,216	1,551,205	2,331,495	233.15	575.88
Cape Henry	152	25,440	32,004	277,698	43,572	378,714	37.87	93.54

In order to facilitate the discussion of the distribution of SAV in the bay, each of the 21 sections in the 3 major zones will be discussed separately.

1. SUSQUEHANNA FLATS

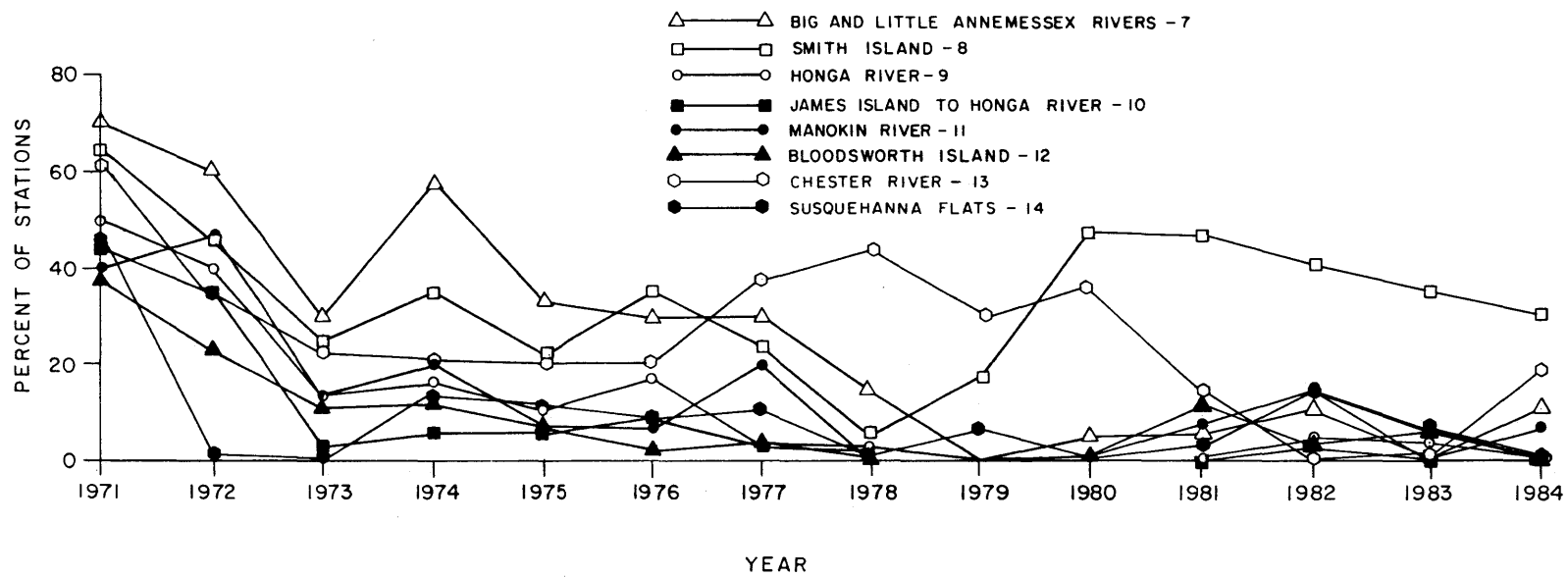
The distribution of SAV in this section for 1984 was based primarily on species presence and abundance from Dr. Stan Kollar because of the loss of imagery of the Flats area. SAV beds on the Flats for 1978 were remapped to allow for greater comparability to the 1984 data. Instead of mapping each small bed, the entire area was remapped as distinct units and given a density classification. Thus, instead of 110 hectares being reported on 1978, the remapping of these data yielded 804 hectares in a density 1 classification. In 1984, the Flats contained sparse patches of SAV throughout the region which were mapped as one unit and then classified as a density of 1 (very sparse). Thus, the 1984 survey showed 2,150 hectares in this section compared to 804 in 1978 (Tables 4-7). The information provided by Kollar indicates a large increase, albeit only in small patches on the Susquehanna Flats, from 1978 to 1984. Seven species of SAV were found in 1984, with milfoil, the most abundant, being found in patches throughout the Flats. Wild celery was the second most important species in this section. Both species were noted in 1978 with milfoil also being the most common. Both Hydrilla and water stargrass were noted in 1984 in small isolated pockets but not in 1978.

The Md.DNR survey sampled 37 stations in 1984 and found no vegetation in any of these stations (Table 8, Fig. 7). No stations were located in the Susquehanna River where SAV occurs along the shoreline just north of the Interstate 95 bridge. The survey did find some vegetation from 1981 to 1983

TABLE 8. FREQUENCY OF STATIONS WITH ROOTED SUBMERGED AQUATIC VEGETATION ON THE CHESAPEAKE BAY SYSTEM, 1971-84

RIVER SYSTEM	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Elk & Bohemia Rivers	6.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sassafras	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	10.0
Howell-Swan Points	16.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chester River	61.1	36.1	26.5	23.5	25.0	25.7	38.9	44.4	33.3	38.9	13.9	0.0	1.1	19.4
Love-Kent Points	0.0	0.0	0.0	12.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eastern Bay	34.0	46.5	34.0	36.2	21.7	42.2	28.3	26.1	17.3	34.8	4.4	4.3	17.4	6.5
Choptank River	35.0	39.7	19.3	27.6	1.7	39.0	25.8	28.3	26.7	25.0	1.7	6.7	5.0	1.7
Little Choptank River	21.0	21.0	0.0	0.0	0.0	15.8	5.3	5.3	5.3	0.0	0.0	0.0	0.0	0.0
James-Barren Islands	44.1	35.3	2.9	5.9	8.8	2.9	0.0	0.0	0.0	0.0	0.0	2.9	0.0	0.0
Honga River	50.0	40.0	13.3	16.7	10.3	17.2	3.3	3.3	0.0	0.0	0.0	3.3	3.3	0.0
Fishing Bay	8.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nanticoke-Wicomico River	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manokin River	40.0	46.7	13.3	20.0	7.1	6.7	20.0	0.0	0.0	0.0	6.7	13.3	0.0	6.7
Little & Big Annemessex R.	70.0	60.0	30.0	57.9	33.3	30.0	30.0	15.0	0.0	5.0	5.0	10.0	0.0	10.0
Pocomoke Sound	18.2	10.0	4.8	0.0	15.0	9.1	10.0	4.5	0.0	0.0	0.0	0.0	0.0	0.0
Bloodsworth-Sound Marsh Is.	37.5	22.7	10.9	11.6	7.0	2.2	4.4	0.0	0.0	2.2	11.1	2.2	4.3	0.0
Smith Island	64.7	45.5	25.0	35.3	22.2	35.3	23.5	5.8	17.6	47.1	47.1	41.2	35.3	29.4
Total Eastern Shore	36.4	28.5	13.3	18.0	9.7	17.7	13.9	11.6	9.0	12.4	5.4	4.5	5.6	4.5
Susquehanna Flats	44.4	2.7	0.0	13.5	11.1	8.1	11.1	2.7	8.1	0.0	2.7	13.5	5.4	0.0
Gunpowder-Bush Rivers	11.1	0.0	0.0	0.0	0.0	0.0	11.1	0.0	11.1	22.2	11.1	11.1	11.1	0.0
Back-Middle Rivers	13.6	4.6	4.6	4.6	9.1	4.6	9.1	4.5	4.5	9.1	4.5	0.0	19.0	17.6
Patapsco River	0.0	5.0	4.8	9.5	0.0	9.5	14.2	9.5	9.5	0.0	9.5	0.0	4.8	0.0
Magothy River	33.3	0.0	16.7	16.7	0.0	16.7	25.0	8.3	16.7	16.7	8.3	0.0	0.0	16.7
Severn River	40.0	20.0	26.7	26.7	0.0	46.2	20.0	26.7	20.0	13.3	6.6	0.0	6.7	0.0
South-West-Rhode River	0.0	0.0	0.0	0.0	0.0	12.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Curtis-Cove Points	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	0.0	0.0	0.0	0.0	0.0
Patuxent River	2.0	4.3	0.0	4.0	0.0	2.1	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0
Total Western Shore	6.8	4.2	4.1	8.3	5.0	8.4	8.8	5.0	7.2	4.0	3.7	3.6	4.6	2.7
Percent of stations vegetated	28.5	21.0	10.5	14.9	8.7	14.9	12.4	9.5	8.4	9.7	4.9	4.2	5.3	4.0
Number of areas with no SAV recorded	5.0	9.0	12.0	9.0	11.0	8.0	8.0	12.0	13.0	16.0	12.0	16.0	15.0	17.0

Figure 7. Trends of occurrence of submerged vegetation at eight of the 26 areas surveyed by the Maryland Department of Natural Resources, 1971-1984.



but the very sparse nature of SAV on the Flats probably resulted in the SAV not being sampled in 1984.

It appears from the SAV survey conducted in 1982 by Dr. Richard Anderson, ground observations by Stan Kollar in 1984 and the 1984 aerial survey, that SAV is expanding both in the Susquehanna River and the Flats.

2. UPPER EASTERN SHORE

Small, scattered SAV beds were found in this section in the Elk and Sassafras Rivers in 1984. A total of 43 hectares were mapped in 1984 compared to 29 hectares in 1978 (Tables 4-7) with 30% of the SAV found in the Elk River of the North East quadrangle. Seven of the 12 quadrangles had SAV in 1984 compared to 8 in 1978. The small beds found in the Elkton and Swan Point quadrangles in 1978 were not observed in 1984 while the SAV beds in the North East quadrangle in 1984 were not present in 1978. Fifteen stations were sampled in the Elk and Bohemia Rivers by the Md.DNR in 1984 with no vegetation recorded at any of the stations (Table 8). Several of the stations were located in deep water just off SAV beds evident on the photography. SAV was found in one of ten stations in the Sassafras River by this survey. The SAV was milfoil and was noted to be abundant throughout Lloyd Creek where SAV had been observed in the photographs in 1978. Five stations on Stillpond had no SAV in the Md.DNR survey although SAV was observed on the aerial photography in 1984 and 1978 in this area on both the Hanesville and Betterton quadrangles. Seven additional stations were sampled in the Howell and Swan Point system and no SAV were found.

3. UPPER WESTERN SHORE

The 1978 aerial survey indicated there were 484 hectares of SAV. In 1984, several flight lines were lost here due to a malfunction in the film processing. As a consequence, SAV beds for 1984 were poorly represented in the Middle, Gunpowder and Bush Rivers where large beds were found in 1978. However, aerial photography of the Gunpowder River was available for 1983 from Martin Marietta which showed SAV beds in areas similar to 1978. Thus, SAV information for 1984 was assumed to be similar to 1983. The Middle River was not flown in 1983 and it could be assumed there was SAV in this river similar to the 1978 distribution. The available 1983-84 photography showed 244 hectares of SAV in this section. Thus, the distribution of SAV in 1984 shown here is probably less than what was actually present.

The Md.DNR survey showed vegetation at 3 of 27 stations in the Gunpowder, Bush, Back and Middle Rivers (Table 8). The three stations that had SAV were in the Middle River and contained wild celery, milfoil and Chara sp. In the Magothy River, two of 12 stations had SAV (only horned pondweed) while no SAV was found in 23 stations in the Patapsco River.

4. CHESTER RIVER

In 1978, the Chester River section contained a diverse assemblage of 7 species of SAV encompassing 1,475 hectares. These species included milfoil, redhead grass, wild celery, horned pondweed, widgeongrass and Naiad species. Eighty-five percent of the SAV in 1978 was in the Langford quadrangle with the grasses occurring along both shorelines of the lower Chester River. In 1984, 731 hectares of SAV were recorded with 82% found in the Chester River, Langford quadrangle. There was a decrease of 655 hectares in the Langford quadrangle from 1978 to 1984. No SAV was mapped for the East and West Forks of Langford Creek in 1984 because of a film processing malfunction. There

were 97 hectares found in this area in 1978. There were SAV beds in this area in 1984, as the Md.DNR survey recorded redhead grass, milfoil and sago pondweed.

The Md.DNR survey found 19.4% of their 35 stations in the Chester River vegetated in 1984 compared to 1% in 1983 and 0% in 1982 (Table 8, Fig. 7). However, this was still lower than the 44% of the stations vegetated in the 1978 photo survey. Notes taken during the 1984 Md.DNR survey indicated large beds of SAV inshore from many of the actual sampling stations as well as much drift SAV.

5. CENTRAL WESTERN SHORE

No SAV's were noted in this section in 1984, compared with 241 hectares found in 1978 (Tables 4-7). Aerial coverage of this section in 1984 was complete. Fifty-seven percent of the vegetation in 1978 in this section was present in the Severn River with smaller amounts found in the South and Rhode Rivers. Seven species were present: milfoil, wild celery, redhead grass, sago pondweed, horned pondweed, widgeongrass and Najas sp.

The Md.DNR survey found no SAV in 1984 in the Severn, South, West and Rhode River systems (Table 8). Twenty-seven percent of the stations in the Severn River were vegetated in 1978. This declined to 0% in 1982. Some vegetation was found in 1983 but declined to 0% again in 1984. Since 1971 the Md.DNR survey has never found SAV in the South-West-Rhode Rivers.

6. EASTERN BAY

In 1984, only 66 hectares of SAV were noted in the aerial photography for the section. This was a significant decrease from the 1,800 hectares of SAV recorded in 1978, which was the most abundant section that year (Tables 4-7). Diverse beds of milfoil, redhead grass, sago pondweed, elodea, horned

pondweed and widgeongrass were found along the shores of Eastern Bay in 1978 but these were considerably reduced by 1984.

The Md.DNR found no vegetation at 8 stations in the Love-Kent Points systems and SAV at only 3 of 46 stations in the Eastern Bay system in 1984 (Table 8). In 1978, 26.1% of the stations were vegetated. This percentage has vacillated between 1978 and 1984, increasing to 34.8% in 1980 and then declining to the 6.5% in 1984. The only species found by the survey in 1984 was widgeongrass.

7. CHOPTANK RIVER

In 1984, only 82 hectares of SAV were noted in the aerial photography compared with 1740 hectares in 1978. Five species were observed in 1978: milfoil, sago pondweed, redhead grass, common elodea and horned pondweed. Large decreases of SAV were noted from 1978 to 1984 in the Claiborne, Oxford, Sharps Island and Church Creek quadrangles. In 1984, 65% of the SAV was found in two quadrangles, Claiborne and Oxford.

The Md.DNR survey found SAV in only 1 of 60 sampled stations in the Choptank River and no SAV in 19 stations in the Little Choptank River (Table 8). The only species found in 1984 was widgeongrass. In 1978, 28.3% of the stations in the Choptank River were vegetated which declined to lower levels after 1980. No vegetation has been found in the Little Choptank River since 1979. The qualitative surveys of the UMDHPL found SAV at only 2 of their 6 monitoring stations in 1984. In 1980, the year they began monitoring all six stations were vegetated. The most dramatic loss of SAV occurred at Benoni Point (Oxford quadrangle), Dickinson Bay (Trappe quadrangle), and Todd's Cove (Church Creek quadrangle) during the 1981-82 growing season.

8. PATUXENT RIVER

In 1984, 9 hectares of SAV were observed from the photography, compared with 34 hectares in 1978 (Tables 4-7). SAV occurred in the Broomes Island, Cove Point and Solomons Island quadrangles in 1984. Two species, widgeongrass and horned pondweed, were found in 1978. The Md.DNR survey found no SAV in 43 stations and have not recorded any since 1979 when 2% of the stations were vegetated, the same percentage as 1978 (Table 8).

9. MIDDLE WESTERN SHORE

No SAV was recorded in this section in 1984 compared to 11 hectares found in 1978 (Tables 4-7). The Md.DNR survey found no SAV in 8 sampled stations in Curtis - Cove Points system (Table 8). This area is a very exposed region and would not be expected to support significant stands of SAV.

10. LOWER POTOMAC RIVER

The Potomac River received more coverage, both from ground and aerial surveys, than any other part of the bay. Ground surveys by the Md.DNR, NVCC, and USGS and the 1984 aerial survey provided excellent coverage of the distribution of SAV's this year. However, several problems were encountered with the aerial survey. Five quadrangles were not covered with photography because of airspace restrictions by the Patuxent NAS: Piney Point, St. Marys City, Point No Point, St. George Island and Point Lookout. The 1978 aerial survey found no SAV's in these quadrangles. However, Carter, et al (1985) did find three or four species growing in the St. Marys River during their 1978-81 survey. Another complication was the timing of the flights for the Potomac River in 1984. Very poor atmospheric conditions delayed the flying of the Potomac River flight lines until early November when some of

the SAV had declined. This resulted in less coverage than that expected during the growing season.

In 1984, the aerial survey noted 194 hectares of SAV compared to 410 hectares found in 1978 (Tables 4-7). SAV was found in the Nanjemoy, Mathias Point, Dahlgren, Colonial Beach North, Colonial Beach South and Stratford Hall quadrangles in 1984, similar to what was observed in 1978. Most of the SAV in 1984 was in the Mathias Point quadrangle (63%) as was the case in 1978 (48%).

The Md.DNR survey sampled 88 stations in the lower section and found vegetation in only one, near Blossom Point at the mouth of Nanjemoy Creek. Wild celery and widgeongrass were the only two species observed.

The USGS sampled only the freshwater tidal and transition zone down to the Wicomico River (in 1983 and 1984) (Fig. 6). Table 9 lists the species found in the vegetated transects. Wild celery, milfoil, redhead grass, sago pondweed, and widgeongrass were among the species found in this section. A comparison with earlier data collected from 1978-1981 indicated more vegetated stations and grabs were found on sampled transects in 1984 than in 1981 (Table 10).

The NVCC survey also sampled in the transition zone (Fig. 5) in 1984 and found 9 species in this section (Table 11). These were the same species found by the USGS survey. The distribution of the species found by NVCC is given in Figs. 8-11. Wild celery was by far the most abundant species found by the NVCC survey and often was found in 100% coverage.

It is apparent from the data collected by the USGS and NVCC that SAV was more abundant than indicated in the aerial survey. Thus, the smaller amount of SAV found in 1984 is most probably due to the timing of the aerial

TABLE 9. SPECIES OF SUBMERSED AQUATIC PLANTS FOUND ON VEGETATED TRANSECTS IN THE TIDAL POTOMAC RIVER AND TRANSITION ZONE, 1984.

n.d. is no data available

Transect	Species ^{1/}	
	Spring	Fall
OR-1R	Hydr, Vall, P. pect, Zann	Heter
AD-1R	Hydr, P. cris	Hydr
DM-1R	Hydr	Cerat, Hydr
DM-2R	Hydr	Cerat, Hydr
DM-3R	Hydr	Cerat, Hydr, Nitella
DM-4R	Hydr, P. pect Vall, Zann	Cerat, Heter, Hydr, Myrio, Nitella, Vall
GC-1R	Cerat	Heter, Hydr, Myrio
GC-2R		Myrio, Vall
GC-4R		Vall
WC-1R	Vall, Zann	Vall
BC-1T-1	Cerat, Heter, Hydr, Myrio, Najas g., P. cris	n.d.
PY-1R	P. pect, Vall	Myrio
PY-1.5R	Myrio, Najas m.	n.d.
PY-2R	Myrio, Najas m.	Cerat, Heter, Hydr, Myrio, Najas g., Vall
PY-3R		Hydr, Myrio Najas g.
PY-4R		Najas g.
PY-5R		Heter
PY-7R	Myrio	Heter, Hydr, Myrio, Najas g., Najas m., Vall
PY-8R	Vall, Zann	Cerat, Heter, Hydr, Myrio Najas g., Vall, Zann
PY-1T-1		Myrio,
PY-1T-3	Cerat	n.d.
PY-2T-1	Hydr	Cerat, Hydr, Myrio
MN-9R	Cerat, P. pect	Vall
MN-10R	P. pect, Vall, Zann	Vall

TABLE 9. (continued)

Transect	Species ^{1/}	
	Spring	Fall
MN-4T-1	Cerat	Cerat, Myrio
MN-4T-2	Vall	Najas g., P. pus, Vall
MP-3R	Vall	n.d.
MP-4R	Myrio, Najas g., Vall, Zann	n.d.
NP-2R	n.d.	Vall
NP-3R	n.d.	Vall
NP-4R	n.d.	P. perf, Vall
NP-5R	n.d.	Vall
NP-6R	n.d.	Cerat, P. pect, P. perf, Vall
NP-7R	n.d.	Vall
NP-8R	n.d.	Vall
NP-9R	n.d.	P. perf, Vall
NP-10R	n.d.	Myrio, P. perf, Vall
NP-11R	n.d.	Vall
NY-3T-3	n.d.	Cerat, Myrio, P. pus
PO-1T-5	n.d.	Myrio, Vall
PO-2T-1	n.d.	Vall
PO-2T-2	n.d.	Vall
PO-2T-3	n.d.	Vall
PO-3T-1	n.d.	Myrio, Vall
WO-5T-1	n.d.	P. perf, Rupp
WO-8T-1	n.d.	Najas g., Rupp

^{1/}Cerat = Ceratophyllum demersum, Heter = Heteranthera dubia,
Hydr = Hydrilla verticillata, Myrio = Myriophyllum spicatum,
Najas g = Najas guadalupensis, Najas m = Najas minor
Nitella = Nitella flexilis, P. cris = Potamogeton crispus,
P. pect = Potamogeton pectinatus, P. pus = Potamogeton pusillus,
Vall = Vallisneria americana, Zann = Zannichellia palustris
P. perf = Potamogeton perfoliatus, Rupp = Ruppia maritima

TABLE 10. RELATIVE OCCURRENCE OF VEGETATED TRANSECTS, STATIONS AND GRABS FOR THE TIDAL POTOMAC RIVER AND ESTUARY, 1978-81 AND 1984.

Relative occurrence as number vegetated/total number					
Site	Vegetated transects		Site	Vegetated transects	
	Date	Date		Date	Date
<u>Tidal river</u>					
Washington Channel	Fall 1981	Fall 1984	Pomonkey Creek	Spring 1981	Fall 1984
transects	1/1	1/1		0/4	0/4
stations	2/4	3/4		0/20	0/20
grabs	6/12	7/12		0/60	0/60
Mattawoman/Piscataway Creeks	Summer 1978	Fall 1984	MN-4T-2	Fall 1981	Fall 1984
transects	1/34	12/34		1/1	1/1
stations	1/160	46/197		3/4	1/5
grabs	3/480	84/491		7/12	3/15
Gunston Cove	Fall 1979	Fall 1984			
transects	0/13	3/13			
stations	0/65	14/77			
grabs	0/195	17/231			
<u>Transition zone</u>					
Maryland Point	Spring 1981	Spring 1984	*Nanjemoy/Port Tobacco River	Summer 1981	Fall 1984
transects	2/4	2/4		17/17	16/17
stations	5/20	20/38		53/108	76/135
grabs	8/60	39/114		119/324	173/405
Wicomico River	Summer 1981	Fall 1984			
transects	2/8	2/8			
stations	3/39	9/44			
grabs	6/117	24/132			

*Only transects which had three or more species in 1978-80 were sampled.

TABLE 11. GRID LOCATIONS IN THE TRANSITION ZONE OF THE POTOMAC RIVER WHERE THE DIFFERENT SPECIES OF SAV WERE FOUND BY THE NVCC SURVEY. PERCENTAGE OF VEGETATION FOUND IN EACH GRID IS ALSO PRESENTED (IH = INDIAN HEAD QUAD, WI = WIDEWATER, NA = NANJEMOY, MP = MATHIAS POINT, PC = POPES CREEK, PA = PASSAPATANZY, KG = KING GEORGE, DA = DAHLGREN, CB = COLONIAL BEACH NORTH; EACH NUMBER OF THE GRID REPRESENTS THE TWO LOWER LEFT COORDINATES. THE FIRST TWO REPRESENT THE VERTICAL NUMERALS AND THE SECOND TWO THE HORIZONTAL ONES (FROM ALLAIRE, ET AL., 1985).

<u>Hydrilla</u>			<u>Myriophyllum</u>			<u>Ceratophyllum</u>			<u>Vallisneria</u>				<u>P. perfoliatus</u>			<u>P. pectinatus</u>			<u>P. crispus</u>			<u>Ruppia</u>			<u>Zannichella</u>			<u>Chara</u>			<u>Elodea</u>							
Grid	#	%	Grid	#	%	Grid	#	%	Grid	#	%	Grid	#	%	Grid	#	%	Grid	#	%	Grid	#	%	Grid	#	%	Grid	#	%	Grid	#	%	Grid	#	%			
WI	0150	1	NA	1057	5	PA	0145	90	PA	0145	8	MP	2449	100	KG	1046	2	NA	1459	10	MP	1652	5	MP	1552	5	MP	1552	5	MP	1552	5	PA	0145	2	MP	2360	50
WI	0252	1	NA	1156	90	WI	0150	9	WI	0150	90	MP	2454	50	MP	1652	5	MP	1853	50	PC	2552	60	MP	2057	5							WI	0262	5	MP	2362	50
WI	0255	60	NA	1357	100	WI	0252	99	PA	0244	100	MP	2455	100	MP	1853	50	MP	1854	10	PC	2650	50	MP	2160	20				MP	2553	10	WI	9751	90			
WI	0259	100	NA	1358	95	WI	0255	30	WI	0255	10	DA	2548	100	MP	1854	50	MP	2359	10	PC	2651	50															
WI	0260	100	NA	1359	100	WI	0263	5	WI	0262	10	PC	2552	40	MP	2057	5																					
WI	0262	85	MP	1455	100	WI	0350	2	WI	0263	5	MP	2553	50	MP	2157	50																					
WI	0263	90	MP	1457	100	IH	0466	10	PA	0344	100	CB	2647	90	MP	2160	40																					
WI	0350	2	NA	1459	50	NA	1056	5	WI	0350	96	CB	2648	90	MP	2357	90																					
IH	0466	90	NA	1460	50	PA	9347	90	WI	0351	100	PC	2649	100	MP	2454	50																					
KG	1046	1	MP	1552	10	WI	9454	100	NA	0549	100	PC	2650	50	MP	2553	40																					
MP	2055	1	MP	1655	50	WI	9555	30	KG	0747	100	PC	2651	40																								
PA	9645	1	MP	1657	80	PA	9645	99	KG	0948	100	PC	9347	10																								
WI	9751	1	MP	1854	40	PA	9648	100	KG	1046	97	WI	9555	70																								
			MP	2261	100	PA	9649	100	KG	1049	100	WI	9654	100																								
			MP	2360	50	PA	9748	98	NA	1056	95	PA	9748	98																								
			MP	2362	60	WI	9751	9	NA	1057	95																											
			CB	2647	10	PA	9947	100	NA	1149	100																											
			CB	2648	10				NA	1150	100																											
			CB	2651	10				NA	1156	10																											
									NA	1250	100																											
									NA	1358	5																											
									NA	1459	40																											
									NA	1460	50																											
									MP	1552	80																											
									MP	1553	100																											
									MP	1652	90																											
									MP	1655	50																											
									MP	1657	20																											
									MP	1752	100																											
									MP	1753	100																											
									MP	1950	100																											
									MP	1954	100																											
									MP	2051	100																											
									MP	2055	100																											
									MP	2057	90																											
									MP	2157	50																											
									MP	2160	40																											
									MP	2250	100																											
									MP	2349	100																											
									MP	2350	100																											
									MP	2362	30																											

Figure 8. Distribution of wild celery (1), Vallisneria americana, in the transition zone of the Potomac River, 1984 (from Allaire, et al., 1985).

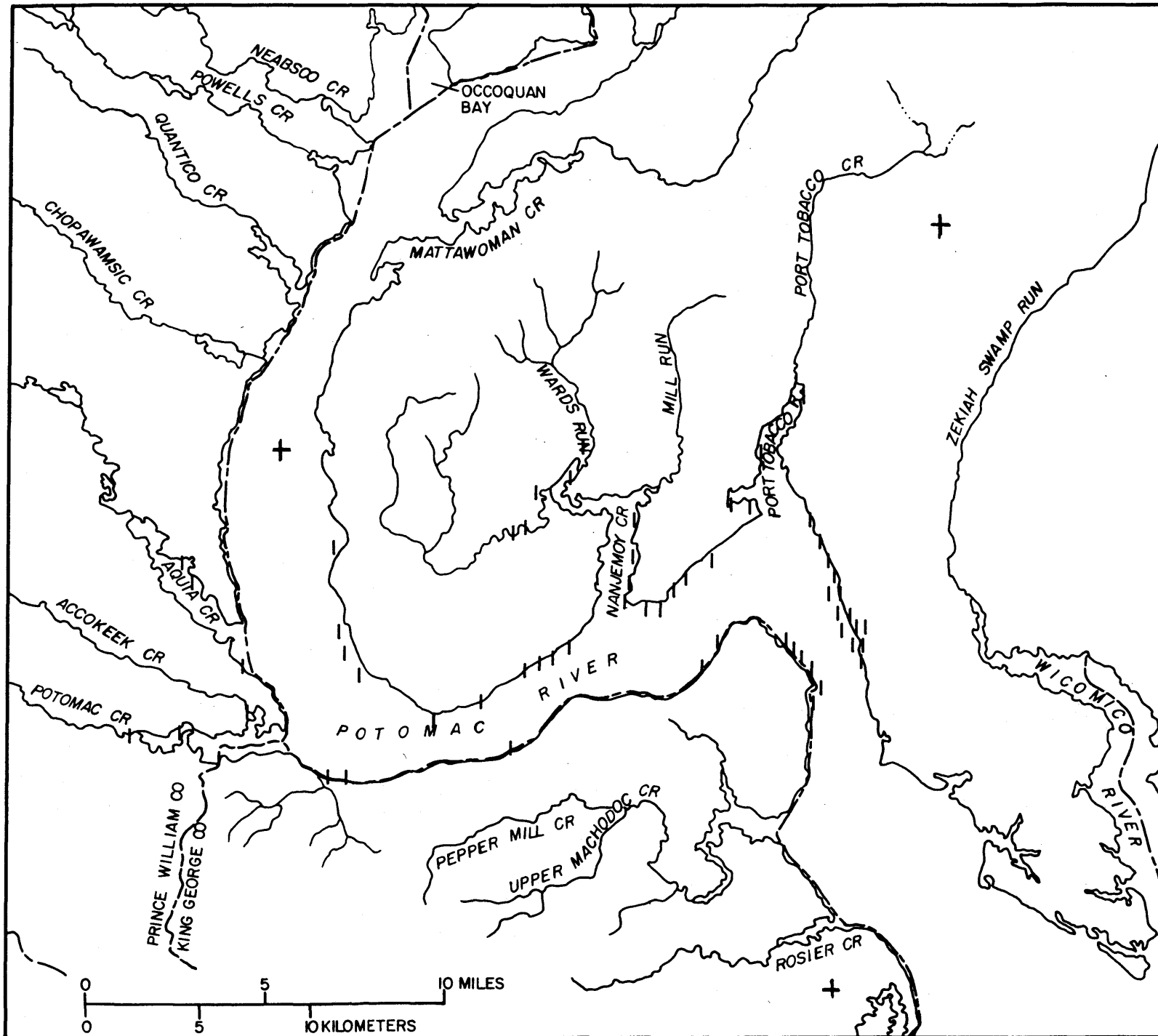


Figure 9. Distribution of Hydrilla (1) Hydrilla verticillata, coontail (2) Ceratophyllum demersum, and milfoil (3) Myriophyllum spicatum in the transition zone of the Potomac River, 1984 (from Allaire, et al., 1985).

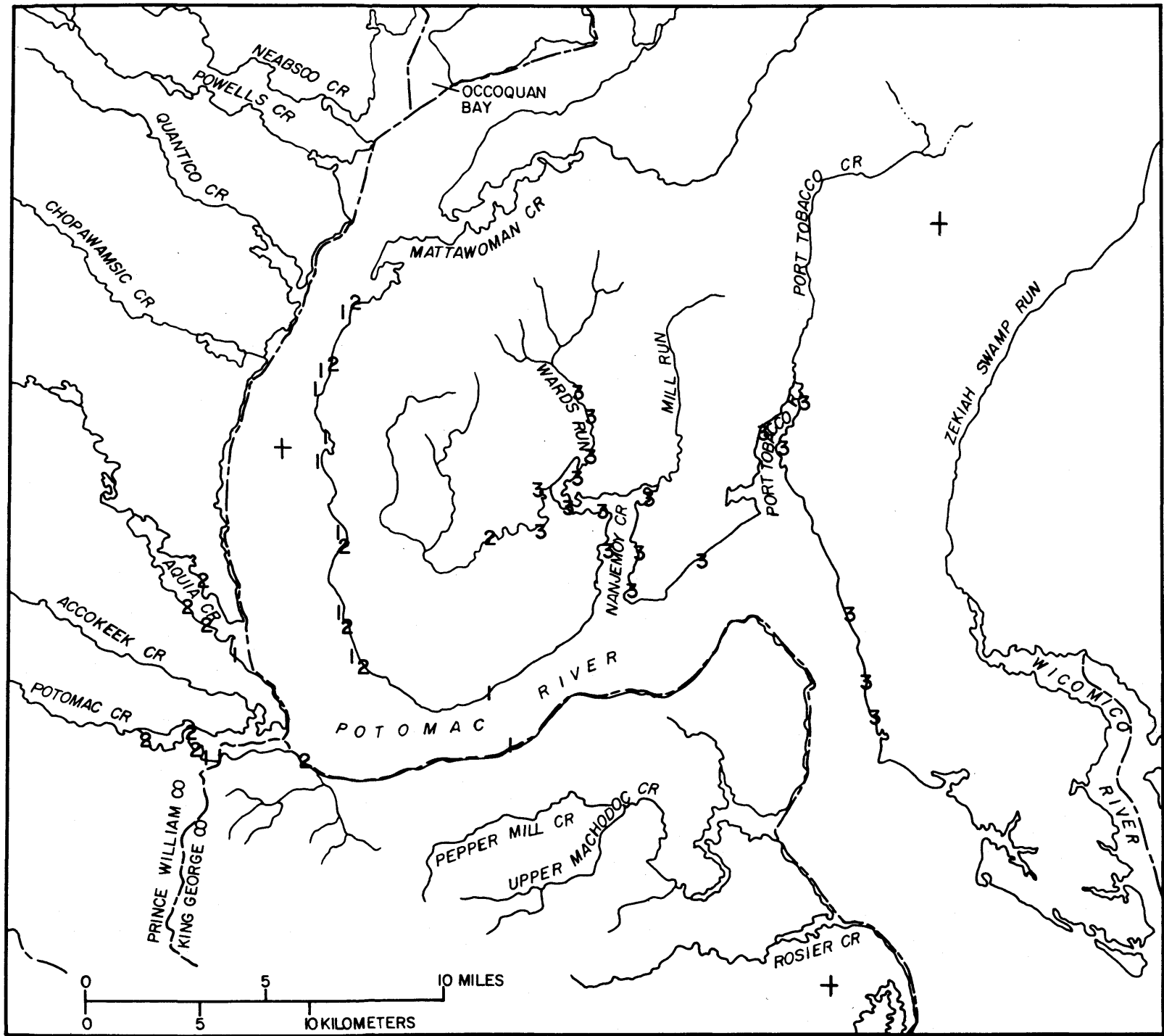


Figure 10. Distribution of sago pondweed (1) P. pectinatus, curly pondweed (2) P. crispus and redhead gras (3) P. perfoliatus in the transition zone of the Potomac River, 1984 (from Allaire, et al., 1985).

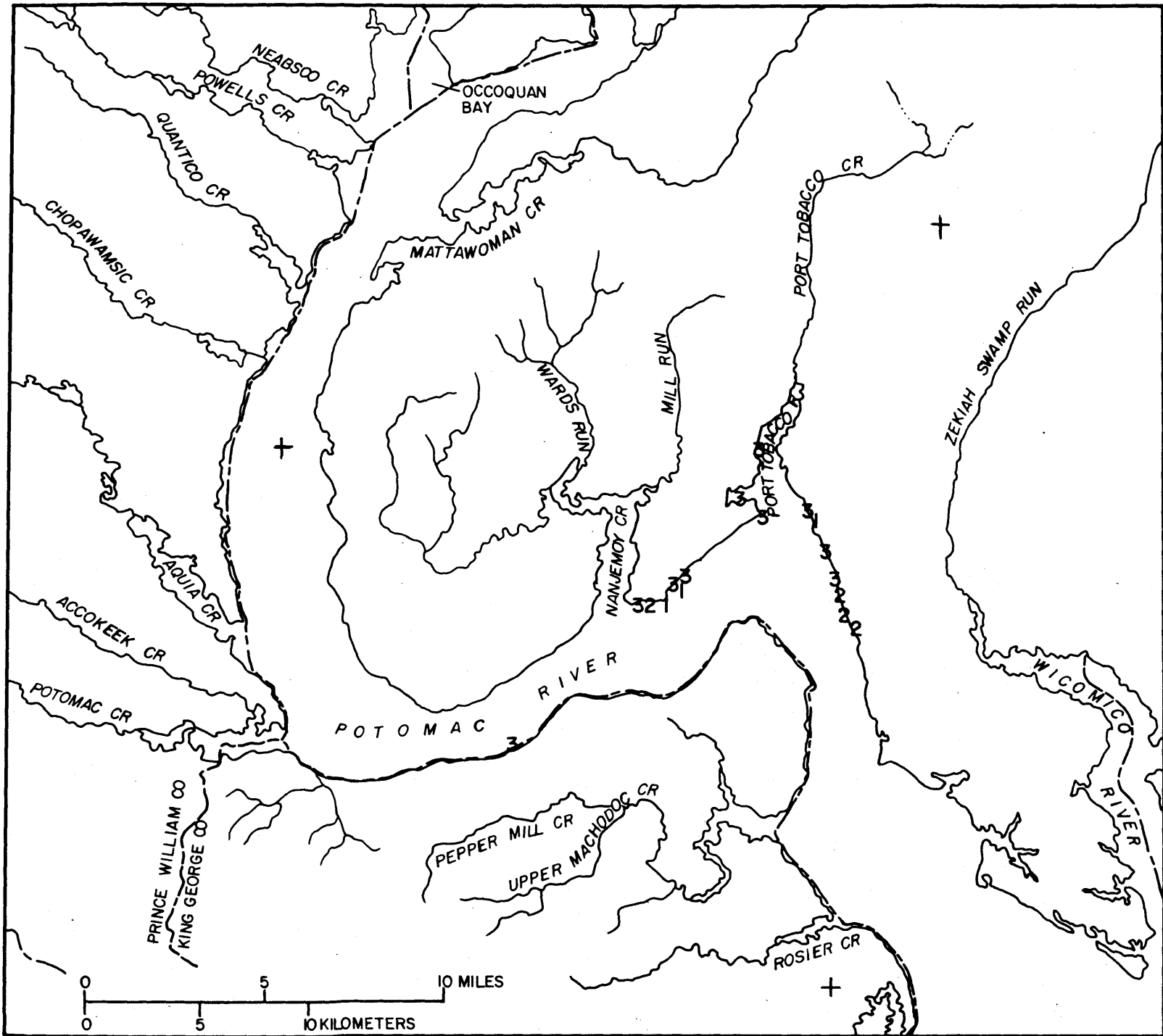
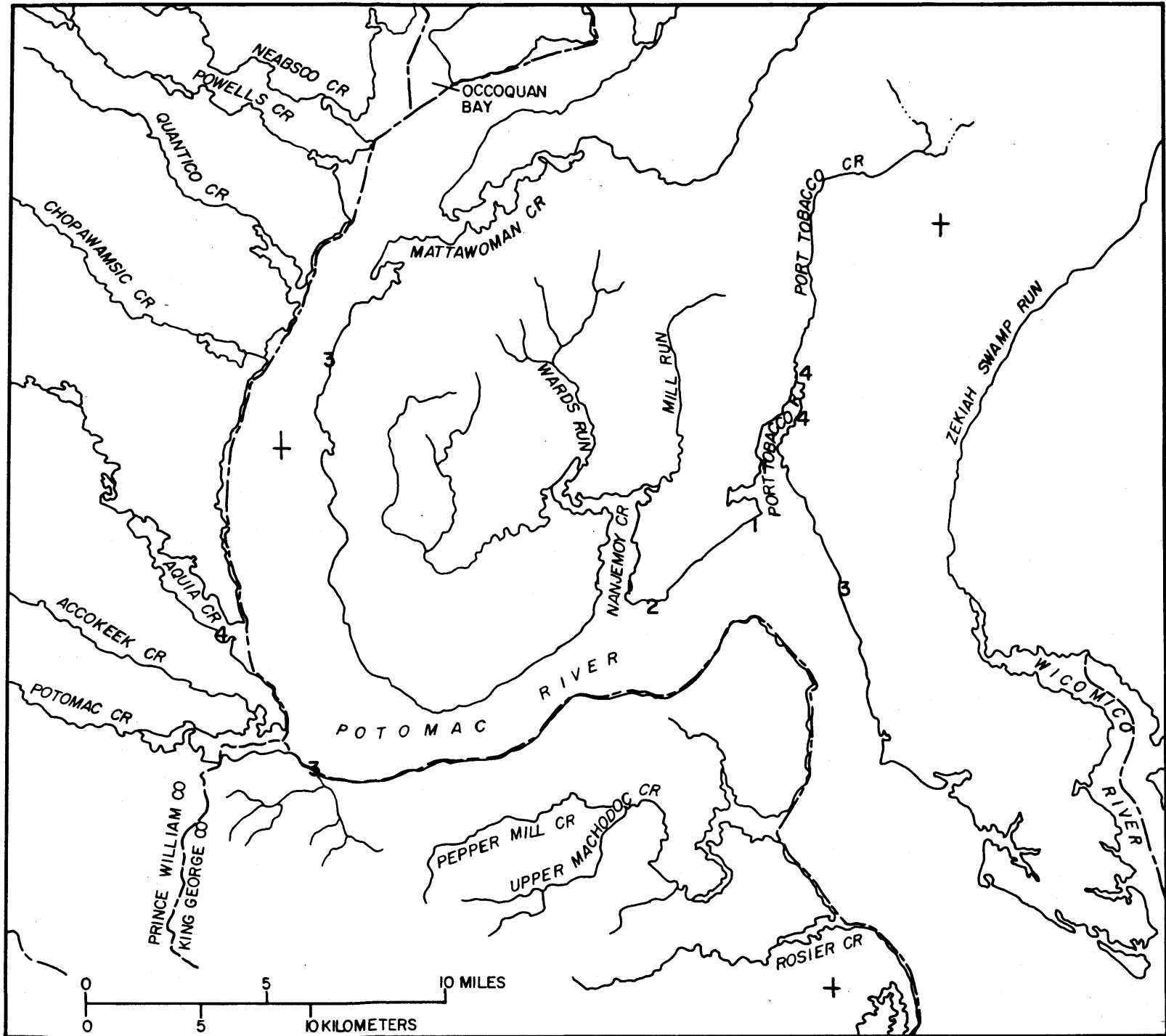


Figure 11. Distribution of widgeongrass (1) Ruppia maritima, horned pondweed (2) Zannichelia palustris, Chara (3) sp., and common elodea (4) Elodea canadensis in the transition zone of the Potomac River, 1984 (from Allaire, et al., 1985).



overflights in this area which were conducted after the peak in standing crop of SAV.

11. UPPER POTOMAC RIVER

This section may be one of the most interesting of this study because of its past history and what has been occurring with SAV in the last three years. This section of the river had been largely devoid of SAV since the 1930's although large beds of SAV were present in the early 1900's (Orth and Moore, 1984; Carter, et al., 1985b). During the 1978-81 USGS surveys no species of SAV were found. Since 1981, however, not only has there been a dramatic increase in many of the native species, but also three species, Hydrilla verticillata, Heteranthera dubia, and Najas minor, not present in earlier surveys (Carter, et al., 1985a,b) were reported. This increase has occurred in the reach between Alexandria, Virginia, and Marshall Hall, Maryland. Fig. 12 shows the species diversity of SAV in the tidal Potomac River in 1983 while Fig. 13 shows the increase in species diversity in this same area in 1984. Comparison of the 1984 transect data (Table 9, Fig. 6) with that of the 1978-81 survey clearly shows the increase in the upper tidal river (Table 10). All of the increase which occurred in the Mattawoman/Piscataway Creeks and the Gunston Cove regions was above Marshall Hall. There is still virtually no SAV in the reach between Marshall Hall and Quantico, Virginia.

The presence of Hydrilla is notable given the growth potential of this species. Hydrilla is a fast growing exotic plant from Southeast Asia. It is considered a nuisance in California, Florida and other southeastern states because it forms thick mats of vegetation which interfere with recreational use of the water. It reproduces both vegetatively and sexually, and overwinters by tubers and turions. In 1981, a small

Figure 12. SAV species diversity in the tidal Potomac River, 1983 (from Carter, et al., 1985a).

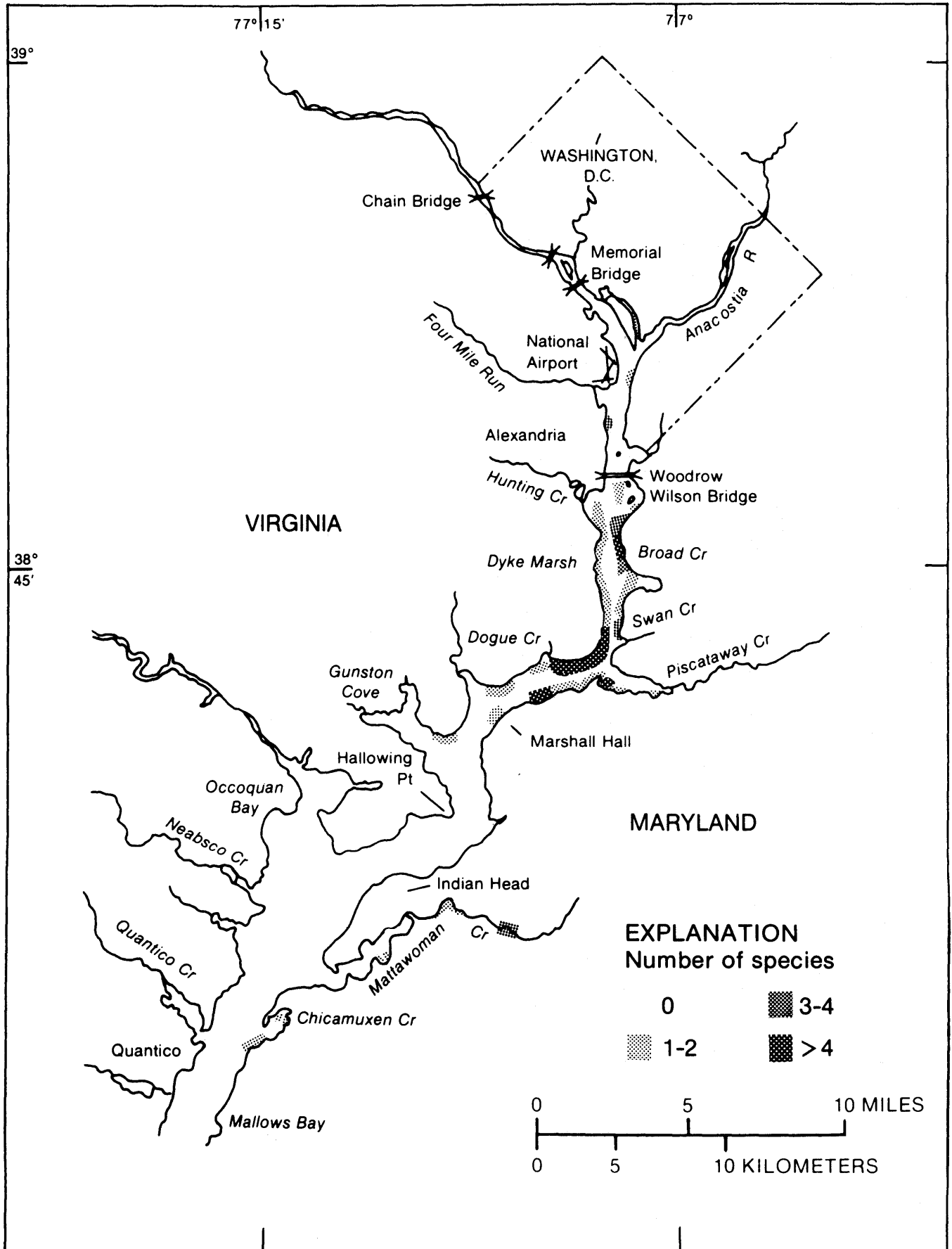
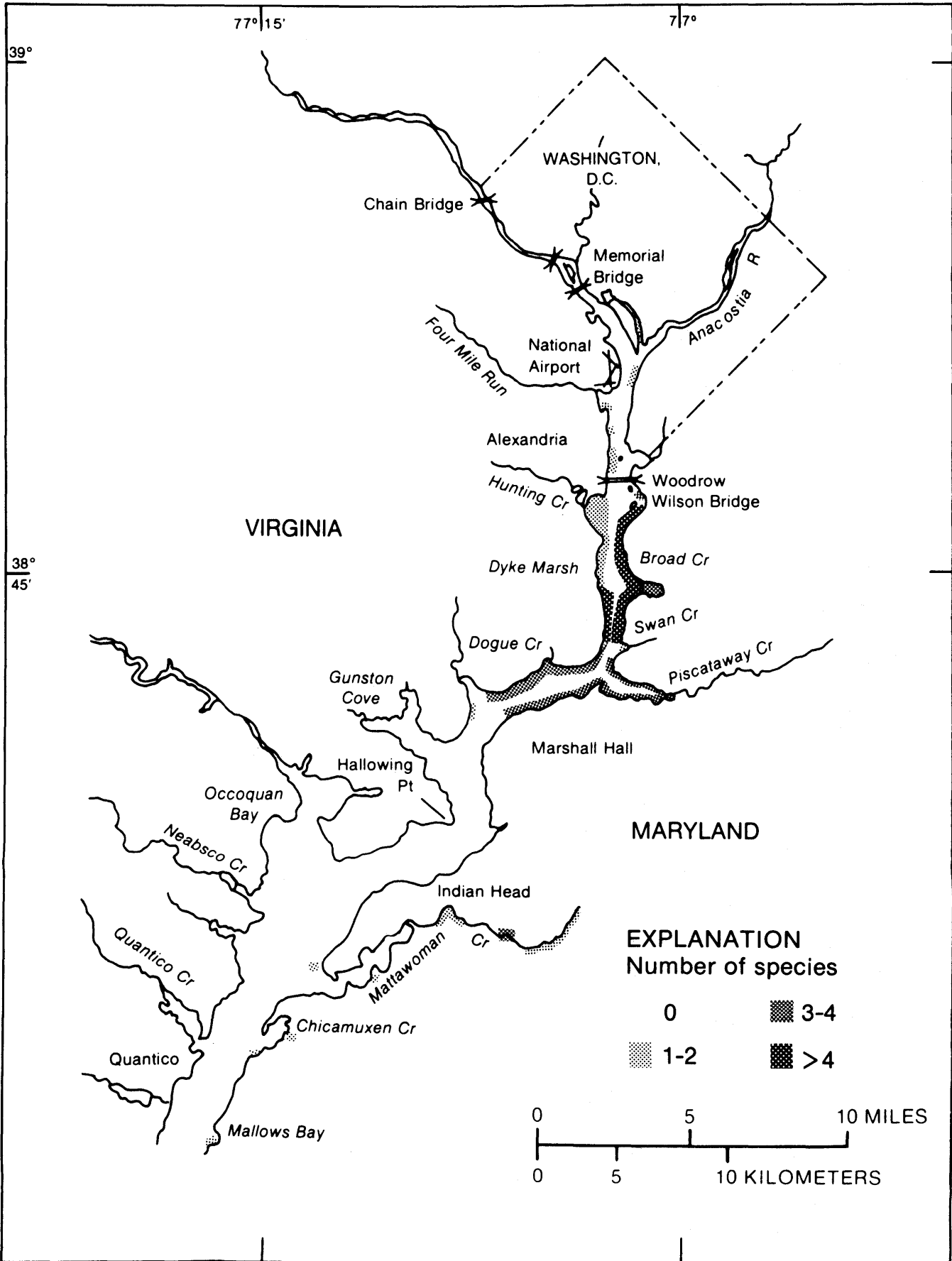


Figure 13. SAV species diversity in the tidal Potomac River, 1984 (from Carter, et al., 1985a).



population of Hydrilla was found in Dyke Marsh, Virginia. In 1982, the Department of Agriculture made a positive identification and discovered that Hydrilla was widespread in lentic environments in the Washington, D.C. area. By 1983, Hydrilla was firmly established in the reach above Marshall Hall, with its greatest population in the Dyke Marsh area on the Virginia side of the river (Fig. 14). In 1984, it filled in along the Maryland and Virginia shorelines, with the largest populations along the shoreline adjacent to and across from Dyke Marsh (Fig. 15). In many parts of the tidal river, it is found growing with many other species and composes less than 10 percent of the total plant material. There is concern that Hydrilla might outcompete other desirable SAV species in the Potomac River.

Allaire et al. (1985) also reported Hydrilla in this section (Table 11) but much farther south than that reported by Rybicki et al. (1985). It was prevalent in the marsh guts on the Maryland side of the river down to Mathias Point and present in 13 of the 186 grids sampled (Fig. 9). One specimen was found floating in a tributary of Potomac Creek, and three plants were found rooted behind the marsh at Aquapo Beach on Aquia Creek. No Hydrilla was found rooted in the main part of the Potomac River in the transition zone.

Allaire et al. (1985) also found other species present in this section (Table 11, Figs. 8-11). No vegetation was found in the Quantico quadrangle while Indian Head, Widewater, Passapatanzy and King George had 20%, 28%, 32% and 12% of the grids vegetated, respectively. Coontail and wild celery were the most abundant species evident.

The Md.DNR survey sampled 52 stations in this section in 1984 and found vegetation in only one, Broad Creek. Hydrilla was present in the three samples collected from this site.

Figure 14. Distribution of Hydrilla in the tidal Potomac River in 1983
(from Rybicki, et al., 1985).

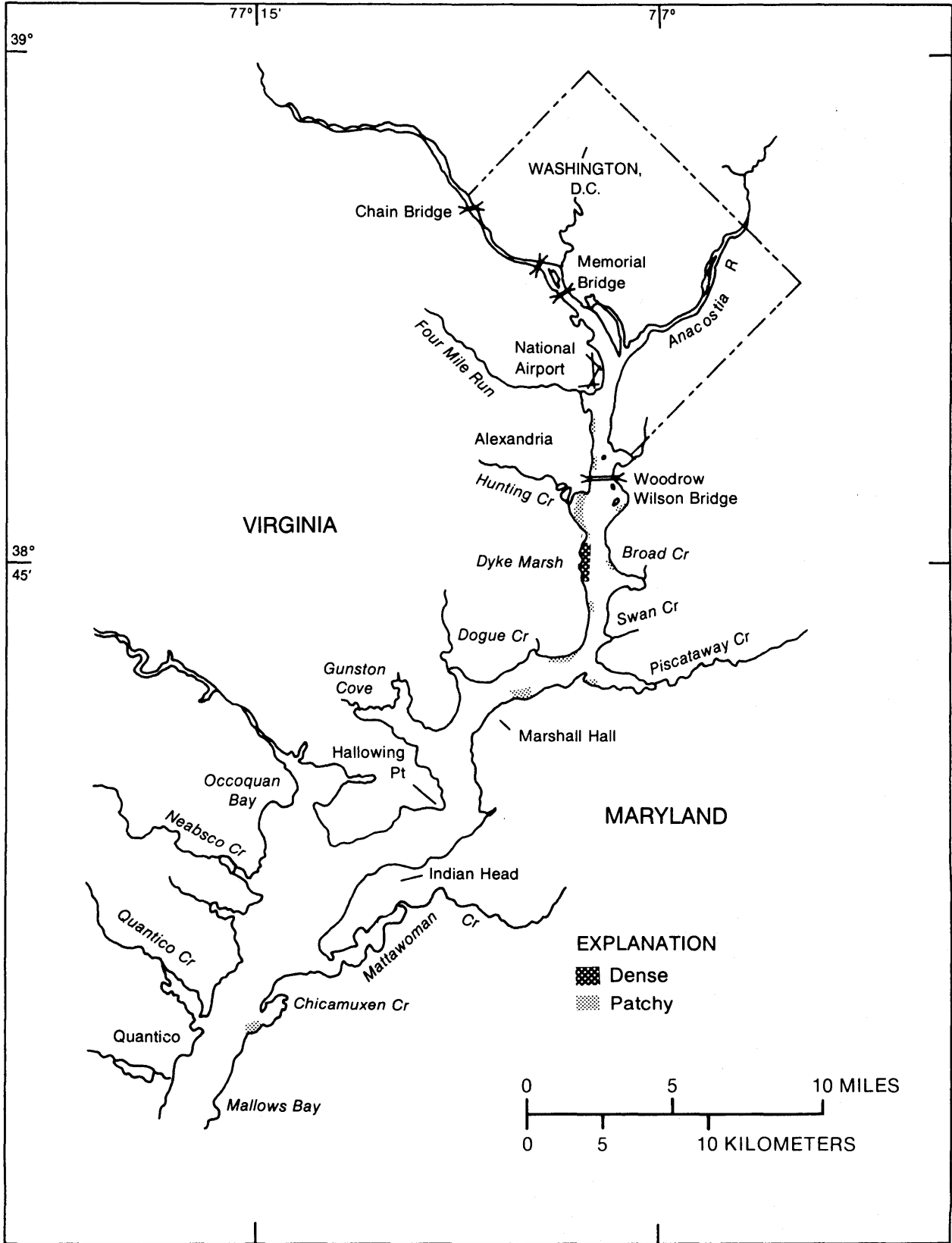
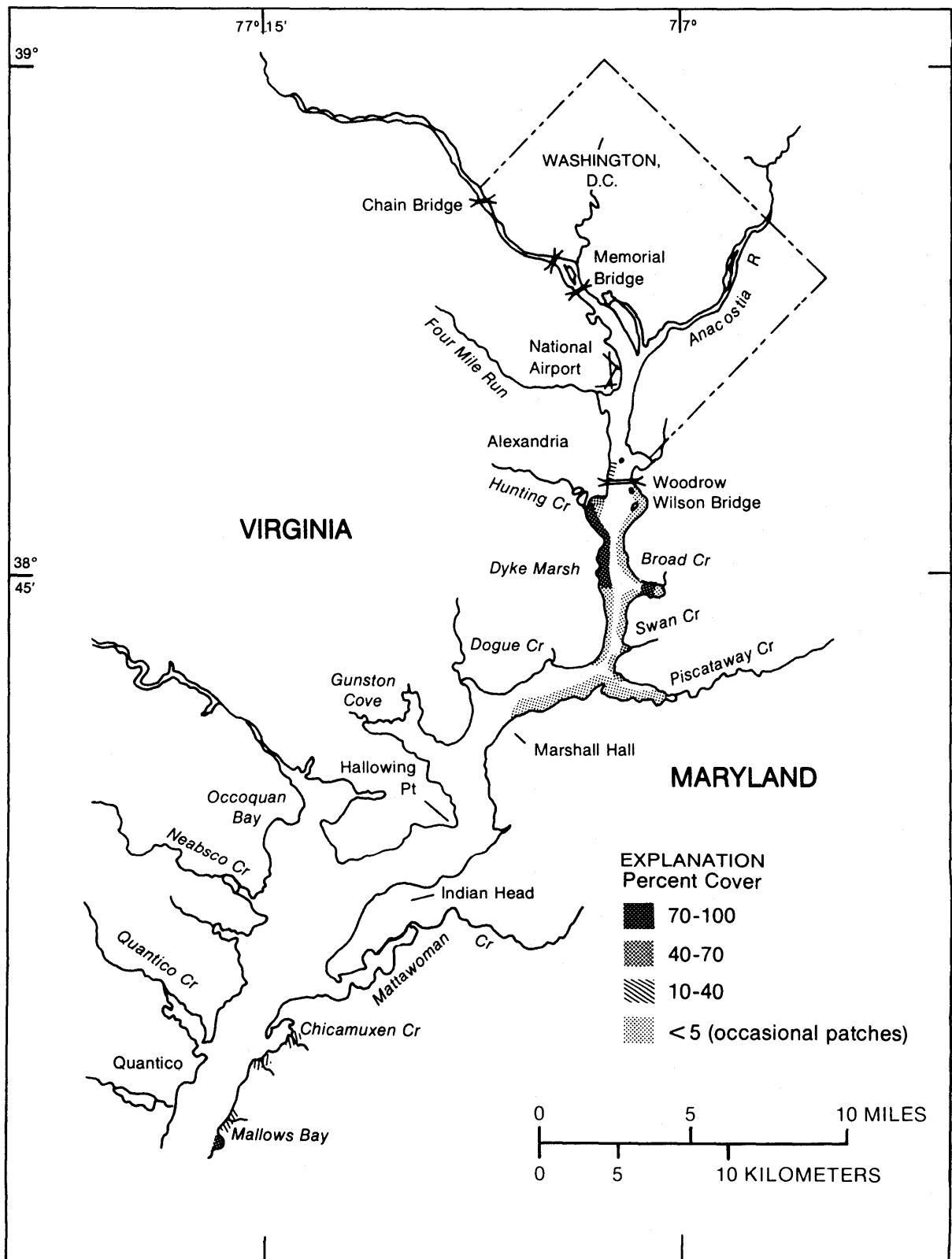


Figure 15. Distribution of Hydrilla in the tidal Potomac River in 1984
(from Rybicki, et al., 1985).



The 1984 aerial survey confirmed the presence of the SAV beds in this section (Tables 4-7) with 631 hectares mapped from the photography. Of the 11 quadrangles in this section, SAV was present in six, with 67% found in the Mt. Vernon quadrangle and 25% in the Alexandria quadrangle. As indicated from the ground surveys of the USGS, the SAV was a mixture of many species, including Hydrilla. No SAV was mapped for this section in 1978.

The cause for the increase in SAV in this section is not known but may be related to nutrient changes in this region. There has been a dramatic decrease in phosphate loading from the Blue Plains sewage treatment plant since the late 1970's. In 1983, Blue Plains began nitrification, changing the predominant nitrogen species in the river from ammonia to nitrate. At the same time, Blue Plains reduced the suspended solids output from the plant (Table 12). Secchi depths in the upper tidal river were significantly higher in 1983 than in the 1978-81 (Table 13). There were blue-green algae blooms during the summer of 1983 and 1984, but the 1983 bloom did not reach the Wilson Bridge until nearly September, moving upriver from the Quantico area. In 1984, the river discharge was higher and the bloom never reached the upper tidal river. These recent algal blooms have thus had little effect upon the water clarity and light available for SAV growth in this section.

12. MIDDLE EASTERN SHORE

In 1984, there was only 32.9 hectares of SAV in this section compared to 210 hectares found in 1978 (Tables 4-7). The earlier aerial survey found only four species present: widgeongrass, horned pondweed, sago pondweed and eelgrass. This section comprises a large area of the mid-bay section with many areas having large, broad flats (Bloodsworth and South Marsh Islands) or coves that would be conducive for SAV growth, yet very little is present

TABLE 12. TOTAL SUSPENDED SOLIDS OUTPUT FROM THE PRIMARY OUTLET OF BLUE PLAINS SEWAGE TREATMENT PLANT, 1982 AND 1983.

[Monthly mean in mg/L (number of observations)]

<u>Month</u>	<u>1982</u>	<u>1983</u>
April	9.8 (30)	1.2 (20)
May	4.16 (31)	1.0 (31)
June	7.09 (30)	1.3 (30)
July	4.82 (31)	1.1 (30)
August	5.18 (31)	1.2 (31)
September	6.7 (30)	1.2 (30)
October	5.24 (31)	1.3 (31)

TABLE 13. SECCHI DEPTH IN THE UPPER AND LOWER TIDAL RIVER, JULY-OCTOBER, 1978-81 AND JULY-OCTOBER, 1983 (SE = STANDARD ERROR, N = NUMBER OF OBSERVATIONS).

[Depth in cm]			
<u>Location/Date</u>	<u>Mean</u>	<u>SE</u>	<u>N</u>
Upper tidal river			
July-October, 1978-81	51.8	3.28	38
July-October, 1983	85.5	4.69	48
July-August, 1983	87.3	5.20	39
Lower tidal river			
July-October, 1978-81	38.8	1.29	72
July-October, 1983	50.8	4.96	13
July-August, 1983	50.8	4.96	13

today in this section. Fifty-five percent of the SAV in this section in 1984 occurs in the Bloodsworth quadrangle with the remaining beds located in Golden Hill, Honga, Wingate and Richland Point quadrangles. No SAV occurs in 8 quadrangles.

The Md.DNR survey sampled 169 stations in this section, examining sites in the James-Barren Island system, Honga River, Fishing Bay, Nanticoke - Wicomico River, Manokin River and Big Annemessex River (Table 8, Fig. 7). Only 1 of 15 stations in the Manokin River had SAV (widgeongrass), while 1 of 12 stations in the Big Annemessex River was also vegetated with widgeongrass (Table 8, Fig. 7). All the stations sampled in the other areas were unvegetated.

13. TANGIER ISLAND COMPLEX

This section contains the second largest number of quadrangles that contain SAV (8) and is the section with the most SAV present. In 1984, 5,376 hectares were mapped compared to 3,759 hectares in 1978, a 43% increase (Tables 4-7). The number of hectares in this section was over twice as much as in the next largest section, the Lower Eastern Shore, which has 2,232 hectares. Of the SAV mapped in the Lower Bay zone, 48% is located in the Tangier Island Complex.

The SAV beds are concentrated in several distinct areas: adjacent to Big Marsh between Chesconessex Creek and Deep Creek, on the west side of Webb and Halfmoon Island, the east side of Fox Islands around Cedar Straits and the areas in and around Tangier and Smith Islands and the large broad shoal area between the two islands. Seventy-three percent (3,909 hectares) of the SAV in this section is located in the Tangier-Smith Island region. This, by far, is the section of the bay that has the densest concentration of SAV.

The Md.DNR survey of Smith Island indicated a decline in SAV from 1983 to 1984, when only 29.4% of the 17 stations were vegetated. This is in contrast to the photographic data showing a large increase in the Smith Island area. A comparison of the 17 DNR station locations and the distribution maps from aerial photography indicated that the twelve unvegetated stations were adjacent to existing beds outlined in the photographs and that the five vegetated stations were in areas classified as dense from the photography.

Two other areas were field checked by the Maryland survey. No SAV was found in the 22 stations in the Pocomoke Sound area although small, scattered beds were aeriually mapped very close to the shoreline, well inshore of the sampled stations. In the Little Annemessex River, the Maryland survey showed no SAV in 8 sampled stations. The aerial survey showed beds located on both shores of the river in a narrow band and well inshore of several of the Maryland stations. The SAV in the Crisfield quadrangle increased from 7 to 107 hectares from 1978 to 1984 in the aerial survey while the Maryland survey has shown no increase and very little vegetation in this region.

14. LOWER EASTERN SHORE

This section contains the largest number of quadrangles that contain SAV (9) and is the second largest section in SAV area in the Lower Bay zone. In 1984, 2,232 hectares, consisting of eelgrass and widgeongrass, were mapped compared to 1,991 hectares in 1978, an increase of 12% (Tables 4-7). The largest beds were found around Cape Charles at the mouth of Cherrystone Inlet, and at the mouths of Hungars and Mattawoman Creeks (also called Vaucluse Shores), Occahannock Creek, Craddock Creek, Pungoteague Creek and Onancock Creek. The areas between these creek systems are sparsely

vegetated or unvegetated because of the exposed nature of these broad sand flats.

SAV in the Vaucluse Shores historical area (includes part of Hungars and Mattawoman Creeks) (see Orth, et al., 1979, for a detailed description of the site) has remained relatively stable since 1978 (Table 14, Fig. 16), although changes prior to 1978 were a result of the dynamic nature of the sand bars and spits in this region. The historical area was also the site where seven transects were made in 1978 for species distribution. These transects showed widgeongrass in the shallowest areas, eelgrass in the deeper sites and both species at intermediate depths. Horned pondweed has also been found mixed with widgeongrass in the shallowest depths.

15. REEDVILLE

In 1984, 264 hectares of SAV were observed in the section compared to the 364 hectares mapped in 1978 (Tables 4-7). Most of the beds, which are found throughout the section, were classified as sparse or very sparse (Table 7). This section contains the Fleets Bay historical site where 101 hectares were mapped in 1984 compared to 73 hectares in 1978 (Table 14, Fig. 16). SAV coverage actually decreased from 1978 to 1980 but increased in 1981. This increase from 1981 to 1984 was noted to occur in areas that were classified as sparse or very sparse.

16. RAPPAHANNOCK RIVER COMPLEX

Only 23 hectares of SAV were found in this section in 1984 compared to 93 in 1978 (Tables 4-7). Several small but dense beds are present in the Milford Haven area, remnants of the dense beds present in the early 1970's. The other beds are small and sparse, located along the north shore of the Rappahannock River. No SAV was observed in the Piankatank River. There were no SAV beds in the Parrott Island historical area (Table 14, Fig. 16).

TABLE 14. AREAS OF SAV AT HISTORICAL MAPPING SITES (LOWER BAY ZONE) 1937-1984

Parrott Islands					
Date	<10%	Area m ²			Total
		10-40%	40-70%	70-100%	
1937	0	297,024	1,598,268	0	1,895,292
1951	394,797	778,146	1,222,410	1,158,384	3,553,737
1960	411,306	631,566	547,014	1,947,372	3,537,258
1968	92,064	1,354,110	1,205,628	124,374	2,776,176
1974	0	2,922	7,710	0	10,632
1978	0	22,872	0	0	22,872
1980	0	0	0	0	0
1981	0	0	0	0	0
1984	0	0	0	0	0

Fleets Bay					
Date	<10%	Area m ²			Total
		10-40%	40-70%	70-100%	
1937	0	1,385,424	548,076	744,864	2,678,364
1953	1,488,258	597,354	591,018	284,232	2,960,862
1961	1,572,612	1,330,140	1,643,892	884,280	5,430,924
1969	1,436,403	1,938,660	1,592,170	270,372	5,237,605
1974	105,714	1,624,884	1,325,040	0	3,055,638
1978	167,688	528,918	33,592	0	730,198
1980	0	121,890	26,040	2,472	150,402
1981	0	683,250	9,816	13,986	707,052
1984	232,164	730,680	33,318	14,556	1,010,718

Mumfort Islands					
Date	<10%	Area m ²			Total
		10-40%	40-70%	70-100%	
1937	0	495,060	397,368	23,832	916,260
1953	151,728	699,252	106,356	1,461,846	2,419,182
1960	0	258,210	1,880,238	0	2,138,448
1971	0	685,536	1,088,976	0	1,774,512
1974	0	127,488	23,826	0	151,314
1978	0	0	0	0	0
1980	0	0	0	0	0
1981	0	0	0	0	0
1984	0	0	0	0	0

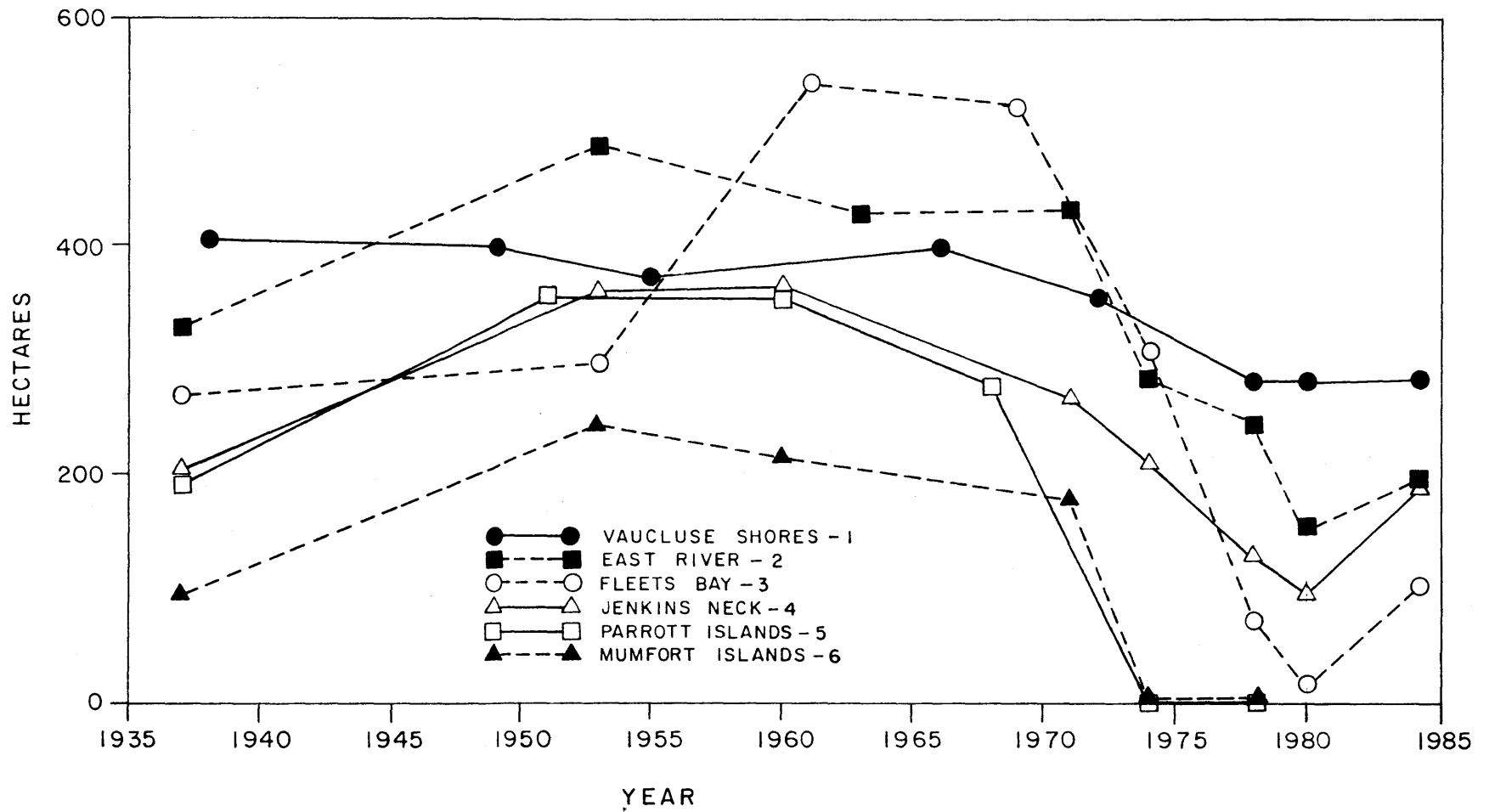
TABLE 14. (continued)

Jenkins Neck					
Date	<10%	Area m ²			Total
		10-40%	40-70%	70-100%	
1937	0	1,180,200	820,612	32,520	2,033,332
1953	426,480	647,112	717,180	1,811,832	3,602,604
1960	140,448	794,178	639,012	2,067,948	3,641,586
1971	0	278,586	2,350,380	33,792	2,662,758
1974	93,972	303,804	1,599,228	93,912	2,090,916
1978	132,714	299,760	671,616	162,408	1,266,498
1980	60,810	191,605	690,968	179,589	1,122,972
1981	0	0	763,194	309,012	1,072,206
1984	72,876	289,388	563,268	954,360	1,879,892

East River					
Date	<10%	Area m ²			Total
		10-40%	40-70%	70-100%	
1937	1,024,010	809,770	1,357,790	85,530	3,277,100
1953	591,840	1,158,490	1,394,740	1,742,050	4,887,120
1963	31,032	1,916,530	2,340,480	0	4,288,042
1971	0	2,007,460	2,253,080	96,620	4,357,160
1974	509,730	348,820	1,955,130	0	2,813,680
1978	47,860	515,000	1,864,850	0	2,427,710
1980	191,520	451,351	808,842	158,634	1,610,347
1981	0	96,174	1,183,542	198,474	1,478,190
1984	496,445	739,836	706,736	88,458	2,031,475

Vaucluse Shores					
Date	<10%	Area m ²			Total
		10-40%	40-70%	70-100%	
1938	0	1,120,284	1,451,392	1,480,128	4,051,804
1948	506,706	1,171,884	1,715,556	0	3,994,146
1955	1,938,258	0	528,996	1,238,124	3,705,378
1966	452,940	402,324	2,534,178	604,176	3,993,618
1972	286,554	364,764	2,515,740	391,770	3,558,828
1978	187,728	507,054	80,872	2,036,526	2,812,180
1980	359,551	7,098	697,842	1,783,938	2,848,429
1981	327,786	97,950	355,344	1,852,392	2,633,472
1984	0	15,792	1,137,882	1,731,678	2,885,352

Figure 16. Trends in areal coverage of SAV at six intensively mapped areas in the lower Chesapeake Bay, 1937-1984.



17. NEW POINT COMFORT REGION

Dense beds of SAV were found in this section in 1984 from New Point Comfort Lighthouse to just north of Horn Harbor (Tables 4-7). Two hundred ninety-nine hectares of SAV were mapped in 1984 compared to 271 hectares in 1978. Prominent features of this section are the distinct, unvegetated sand bars found parallel to the shoreline with SAV found in the troughs between successive bars.

Two transects were made in the area in 1978 for species distribution. Both eelgrass and widgeongrass were present, with widgeongrass in the shallower depths along the transect and eelgrass in the deeper zones.

18. MOBJACK BAY COMPLEX

This section contains one of the largest amounts of SAV in the lower Bay zone. In 1984, 1,550 hectares were mapped compared to 1785 hectares in 1978 (Tables 4-7). SAV beds, consisting of eelgrass and widgeongrass, are present along the shorelines of the entire Mobjack Bay and three of the four tributaries: Severn, Ware and North Rivers. Little SAV is present in the East River. One of the largest and densest beds found along the western shore of the lower bay is present around the Guinea Marshes in the New Point Comfort quadrangle.

Four transects on the Achilles quadrangle (Browns Bay and Ware Point) and two in the New Point Comfort quadrangle (mouth of East River) were made in 1978. Data from these transects also showed widgeongrass in the shallowest depths and eelgrass predominantly in the deeper locations with the two found together at intermediate depths.

SAV in the East River historical area (see Orth, et al., 1979, for a detailed description of this site) decreased from 1978 to 1984, but examination of data collected in 1980 and 1981 showed SAV increasing 37%

from 1981 to 1984 (Table 14, Fig. 16). Observation of this area has shown the increase also occurring from recruitment and growth of seedlings.

19. YORK RIVER

There were 238 hectares of SAV mapped in 1984 compared to 157 hectares in 1978, an increase of 52% (Tables 4-7). The major SAV beds, consisting of eelgrass and widgeongrass, in this section are present on the north side of lower York River in the Achilles quadrangle. There are no SAV beds above Gloucester Point in the Clay Bank quadrangle. One small bed present in the Yorktown quadrangle in 1984 near Gloucester Point was transplanted to this area in the fall of 1983 (Orth, unpublished data). Monitoring of the lower York River has shown these areas to be increasing as a result of seedling recruitment from adjacent, upstream beds, followed by rapid growth of these seedlings.

There was still no SAV present in the Mumfort Island historical area while SAV increased 48% from 1978 in the Jenkins Neck historical area (Table 14, Fig. 16) (see Orth, et al., 1979, for a detailed description of the sites). The increase is a result of seedling establishment and growth.

Two additional 0.25-hectare beds were transplanted near Gloucester Point in the Achilles quadrangle, one in the fall of 1982 and the second in the fall of 1983. The 1982 planting was done on 1.0 and 0.5 m centers using eelgrass. The bed has grown almost into one unit in less than three years. The 1983 eelgrass planting was conducted on 2 m centers and the units have not coalesced but are still present and growing very well. The 0.25-hectare plot in the Yorktown quadrangle was also planted on 2 m centers.

20. LOWER WESTERN SHORE

The SAV in this section, consisting of eelgrass and widgeongrass, was found in the Broad Bay area off Lynnhaven River, Back River, Drum Island

Flats between Back and Poquoson Flats, Poquoson River and on the south side of Goodwin Island. There were 1,149 hectares of SAV mapped in 1984 compared to 925 hectares in 1978 (Tables 4-7). The SAV beds in the Broad Bay area (37.87 hectares-Cape Henry quadrangle) were not mapped in 1978, although it is most likely they were present that year since subsequent surveys from 1980 through 1983 has shown the persistence of this vegetation. The distribution of vegetation in the Hampton and Poquoson West quadrangles remained similar while there was a 33% increase in SAV (516 to 687 hectares) in Poquoson East quadrangle. This increase occurred on the Drum Island Flats adjacent to existing beds of SAV that have persisted since the early 1970's. Most of the beds in this section have been classified as moderate (40 to 70%) or dense (70 to 100%) (Table 7).

21. JAMES RIVER

The small patches of SAV, consisting of eelgrass, in the Hampton Roads area present in 1978 had disappeared by 1980 and were still absent in 1984 (Tables 4-7). The remaining SAV beds identified in 1978 were located in the Norge quadrangle, and although this area was not photographed and mapped in 1984, an aerial reconnaissance survey of the area in late 1984 indicated that these beds were still present that appeared very similar to the 1978 distribution maps. We have assumed here that the 1984 total would be similar to the 1978 total. These beds occur as narrow fringing beds located along the edge of the marsh channels at water depths of less than 1 meter. The dominant species here are coontail, several Naiad species and common elodea (Orth, et al., 1979).

SECTION 5

SUMMARY AND CONCLUSIONS

The distribution of beds of submerged aquatic vegetation in the Chesapeake Bay and tributaries in 1984 was examined using both aerial photographic and ground surveys. Aerial photographs were used to map SAV bed outlines onto topographic quadrangles while ground surveys provided both photo verification of the SAV beds and species identification. To delineate SAV beds on a baywide basis, the distribution of SAV was divided into three major zones and 21 sections within the three zones. The areas mapped were displayed on 157 topographic quadrangles. The quadrangles include all areas with a potential for SAV growth in the bay region. The distribution data for 1984 were compared to data collected from a baywide survey conducted in 1978.

In 1984, SAV was found occupying 15,400 hectares of bottom. Of this total, 18.7% of the beds were classified as very sparse (<10% coverage), 18.6% as sparse (10-40%), 27.3% as moderate (40-70%) and 35.5% as dense (70-100%). In 1984, 20.6% of the SAV beds were located in the Upper Bay zone, 6.3% in the Middle Bay zone and 73.0% in the Lower Bay zone. The coverage of SAV in 1984 was less than the total found in 1978 (16,637 hectares). In the 1978 survey, 16.8% of the vegetation was found in the Upper Bay zone, 26.7% in the Middle Bay zone and 56.5% in the Lower Bay zone. Increases in SAV coverage from 1978 to 1984 were measured in 8 of the 21 sections: Susquehanna Flats, Upper Eastern Shore, Upper Potomac River, Tangier Island Complex, Lower Eastern Shore, New Point Comfort Region, York River and Lower Western Shore. Decreases were measured in 13 of the 21 sections: Upper Western Shore, Chester River, Central Western Shore, Eastern Bay, Choptank River, Patuxent River, Middle Western Shore, Lower Potomac River, Middle

Eastern Shore, Reedville, Rappahannock River Complex, Mobjack Bay Complex and James River.

In the Upper Bay zone, although there was an increase noted, all of this occurred on the Susquehanna Flats where 95% of the area was classified as very sparse (<10% coverage). Independent aerial and ground surveys of this area in 1982 and 1984, respectively, indicate that there has been an expansion of SAV in this section since 1978 but that the vegetation is very patchy and not readily apparent on higher altitude photography. Most of the SAV observed on the Susquehanna Flats was Myriophyllum spicatum (milfoil) with Vallisneria americana (wild celery) occurring in lesser abundance. A total of only 2 species were noted in the ground surveys in 1984, in contrast to the 15 species found here in the late 1950's (Bayley, et al., 1978; Orth and Moore, 1984). Reductions of SAV were recorded in the Upper Eastern Shore and Upper Western Shore sections. Although, there was some loss of the aerial imagery from these two sections, the Md.DNR ground survey showed reductions of SAV in these areas.

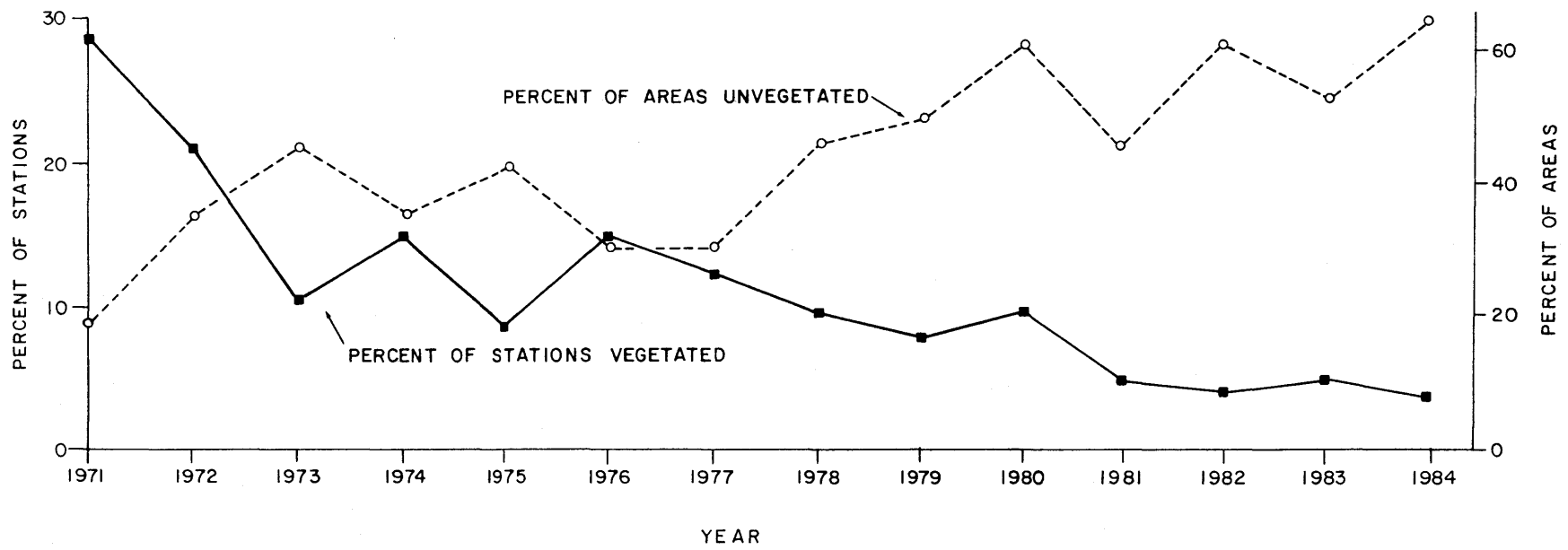
SAV in the Middle Bay zone was reduced from 1978 to 1984: 4,446 to 984 hectares, respectively. Seven of the eight sections showed a decline of SAV. In one of these sections, Lower Potomac River, aerial photography obtained late in the season may have resulted in an underestimation of SAV abundance. Ground surveys by USGS and NVCC personnel documented SAV presence at a number of stations in areas that did not show SAV in the aerial photography. Given the survey information for 1984, and what was observed for the entire Potomac River in 1984, the actual abundance of SAV in the Lower Potomac River was at least equal to that recorded in 1978. The Upper Potomac River section was the only area of the river to show a significant increase. No aerial photography of the Upper Potomac was

obtained in 1978 and ground surveys found no SAV through 1981. From 1981 to 1984, 631 hectares of river bottom became vegetated with SAV. This increase includes not only many native species but also significant populations of two species not recorded in earlier surveys of the river: Hydrilla verticillata (Hydrilla) and Heteranthera dubia (water stargrass). Since Hydrilla has become a problem species in other areas of the U.S., there is concern over its increase to nuisance levels in certain sections of the Potomac. The river should be carefully monitored in succeeding years to follow the growth of Hydrilla as well as other native species.

The Lower Bay zone showed an increase of 1778 hectares since 1978 (19%) with most of the increase (82%) occurring in the Tangier Island Complex. Increases in SAV beds in the York River have been observed to occur from seed recruitment from nearby vegetated areas. This increase was also noted in 3 of the 6 historical sites in this zone: Jenkins Neck, East River and Fleets Bay. As in 1978, no SAV was observed at two sites (Mumfort Island and Parrott Island). The sixth site, Vaucluse Shores, has remained relatively stable since 1978.

In summary, although the total amount of SAV in the bay in 1984 is somewhat less than that found in 1978, both increases and decreases have been observed in particular sections. Most of the decrease has occurred in the region from just below the Susquehanna Flats to Smith Island. This decrease in vegetation during the last 6 years has also been noted by the Md.DNR vegetation survey (Table 8, Fig. 17). The number of sampled stations with SAV has continued to decrease from earlier years. In 1984, only 4.0% of the stations were vegetated compared to 9.5% in 1978. Seventeen of 26 areas were without any SAV compared to 12 in 1978. However, certain procedures used in the Maryland DNR survey, such as stations located in

Figure 17. Trends in occurrence of SAV in the Maryland portion of the Chesapeake Bay, 1971-1984. Values represent the percentage of stations with vegetation (N = 644) and the percentage of unvegetated areas (N = 26).



waters too deep to support SAV growth, may be resulting in a skewed or an unrealistically low impression of total SAV presence.

Increases in SAV have been noted in the Upper Potomac River, Susquehanna Flats and at a number of locations in the Lower Bay zone. The increase of SAV in the upper Potomac River may be related to nutrient changes in this part of the river, primarily from a reduction in phosphate loading and suspended solids from the Blue Plains sewage treatment plant and the initiation of nitrification in 1983. The causes for the increase in SAV in several sections and decreases in others is not known, but annual monitoring of SAV populations along with the monitoring of nutrient and light parameters at these areas is essential for generating any significant correlative data. In addition, the success of various transplant efforts by both states should be examined carefully with regard to the nutrient and light regimes found in those river systems where the transplanting is being conducted. These data will be critical in understanding the success at these sites.

SECTION 6

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APPENDIX A

SPECIES OF SUBMERGED AQUATIC PLANTS FOUND IN THE CHESAPEAKE BAY AND
TRIBUTARIES (MODIFIED FROM CARTER, ET AL., 1985)

Family	Species	Common name
Characeae (muskgrass)	<u>Chara braunii</u> Gm. <u>Chara zeylanica</u> Km. ex Wild <u>Nitella flexilis</u> (L). Ag.	Muskgrass
Najadaceae (pondweed)	<u>Potamogeton perfoliatus</u> L. <u>Potamogeton pectinatus</u> L. <u>Potamogeton crispus</u> L <u>Potamogeton pusillus</u> L. <u>Ruppia maritima</u> L. <u>Zannichellia palustris</u> L. <u>Najas quadalupensis</u> (Spreng.) Morong <u>Najas gracillima</u> Magnus <u>Najas minor</u> All	Redhead-grass Sago pondweed Curly pondweed Slender pondweed Widgeongrass Horned pondweed Southern naiad Naiad
Hydrocharitaceae (frogbit)	<u>Vallisneria americana</u> Michx. <u>Eloдея canadensis</u> (Michx.) Planch. <u>Egeria densa</u> Planch. <u>Hydrilla verticillata</u> (L.f.) Caspary	Wildcelery Common elodea Water-weed Hydrilla
Ceratophyllaceae (coontail)	<u>Ceratophyllum demersum</u> L.	Coontail
Haloragidaceae (watermilfoil)	<u>Myriophyllum spicatum</u> L.	Eurasian watermilfoil
Ponedariaceae (pickerelweed)	<u>Heteranthera dubia</u> (Jacqin) MacM.	Water-stargrass
Potamogetonaceae	<u>Zostera marina</u> (L.)	eelgrass

APPENDIX B

TOPOGRAPHIC QUADRANGLES SHOWING THE DISTRIBUTION AND ABUNDANCE OF SAV (1 = <10%; 2 = 10-40%; 3 = 40-70%; 4 = 70-100%)

SUBMERGED AQUATIC VEGETATION 1984



Mapped, edited, and published by the Geological Survey
Control by USGS and USCGS
Contours and drainage is part compiled from aerial photographs
taken 1962. Topography integrated from 1:62,500 scale map of
Havre de Grace quadrangle, 15-minute series. Original map by
plane table survey, 1939-1940. Revised 1963
Photographs from USGS chart 572 dated 1967
Projection: projection - 1927 North American datum
10,000-foot grid based on Maryland coordinate system
Not for nautical use in which only
landmark buildings are shown
1000-meter Universal Transverse Mercator grid ticks
zone 18 shown in blue



SCALE 1:24,000

CONTOUR INTERVAL: 30 FEET
NATIONAL GEODETIC SURVEY, DEPARTMENT OF COMMERCE
DEPTH CURVES AND SOUNDINGS IN FEET - 2000 to 10000
VERTICAL DATUM: MEAN SEA LEVEL, 1929
HORIZONTAL DATUM: NORTH AMERICAN DATUM, 1927

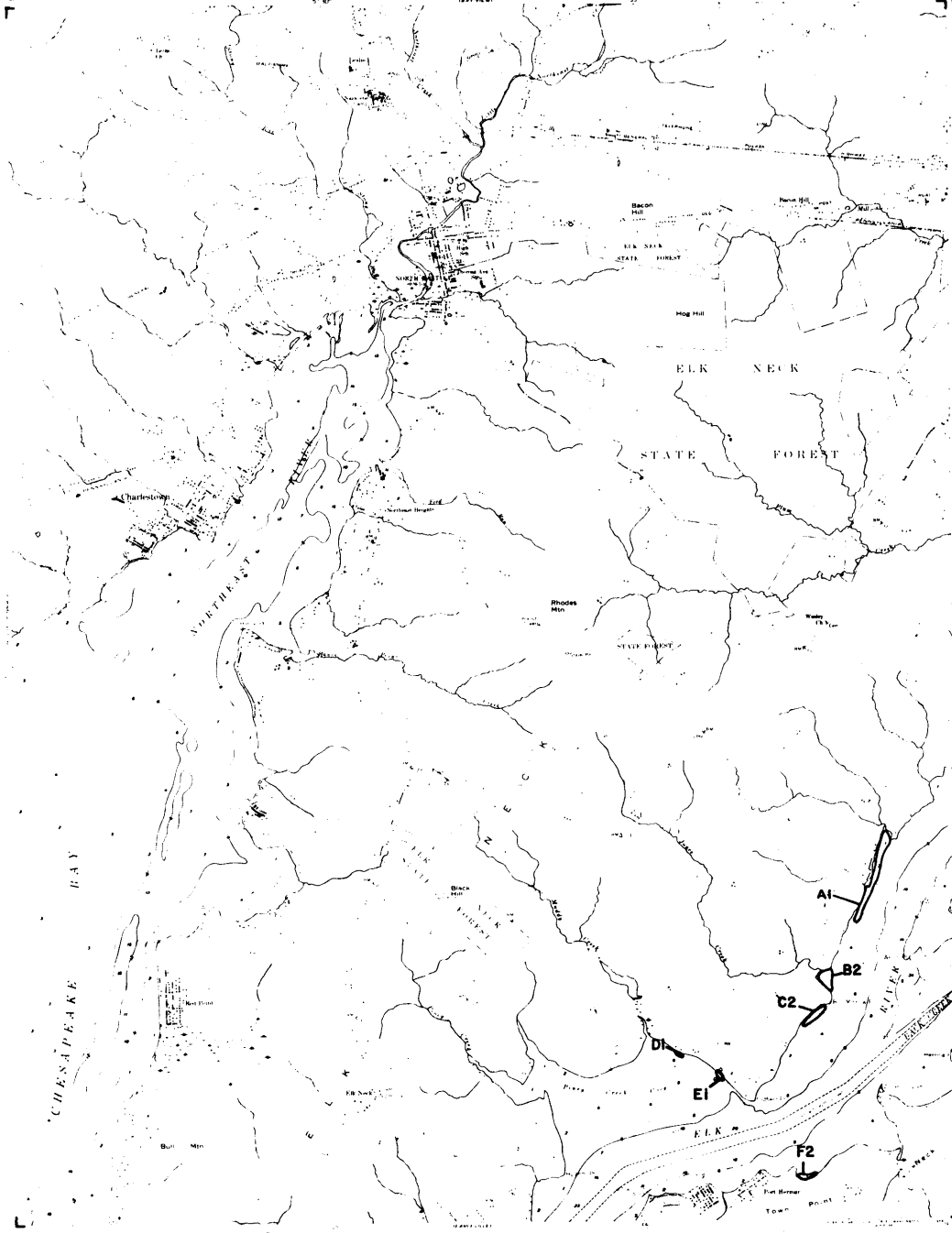
THIS MAP COMPLETES THE NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092
A POLAR PROJECTION TOPOGRAPHIC MAP IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION
Primary highway all weather Light duty road, all weather
hard surface Improved surface
Secondary highway all weather Unimproved road, low or no
hard surface
Interstate Route U.S. Route State Route

HAVRE DE GRACE, MD
H 9300-1-7500/7.5

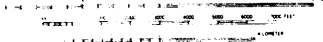
PHOTOGRAPHED 1964 AND 1975
DATE 1984 U.S. G.S. 1984

SUBMERGED AQUATIC VEGETATION 1984



Mapped, edited, and published by the Geological Survey
Control by USGS and USCGS
Culture and drainage in part compiled from aerial photographs
taken 1962. Topography enlarged from 1:62,500 scale map of
Elk Neck quadrangle, 15 minute series. Original map by
Hovey Lake survey, 1939, 1940. Revised 1953.
Hydrographic from USCGS chart 512 dated 1967.
Projections: projection 1927 North American datum
10,000 foot grid based on Maryland coordinate system

SCALE 1:24,000



ROAD CLASSIFICATION

Heavy-duty	Light-duty
Major-duty	Unimproved det.
U.S. Road	State Road

C 8143
NORTH-EAST QUADRANGLE
PWA LISTED IF AVAILABLE
16300-16700 5/73
1988

SUBMERGED AQUATIC VEGETATION 1984*



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS

EDGEWOOD QUADRANGLE
MARYLAND
7.5 MINUTE SERIES
THE UNIVERSITY OF CHICAGO
1963-68 (REV.)

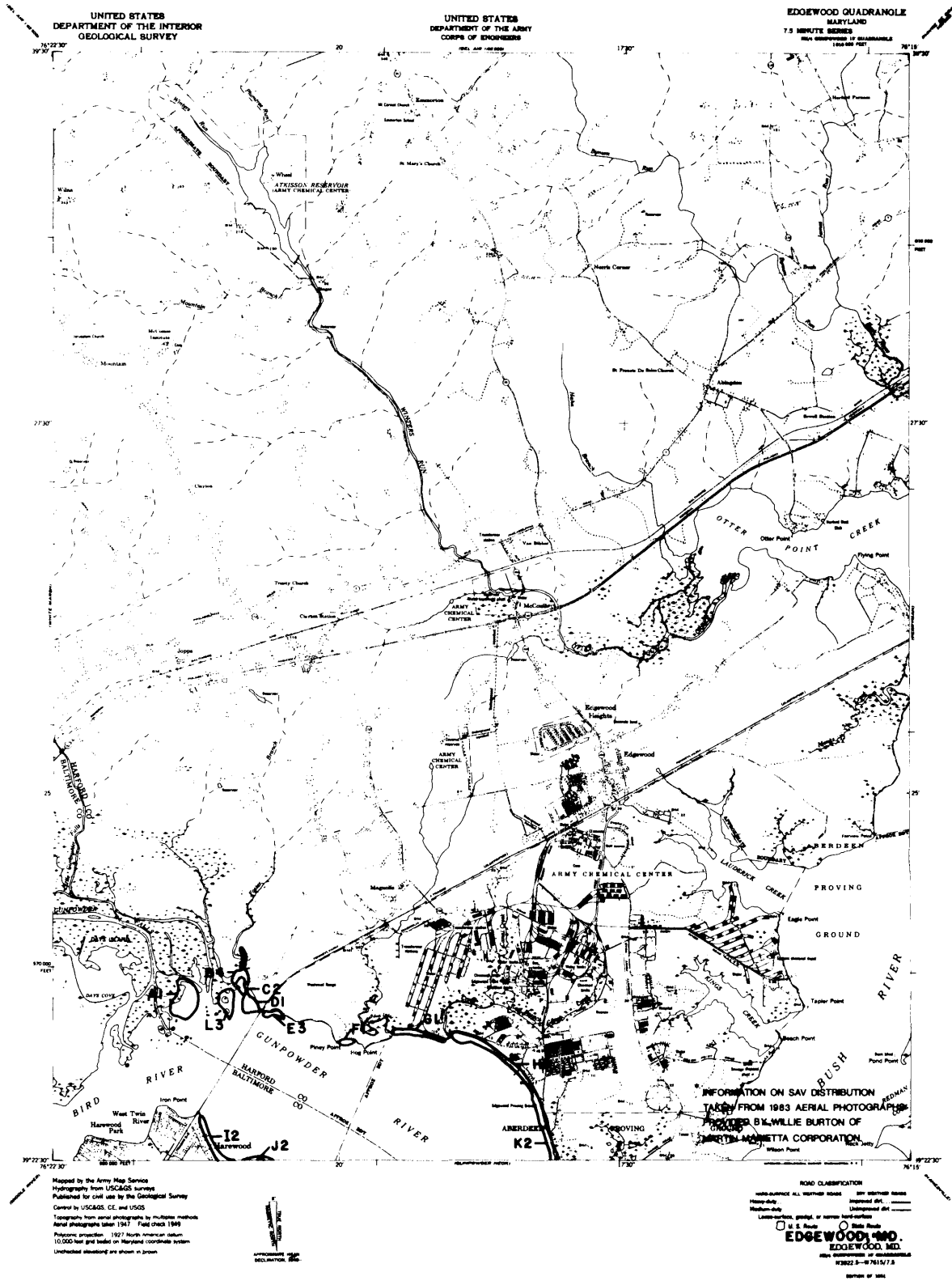
Mapped by the Army Map Service
Hydrography from USCGS surveys
Published for civil use by the Geological Survey
Control by USGAS, CE, and USGS
Topography from aerial photography by multiple methods
Aerial photography taken 1947. Field check 1949
Reference projection: 1887 North American datum
10,000-foot grid based on Maryland coordinate system
Unchecked soundings are shown in green

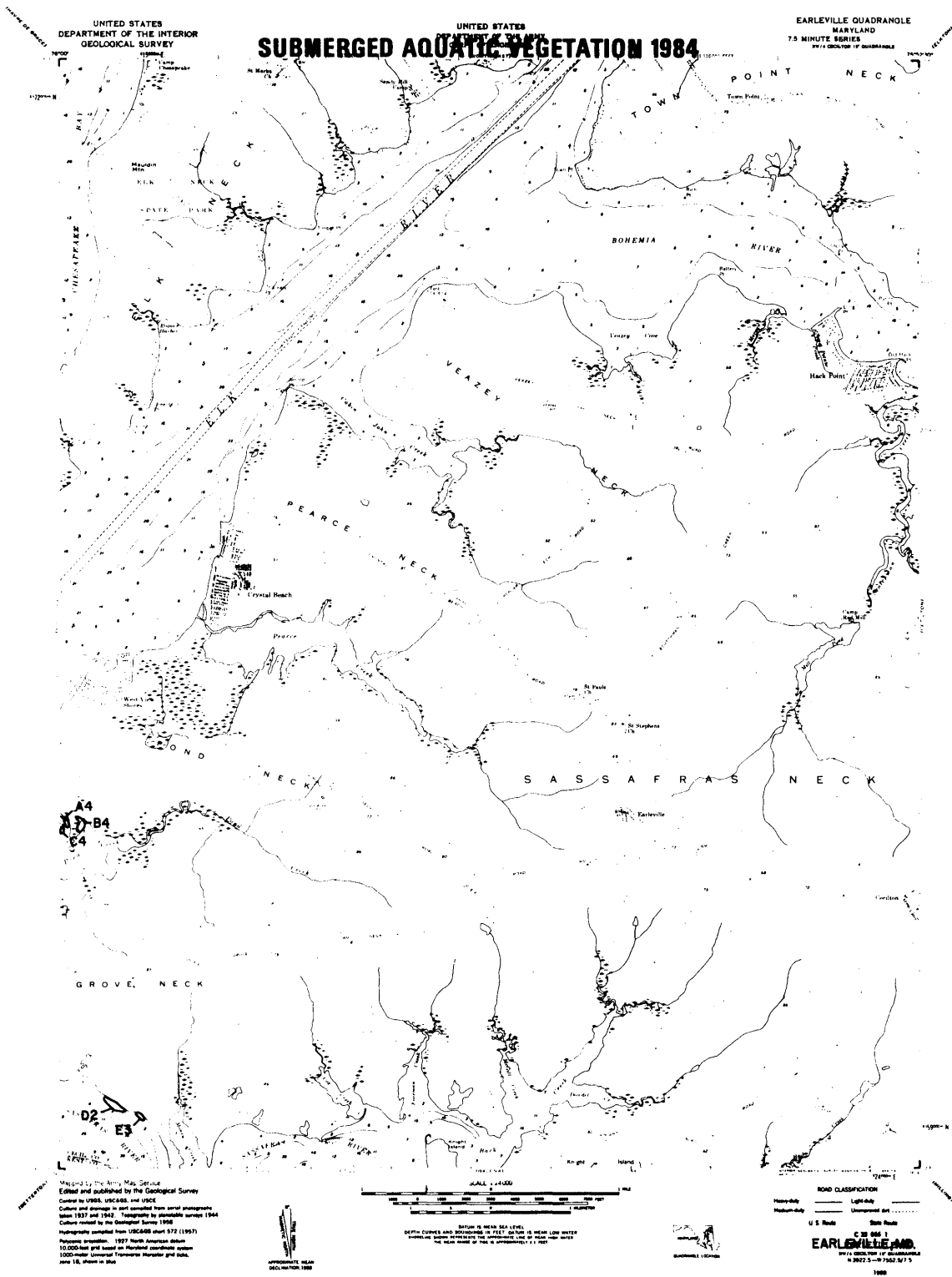


INFORMATION ON SAV DISTRIBUTION
TAKEN FROM 1983 AERIAL PHOTOGRAPHS
OBTAINED BY WILLIE BURTON OF
THE MARYLAND BUREAU OF MARSHLANDS
AND WETLANDS

ROAD CLASSIFICATION
 Unimproved, all-weather road
 Improved dirt
 Improved bit
 U.S. Road
 State Road
EDGEWOOD 800
 EDGEWOOD, MD.
 THE UNIVERSITY OF CHICAGO
 72822 5-87/11/7.5
 DATE OF 1984

SUBMERGED AQUATIC VEGETATION 1984*



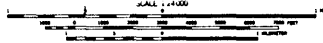


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES
GEOLOGICAL SURVEY
SUBMERGED AQUATIC VEGETATION 1984

EARLEVILLE QUADRANGLE
MARYLAND
7.5 MINUTE SERIES
BY 15 MINUTE QUADRANGLES

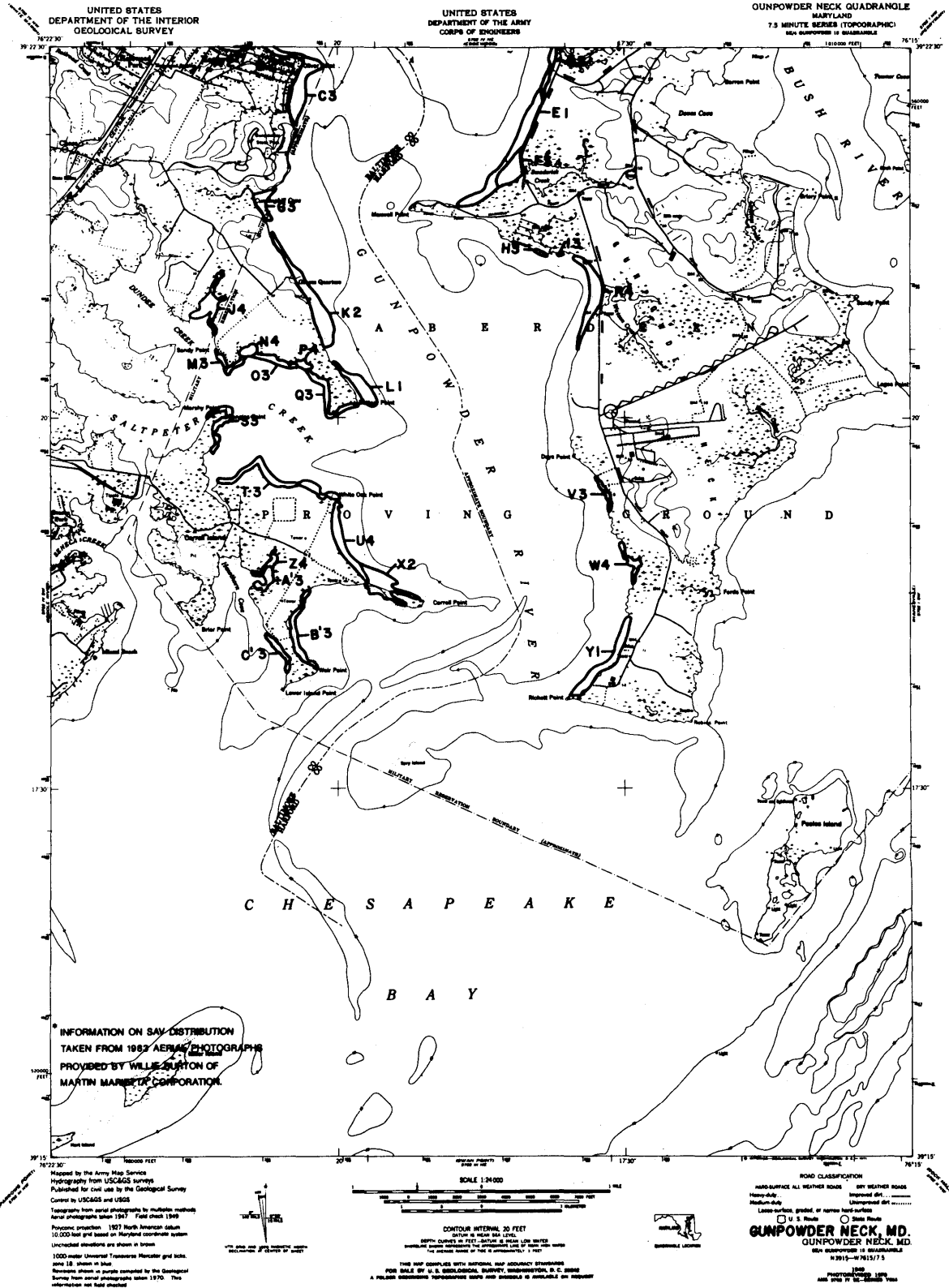
Prepared by the Army Map Service
Edited and published by the Geological Survey
Controlled by USGS, USCGAS, and USACE
Culture and drainage in part compiled from aerial photographs
taken 1937 and 1942. Topography by available surveys 1944
Controlled by the Geological Survey 1968
Hydrography compiled from USCGAS chart 572 (1957)
Datum projection: 1927 North American datum
1:50,000 feet and based on North American datum
1000-meter Universal Transverse Mercator grid scale,
June 18, 1983 as shown



DEPTH CURVES AND SOUNDINGS IN FEET, DATUM IS MEAN LOW WATER
SOUNDINGS SHOWN OTHERWISE BY THE SURVEYOR AND BY MEAN LOW WATER
THE MEAN LOW WATER IS THE MEAN LOW WATER

ROAD CLASSIFICATION
Heavy-duty Light-duty
Medium-duty Unimproved dirt
U.S. Route State Route
C 38 861
EARLEVILLE, MD.
BY 15 MINUTE QUADRANGLES
1:50,000 FEET SCALE
NAD 83 UTM PROJECTION

SUBMERGED AQUATIC VEGETATION 1984*

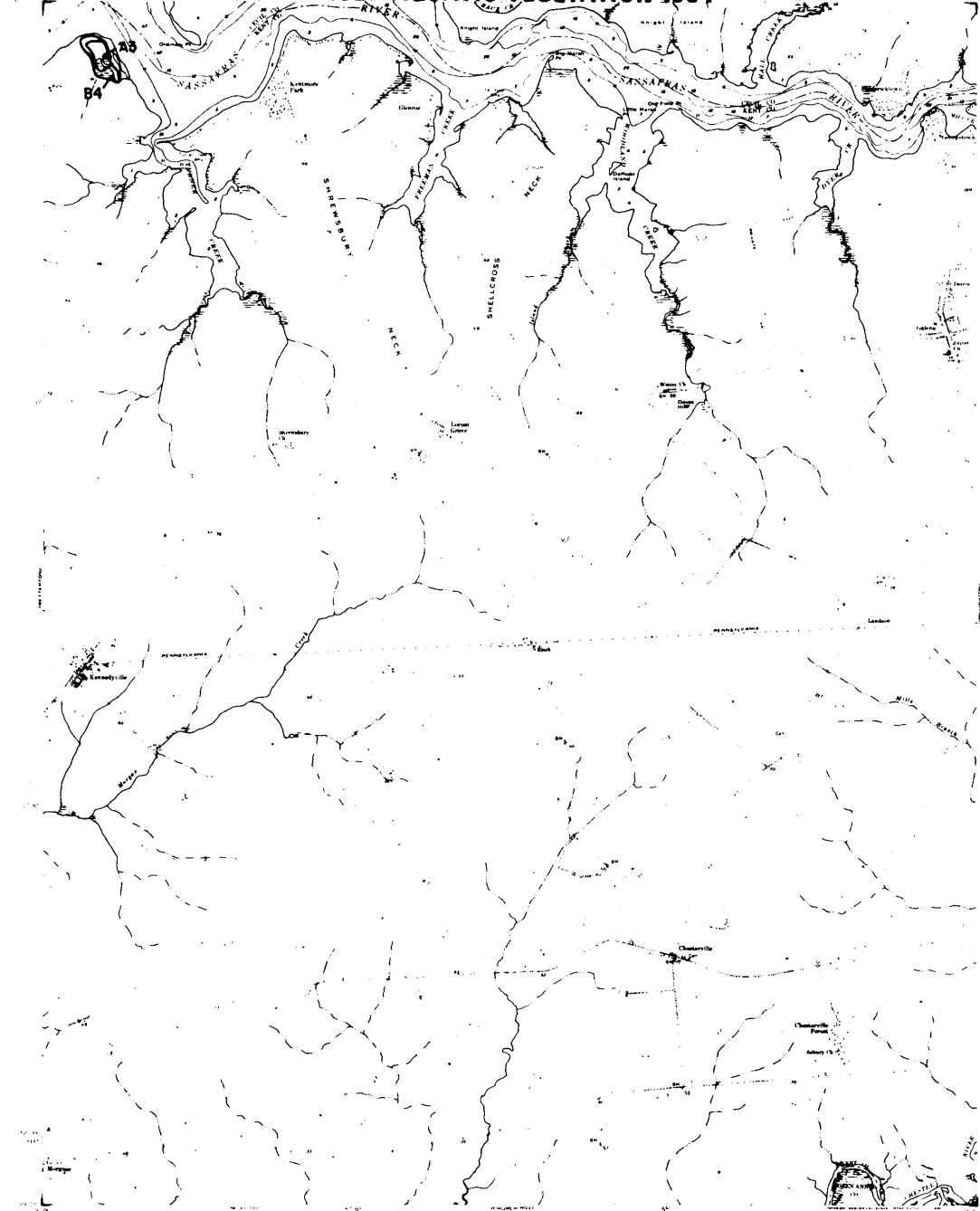


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES
DEPARTMENT OF THE ARMY

GALENA QUADRANGLE
MARYLAND
7.5 MINUTE SERIES
SHEET C-10701-19 QUADRANGLE

SUBMERGED AQUATIC VEGETATION 1984



Mapped by the Army Map Service
Edited and published by the Geological Survey
Control by USGS and USCAGS
Culture and drainage in part compiled from aerial photographs
taken 1927 and 1947. Topography by stereo-plot survey.
Culture revised by the Geological Survey, 1953.
Hydrography from USCAGS sheet 172, dated 1941.
Polygonic projection. 1927 North American datum.
10,000-foot grid based on Maryland coordinate system.



DEPTH CURVES AND SOUNDINGS IN FEET; DATUM IS MEAN LOW WATER
SOUNDING INDICES PRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE HIGH WATER IS 1.8 FT.



ROAD CLASSIFICATION
Heavy-duty _____ Light-duty _____
Medium-duty _____ Unimproved dirt _____

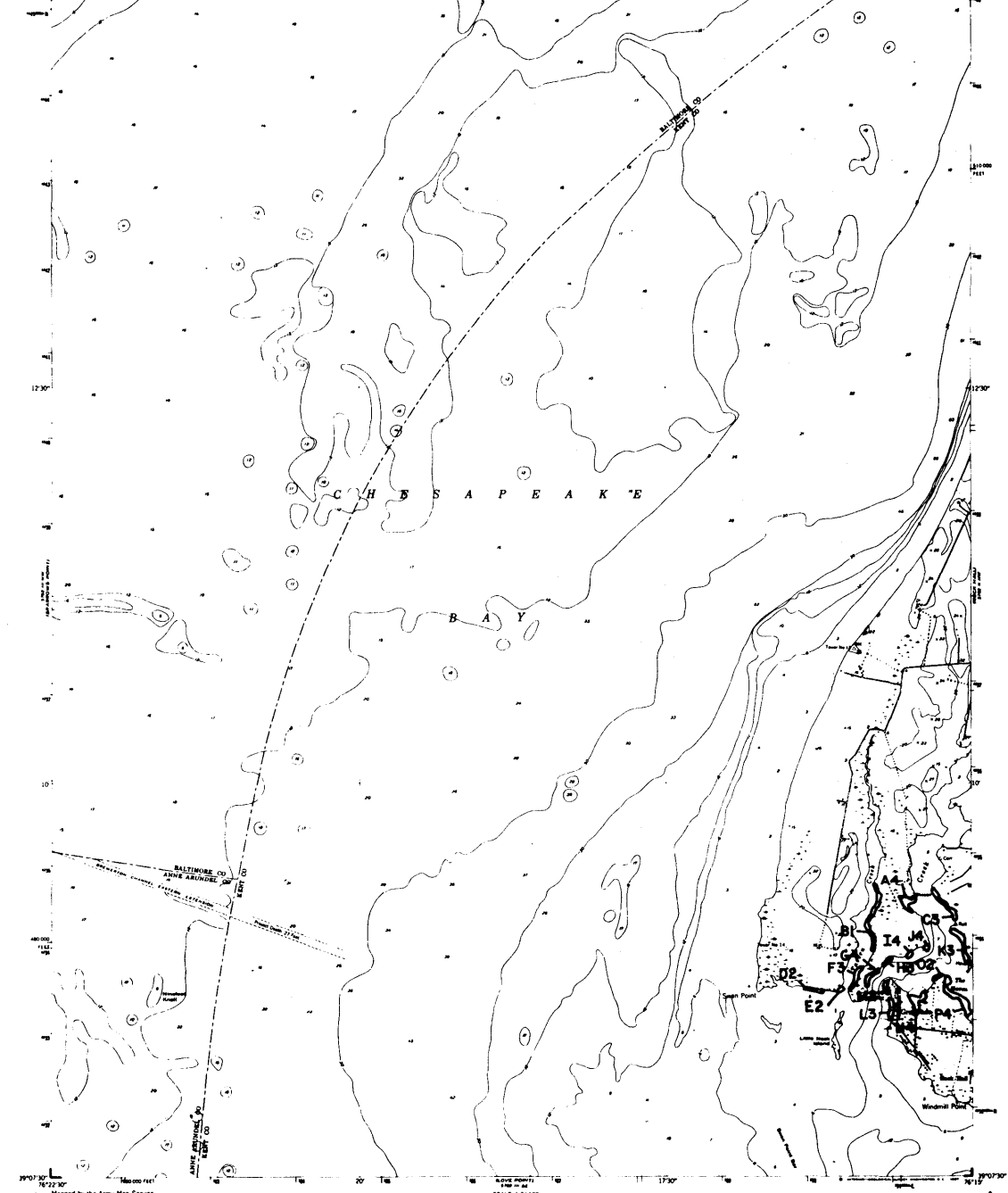
U.S. Route _____ State Route _____

GALENA QUADRANGLE
SHEET C-10701-19 QUADRANGLE
1984

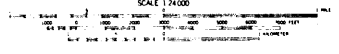
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES
SUBMERGED AQUEOUS VEGETATION 1984

SWAN POINT QUADRANGLE
MARYLAND
7.5 MINUTE SERIES (TOPOGRAPHIC)
NEAR NORTH PART OF QUADRANGLE



Mapped by the Army Map Service
Edited and published by the Geological Survey
Control by USCGS
Contours and drainage on part compiled from aerial photographs
Topography by direct survey
Culture revised by the Geological Survey, 1953
Hydrography from USCGS chart 549 dated 1944
Photometric projection, 1927 North American datum
10,000-foot grid based on Maryland coordinate system
1000-meter Universal Transverse Mercator grid ticks
zone 18 shown in blue



SCALE 1:24,000
CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET; DATUM IS MEAN LOW WATER
HEIGHTS FROM MEAN SEA LEVEL UNLESS OTHERWISE NOTED

ROAD CLASSIFICATION
Highway Light Only
Medium-duty Unimproved dirt
U.S. Route State Route

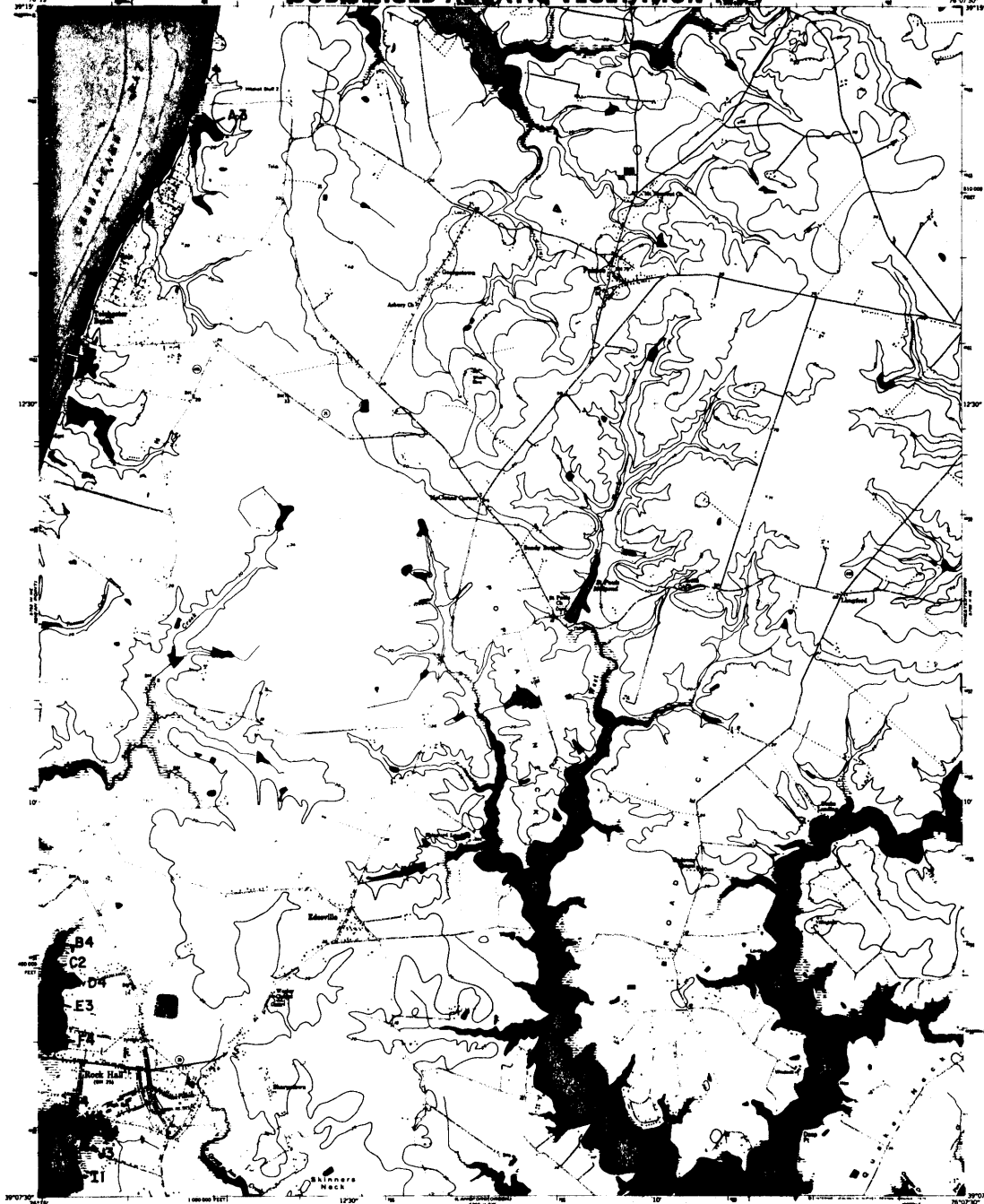
SWAN POINT, MD.
NEAR NORTH PART OF QUADRANGLE
N 2007 S-7615/75

THIS MAP COMPLETES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20508
A FOLDER BEARING THE SAME TITLE AND SYMBOLS IS AVAILABLE ON REQUEST

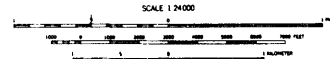
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES
DEPARTMENT OF THE INTERIOR
SUBMERGED AQUATIC VEGETATION 1984

ROCK HALL QUADRANGLE
MARYLAND—FREET CO.
7.5-MINUTE SERIES (TOPOGRAPHIC)
WITH CONTINUITY OF SHADINGS



Mapped by the Army Map Service
Edited and published by the Geological Survey
Control by USGS, USCGA, and USMC
Culture and drainage in part compiled from aerial
photographs. Topography by stereo-tilde survey
Culture revised by the Geological Survey 1983
Hydrography from USCGS charts 148 and 548,
dated 1984
Polygonal projection. 1927 North American datum
10,000-foot grid based on Hawaiian coordinate system
1000-meter Universal Transverse Mercator grid cells
and 18 inches in size
Revisions shown in purple completed by the Geological Survey from
aerial photographs taken 1973. This information not field checked



SCALE 1:24,000
CONTOUR INTERVAL, 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
SOUNDINGS IN METERS—DATUM IS MEAN LOW WATER
THIS MAP COMPILED WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, RESTON, VIRGINIA, 20192
A POLAR PROJECTION TOPOGRAPHIC MAP AND SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION
Heavy-duty Light-duty
Medium-duty Unimproved dirt
U.S. Route State Route

ROCK HALL, MD.
WITH CONTINUITY OF SHADINGS
7500 5-W 7607.5/7.5
PHOTOGRAPHED 1979
AND 5-W 7607.5/7.5

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

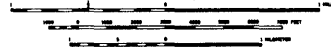
UNITED STATES
DEPARTMENT OF THE ARMY
ENGINEER REGIMENT

GIBSON ISLAND QUADRANGLE
MARYLAND—ANNE ARUNDEL CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
874 NORTH POINT OF BALTIMORE

SUBMERGED AQUATIC VEGETATION 1984



Supplied by the Army Map Service
Edited and published by the Geological Survey
Control by USCGAS
Culture and drainage to port extracted from aerial photographs
taken 1962. Topographic information revised 1962
Culture revised by the Geological Survey 1964
Hydrography from USCGAS chart 849 dated 1944 and
chart 545 dated 1948
Photographic projection 1987 North American datum
11,000-foot grid based on Maryland coordinate system
1,000-meter Universal Transverse Mercator grid zone
18N, shown in blue
Boundary shown in purple compared by the Geological
Survey from aerial photographs taken 1970. This
information not field checked



CONTOUR INTERVAL, 20 FEET
ELEVATION IN FEET AND METERS
DEPTH SOUNDINGS AND SOUNDINGS TO FIRST SOUNDING IN FEET AND METERS
INDICATED SOUNDINGS REPRESENT THE DEPTHS OF WATER AT LOW TIDE
THE SHORE LINE OF THIS ISLAND IS



ROAD CLASSIFICATION
Heavy-duty Light-duty
Medium-duty Unimproved dirt
U.S. Route State Route

GIBSON ISLAND, MD.
7.5 MINUTE SERIES (TOPOGRAPHIC)
874 NORTH POINT OF BALTIMORE
1984
PHOTOGRAPHED 1970
AND OVER BY SP-1 SERIES VESSEL

UNITED STATES
DEPARTMENT OF THE ARMY
SUBMERGED AQUATIC VEGETATION 1984



Maped by the Army Map Service
Published for civil use by the Geological Survey
Control by USCGS
Topograp from aerial photographs by photogrammetric methods
and by conventional survey (1962). Aerial photographs taken (1962)
Projection: projection, 1917, North American datum
1:100,000 feet to a base of Maryland or State system
1:100,000 feet to a base of Maryland or State system
1:100,000 feet to a base of Maryland or State system
1:100,000 feet to a base of Maryland or State system

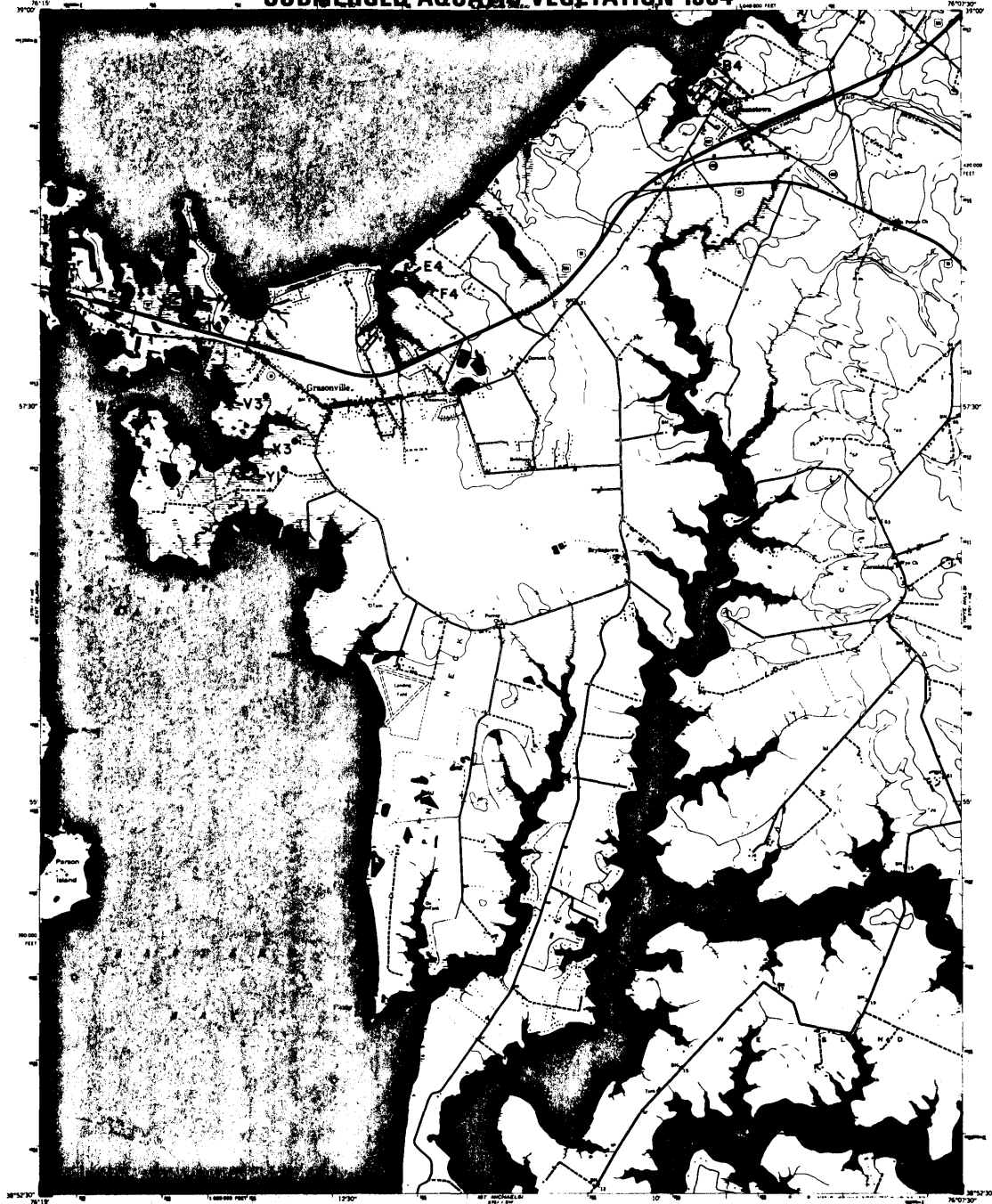
SCALE 1:24,000
CONTINUOUS INTERVAL, 20 FEET
NATIONAL GEODETIC SURVEY, BUREAU OF 1929
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20508
A POLAR DECLINATION, LONGITUDE, DATE AND SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION
Heavy duty Light duty
Medium duty Unimproved dirt
U.S. Route State Route
KENT ISLAND, MD.
1984
PHOTOGRAPHED 1973
AND 1971 BY THE SERVICE TEAM

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SUBMERGED AQUATIC VEGETATION 1984

QUEENSTOWN QUADRANGLE
MARYLAND
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped by the Army Map Service
Published for civil use by the Geological Survey
Controlled by USGCS
Topography from aerial photographs by photogrammetric methods
and by stroboscopic surveys 1942. Aerial photographs taken 1942
Photographic projection: 1927 High-Altitude datum
10,000-foot grid based on Maryland coordinate system
1000-meter Universal Transverse Mercator grid ticks,
zone 18, shown in blue
Boundaries shown in purple transferred by the Geological Survey from
aerial photographs taken 1973. This information not held checked

SCALE 1:24,000
CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1985
VERTICAL DATUM RELAYED TO THE DATUM OF 1985 BY THE
FEDERAL BUREAU OF SURVEY

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 20192
A POLAR PROJECTION TOPOGRAPHIC MAP AND TRIMBLE IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION
Major Road
Minor Road
U.S. Route
State Route

QUEENSTOWN, MARYLAND, M.D.
H. 8862 S-47627.5/7.5
1982
PHOTOREPRODUCED 1973
AND 874.1 (REV. 6-1982) 1984

SUBMERGED AQUATIC VEGETATION 1984

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ALEXANDRIA QUADRANGLE
VIRGINIA-DISTRICT OF COLUMBIA-MARYLAND
7.5 MINUTE SERIES (TOPOGRAPHIC)



Map prepared and published by the Geological Survey
Control by USGS, USACE, USMC, and USNSC
Topography by photogrammetric methods from aerial photographs
Issue 1955. Form checked 1956. Revised 1963.
Selected hydrographic data compiled from USACE's Chart 140 (1964).
This information is not intended for navigational purposes.
Publication projection: 1927 North American datum.
1:25,000 feet at sea level on Virginia coordinate system, north zone
and Maryland coordinate system.
1:25,000 meter interval. Vertical datum: Mean Sea Level, zone 18.
Sheet in series.
This map is the published North American Datum 1983
from the projection zone. It means south and
25 meters will be shown by shaded contour lines.
Red dot indicates areas in which only benchmark buildings are shown.

Vertical datum: Mean Sea Level, zone 18.
Horizontal datum: North American Datum 1983.
Scale: 1:25,000.
Vertical datum: Mean Sea Level, zone 18.
Horizontal datum: North American Datum 1983.
Scale: 1:25,000.

NATIONAL GEODETIC SURVEY OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET. DATUM IS MEAN SEA LEVEL
OF BOSTON HARBOUR AT MEAN LOW WATER. (NAD 83).
VERTICAL DATUM: MEAN SEA LEVEL, ZONE 18.
HORIZONTAL DATUM: NORTH AMERICAN DATUM 1983.
THIS MAP CONFORMS WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY. BEST COPY AVAILABLE 2009.
AND VIRGINIA DIVISION OF GENERAL RESOURCES. CHARLottesville, VIRGINIA 22903.
A FOLDER OF RELATED TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST.

Boundaries shown in purple. Contours in cooperation with State of
Virginia agencies from aerial photographs taken 1978 and other
source data. This information not for navigation. Map dated 1978.
Boundaries shown in purple. Contours in cooperation with State of
Virginia agencies from aerial photographs taken 1978 and other
information available from the controlling authority.
Please see individual description of other areas.

ALEXANDRIA, VA - D.C. - MD.
4,2645 - 4700 7.5
PHOTODUPLICATED 1978
DATA 1981 BY SCRS 1978

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SUBMERGED AQUATIC VEGETATION 1984

CLAIBORNE QUADRANGLE
MARYLAND
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped by the Army Map Service
Published for civil use by the Geological Survey
Control by USGAS
Topography from aerial photographs by photogrammetric methods
and by plane-table surveys 1942 and photographs taken 1942
Reference elevation - 1929 Mean American Datum
10,000-foot grid based on Maryland coordinate system
1000-meter Universal Transverse Mercator grid 48x,
June 18, shown in blue
Boundary shown in outline compared by the Geological Survey from
aerial photographs taken 1974. This information was hand checked.

1:24,000
1:12,000
1:6,000
1:3,000
1:1,500
1:750
1:375

SCALE 1:24,000
MAXIMUM ELEVATION 20 FEET
NATIONAL GEODESIC SURVEY DATUM OF 1929
DASHED LINE BOUNDARY REPRESENTS THE APPROXIMATE LINE OF 2000 FEET WATER
LEVEL BASED ON THE 1929 DATUM

ROAD CLASSIFICATION
Heavy duty
Medium duty
Light duty
Unimproved dirt
Saw Road

CLAIBORNE, MD

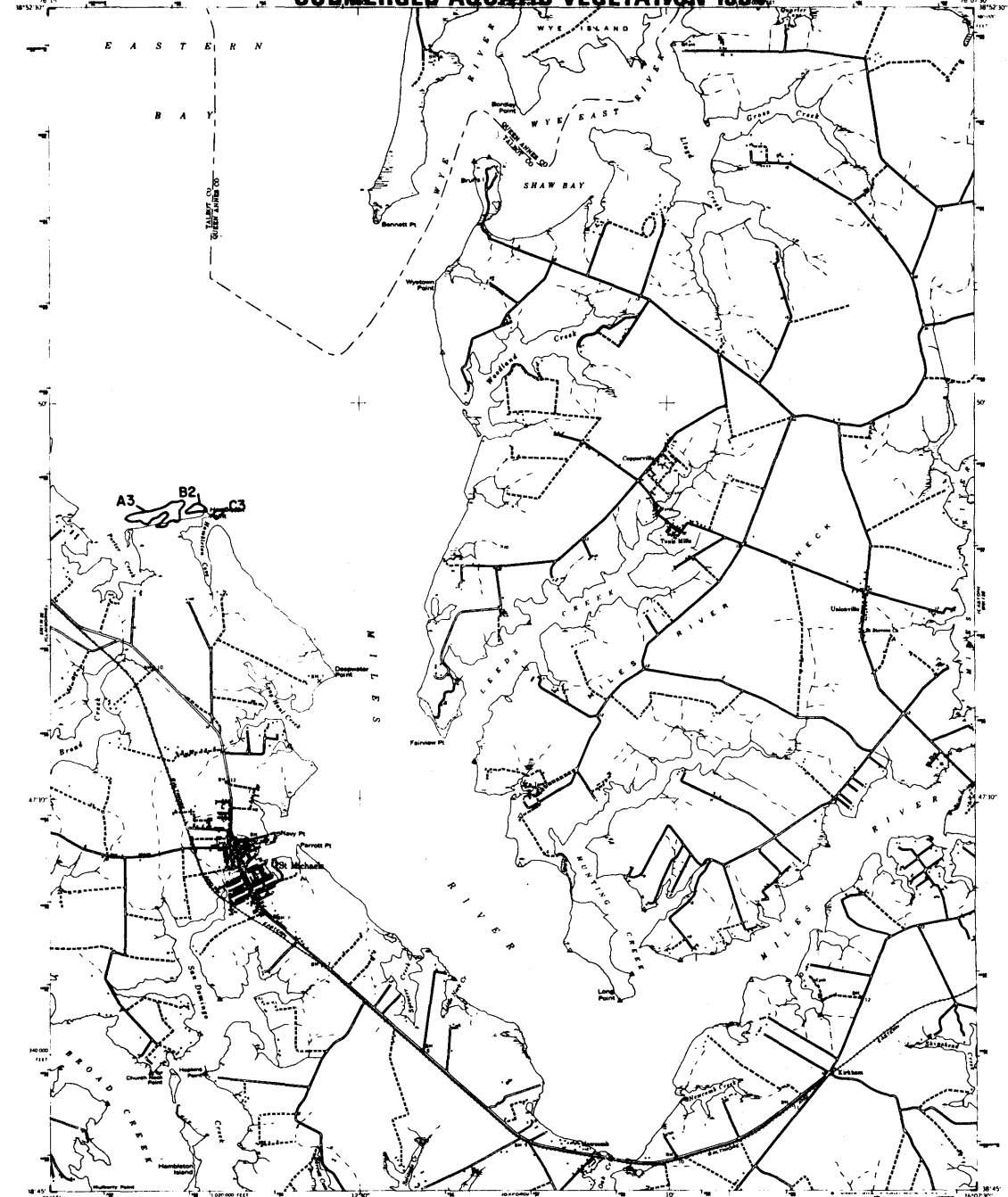
N 3845-W 7615/7.5
1982
PHOTOGRAPHED 1974
AMS 574 (14) 54-SERIES 7481

THIS MAP COMPLES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY WASHINGTON, D.C. 20509
A FOLDER INCLUDING PHOTOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ST. MICHAELS QUADRANGLE
MARYLAND
7.5 MINUTE SERIES (TOPOGRAPHIC)

SUBMERGED AQUATIC VEGETATION 1984



Mapped by the Army Map Service
Published for civil use by the Geological Survey
Control by USCGS
Topography from aerial photographs by photogrammetric methods
and by stroboscopic survey 1942 Aerial photographs taken 1942
Photocopy projection 1927 North American datum
1:250,000-foot grid based on Maryland coordinate system
1000-meter Universal Transverse Mercator grid ticks
every 10 shown in blue

SCALE 1:24,000
MAXIMUM ELEVATION 18 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
SHOWING HEIGHTS IN FEET AND APPROXIMATELY IN METERS
THE SEA LEVEL OF THIS IS INDICATED BY 0 FEET
THIS MAP COMPLEYS WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 20192
A PULVER RESERVE PHOTOGRAPHIC SALES AND SERVICE IS AVAILABLE ON REQUEST

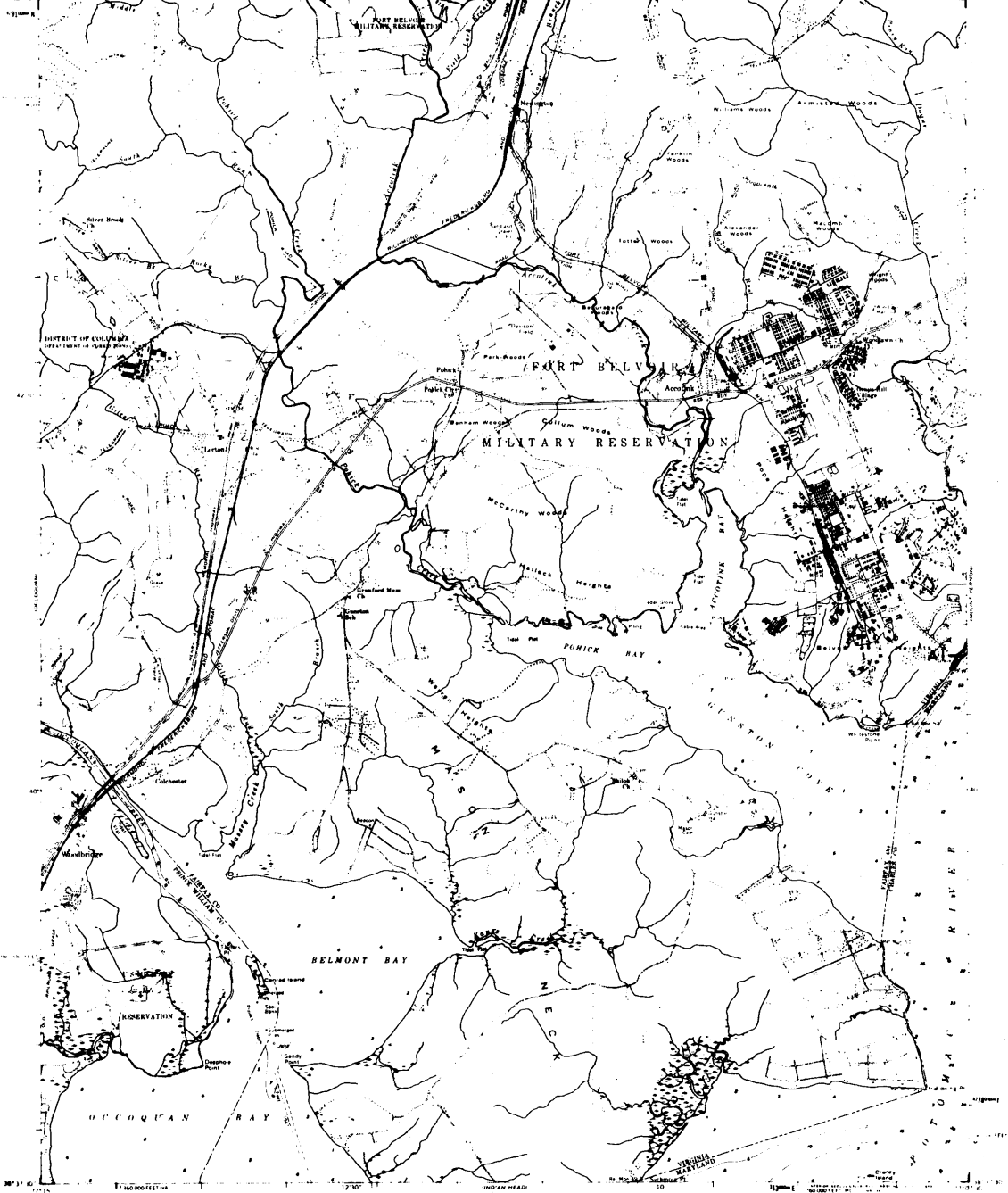
ROAD CLASSIFICATION
Highway
Medium-duty
Unimproved dirt
State Route

ST. MICHAELS, MD.
N 3845-W7507 5175
1942
AND OTHER INFORMATION

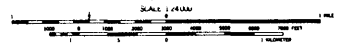
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES
DEPARTMENT OF THE ARMY
SUBMERGED AQUATIC VEGETATION 1984

BELVOIR QUADRANGLE
VIRGINIA - MARYLAND
7.5 MINUTE SERIES
1974 ISSUE (SEE 18 QUADRANGLE)



Mapped by the Army Map Service
Published for civil use by the Geological Survey
Control by USGS, USCGAS, and USACE
Topography from aerial photographs by photogrammetric methods. Aerial photographs taken 1960. Culture and drainage derived from aerial photographs taken 1966. Field check 1966.
Hydrography compiled from USCGAS chart 560 (1966)
Precipitation: 1957 North American datum
10,000-foot grid based on Virginia coordinate system, north zone, and Maryland coordinate system
1000-meter Universal Transverse Mercator grid tabs, zone 18, shown in blue
Unchecked elevations are shown in brown



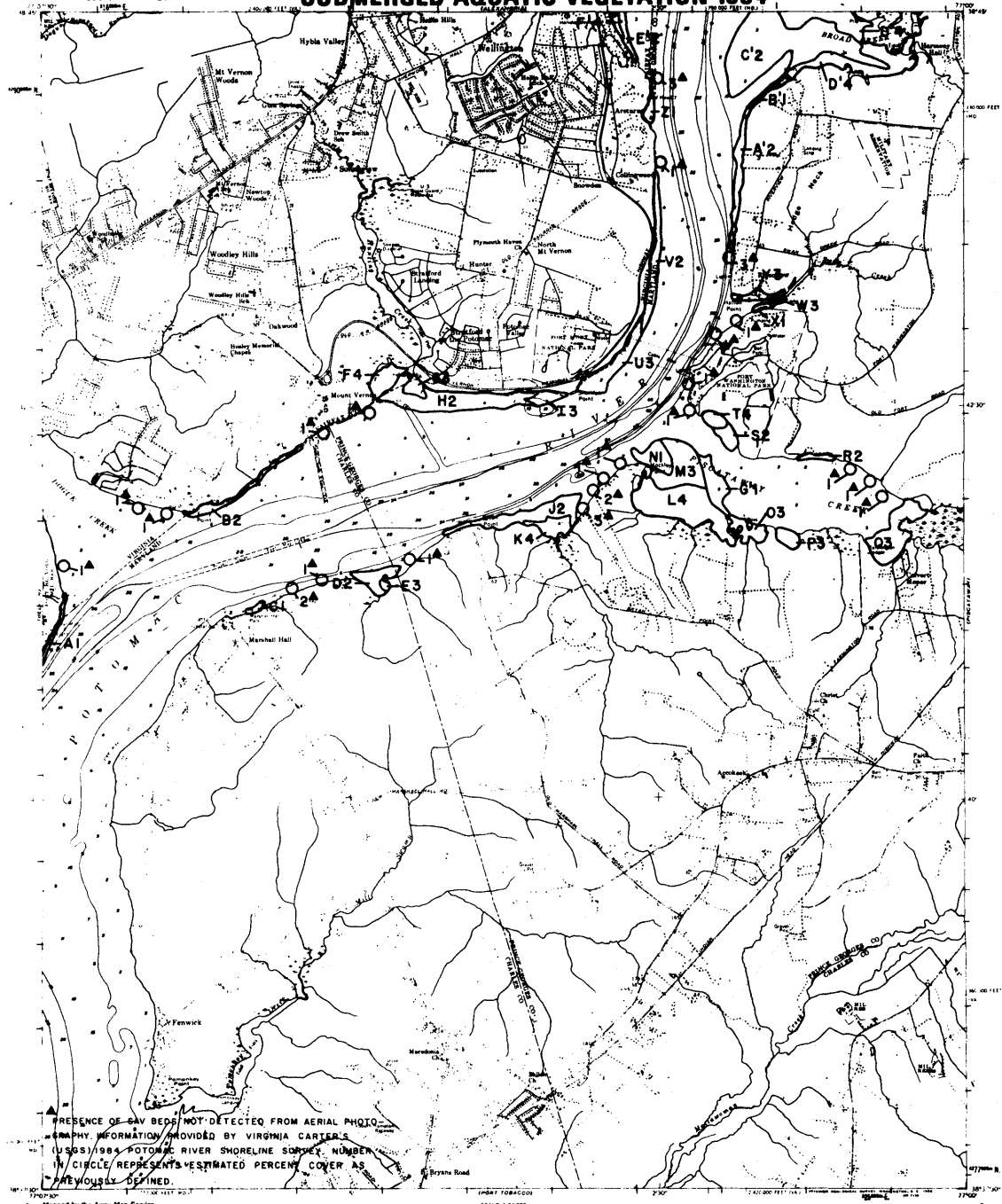
DEPTH CURVES AND BOUNDARIES IN FEET - DATUM IS MEAN LOW WATER
BOUNDARY LINE INDICATES THE 1000-FOOT DEPTH OF MEAN LOW WATER
THE MEAN RANGE OF THE SUBMERGED LINE IS FEET



ROAD CLASSIFICATION
Heavy-duty ——— Light-duty ———
Medium-duty ——— Unimproved dirt ———

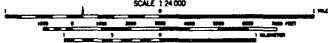
U.S. Route
BELVOIR, VA - MD.
BELVOIR, VA - MD.
1974 ISSUE (SEE 18 QUADRANGLE)
430375-7707 5/75
1984

UNITED STATES
SUBMERGED AQUATIC VEGETATION 1984



▲ PRESENCE OF SAV BEDS NOT DETECTED FROM AERIAL PHOTO
▲ ONLY INFORMATION PROVIDED BY VIRGINIA CARTERS
(USGS) 1984 POTOMAC RIVER SHORELINE SURVEY NUMBER
IN CIRCLE REPRESENTS ESTIMATED PERCENT COVER AS
PREVIOUSLY DEFINED.

Mapped by the Army Map Service
Control by USGS, USCGA, and USCE
Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1950. Culture and drainage revised
from aerial photographs taken 1958. Final check 1958
Highways corrected from USGS 68 chart 540 (1958)
Perennial streamlines, 1927 North American edition
10,000-foot grid based on Maryland coordinate system,
and Virginia coordinate system, north zone
1000-meter Universal Transverse Mercator grid lines,
zone 18, shown in blue
Unshaded spot heights are shown in brown



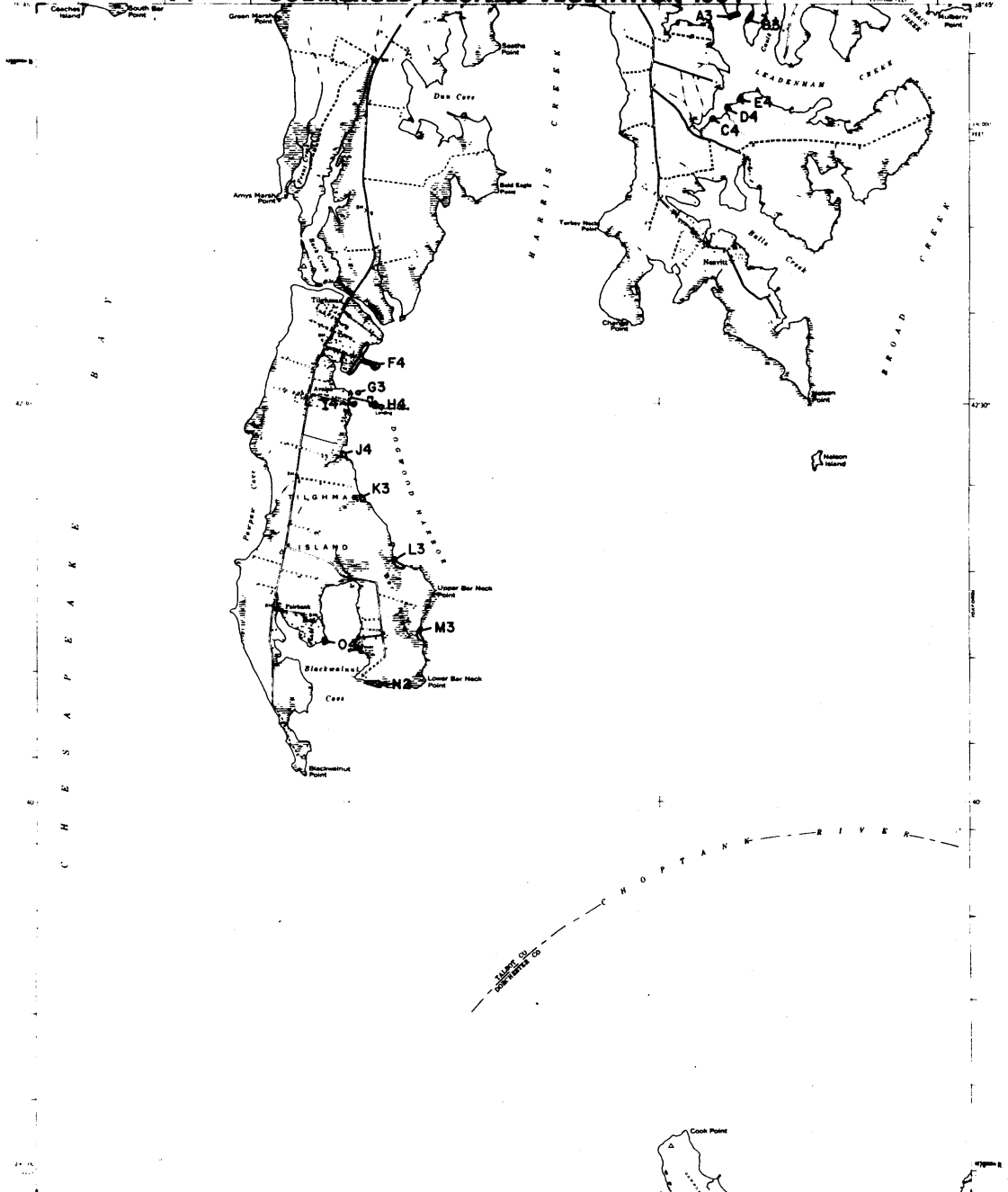
DEPTH CURVES AND SHORELINES IN FEET, OTHER IN METERS, LOW WATER
SHOWN ON BASIS OF THE MEAN LOW WATER
LINE AS SHOWN ON THE CHARTS OF THE U.S. COAST AND GEODETIC SURVEY

ROAD CLASSIFICATION
Heavy-duty _____ Light-duty _____
Medium-duty _____ Unimproved dirt _____
MOUNT VERNON, MD.-VA.
MOUNT VERNON, MD.-VA.
24.1 MINUTE SHEET OF QUADRANGLE
1987-3-107701/7.5

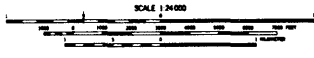
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SUBMERGED AQUATIC VEGETATION 1984

TILOHMAN QUADRANGLE
MARYLAND
7.5 MINUTE SERIES
SIX-EIGHT SEALS OF QUADRANGLE



Map made by the Army Map Service
Published for civil use by the Geological Survey
Controlled by USGCRS
Topography from aerial photographs by photogrammetric methods
and by photostatic survey 1962. Aerial photographs taken 1962.
Photostatic production. 1977 North American datum.
10,000-foot grid based on Maryland coordinate system.
3000-meter Universal Transverse Mercator grid zone,
zone 18, shown in blue.



ROAD CLASSIFICATION
Highway 1
Unimproved rd

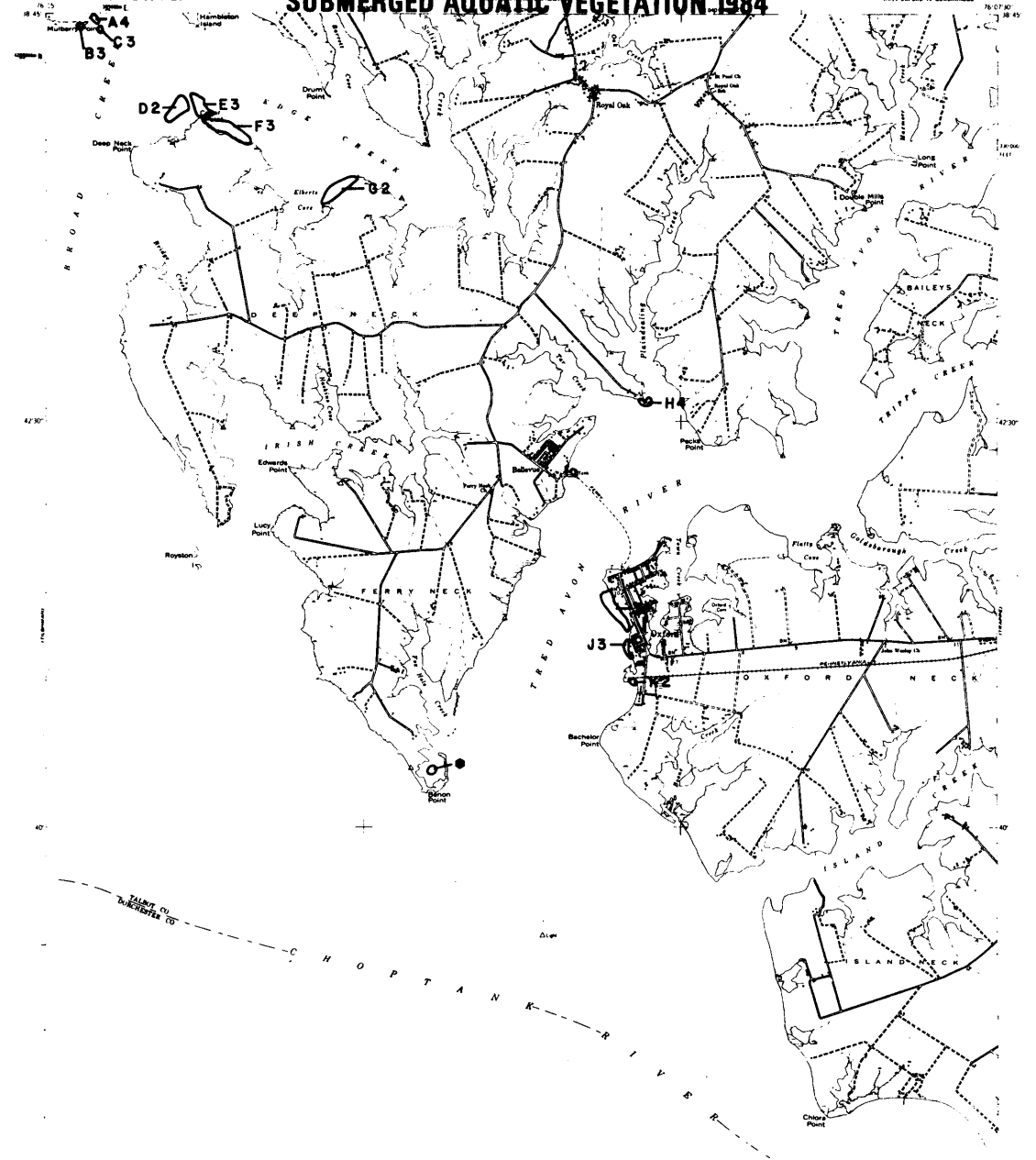
TILOHMAN QUADRANGLE
MARYLAND
7.5 MINUTE SERIES
SIX-EIGHT SEALS OF QUADRANGLE
8287 5-76/16/7.5

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

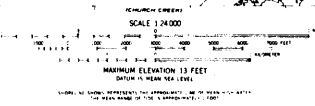
OXFORD QUADRANGLE
MARYLAND
7.5 MINUTE SERIES (TOPOGRAPHIC)
SERIAL OXFORD 14 QUADRANGLE

SUBMERGED AQUATIC VEGETATION 1984



SAV PRESENT IN THIS AREA BUT NOT DETECTED ON THE AERIAL PHOTOGRAPHY. INFORMATION PROVIDED BY ROBERT J. WILSON OF THE UMD, HORN POINT ENVIRONMENTAL LABORATORIES.

Mapped by the Army Map Service
Published for civil use by the Geological Survey
Control by USCGS
Topography from aerial photography by photogrammetric methods and by aneroid barometer surveys 1962. Aerial photographs taken 1962
Projection projection: 1927 North American datum
1:250,000 scale based on Maryland coordinate system
1:250,000 scale Universal Transverse Mercator grid ticks
zone 18, datum in blue

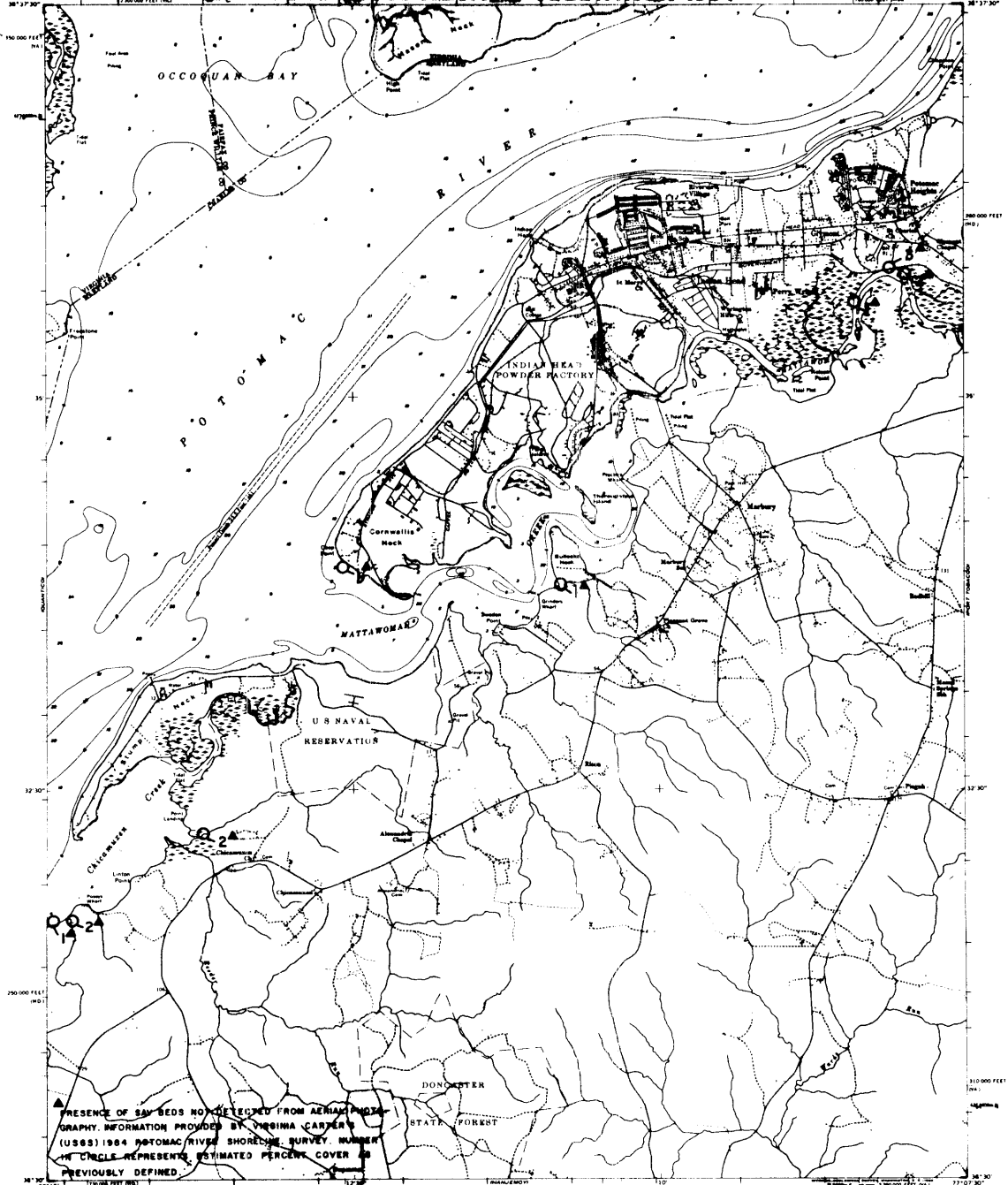


ROAD CLASSIFICATION
Heavy Duty
Medium Duty
Light Duty
Unimproved

OXFORD, MD.
7.5 MINUTE QUADRANGLE
SERIAL OXFORD 14 Q. 1
1982

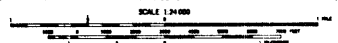
THIS MAP CONFORMS WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON 20, D. C.
A POLAR PROJECTION TOPOGRAPHIC MAP AND PRINTING IS AVAILABLE ON REQUEST

UNITED STATES
SUBMERGED AQUATIC VEGETATION 1984



▲ PRESENCE OF SAND BEDS NOT DETECTED FROM AERIAL PHOTOGRAPHY. INFORMATION PROVIDED BY VIRGINIA CARTER (USGS) 1984 POTOMAC RIVER SHORELINE SURVEY. NUMBER IN CIRCLE REPRESENTS ESTIMATED PERCENT COVER IN PREVIOUSLY DEFINED

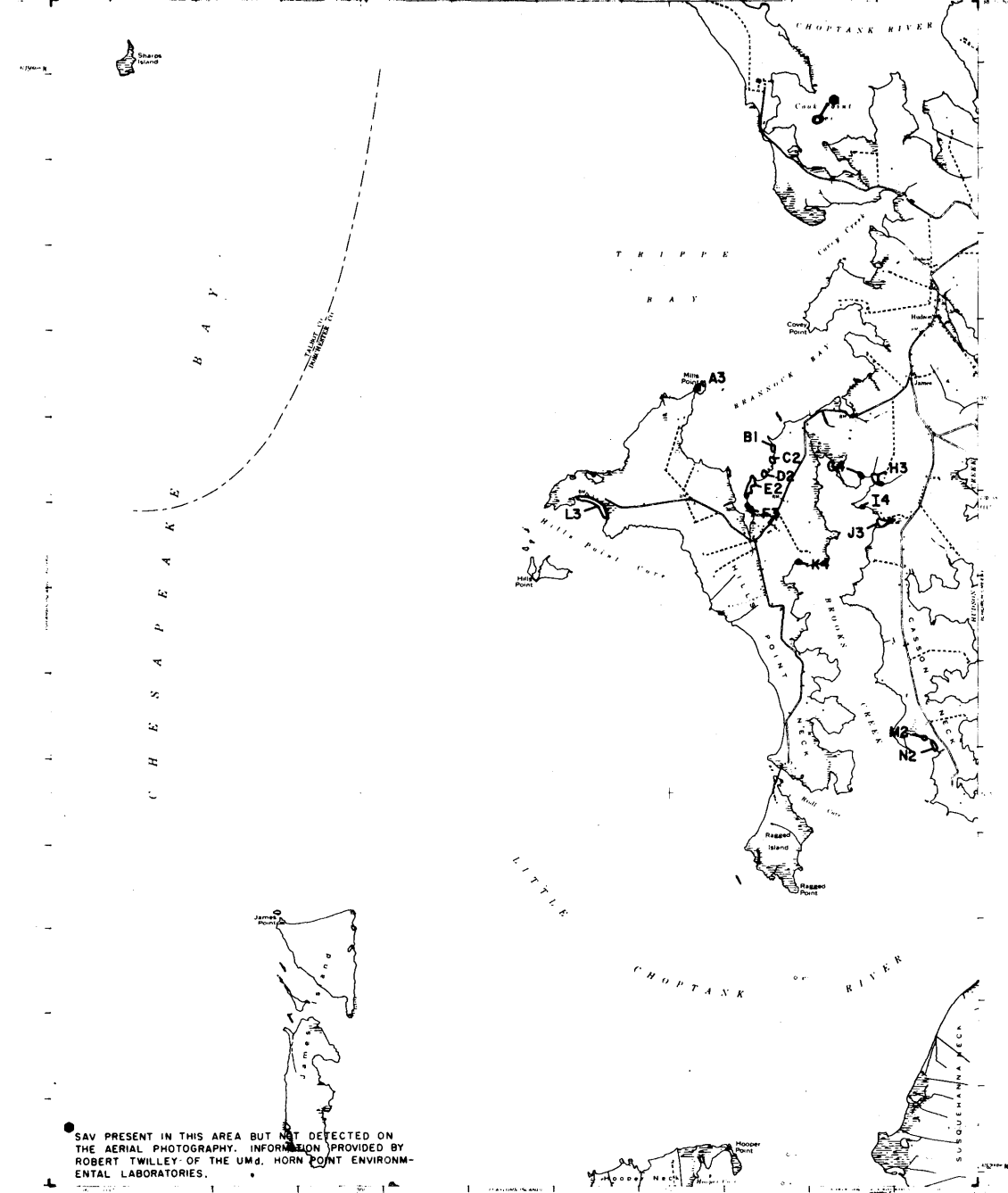
Prepared by the Army Map Service
Published for sale use by the Geological Survey
Controlled by USGS, USCGS, and USNPS
Photography from aerial photography by stereophotogrammetry
method, based on photographs taken 1955. Contours and depths
control from optical photographs taken 1955. Flood elevations 1955
photography compiled from USGS charts 100 21500 and
100 11500
Photographic projection: 1987 North American datum
63,000-foot grid based on Modified coordinate system,
and height coordinate system, earth 1984
1985-meter Universal Transverse Mercator grid data,
zone 18, datum is NAD
Unpublished elevations are shown in brackets



DEPTH SOUNDINGS AND CONTOURS IN FEET. WATER IS MEAN LOW WATER
UNLESS OTHERWISE NOTED. FOR MORE INFORMATION, CONTACT THE
NATIONAL CENTER FOR Nautical Information, 1115

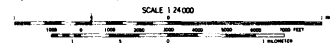
ROAD CLASSIFICATION
 Main-Shop ——— Light-duty
 Main-Shop ——— Unimproved dirt
 State Road
 INDIAN HEAD, MD., VA. J.A.
 1985

SUBMERGED AQUATIC VEGETATION 1984



SAV PRESENT IN THIS AREA BUT NOT DETECTED ON THE AERIAL PHOTOGRAPHY. INFORMATION PROVIDED BY ROBERT TWILLEY OF THE UMD, HORN POINT ENVIRONMENTAL LABORATORIES.

Mapped by the Army Map Service
Published for civil use by the Geological Survey
Covered by USGASS
Topography from aerial photographs by photogrammetric methods and by planimetric surveys 1942. Aerial photographs taken 1942.
Hydrographic information: 1927 North American datum.
10,000-foot grid based on Maryland coordinate system.
1000-meter Universal Transverse Mercator grid ticks.
Scale 1:8,000 in sheet.

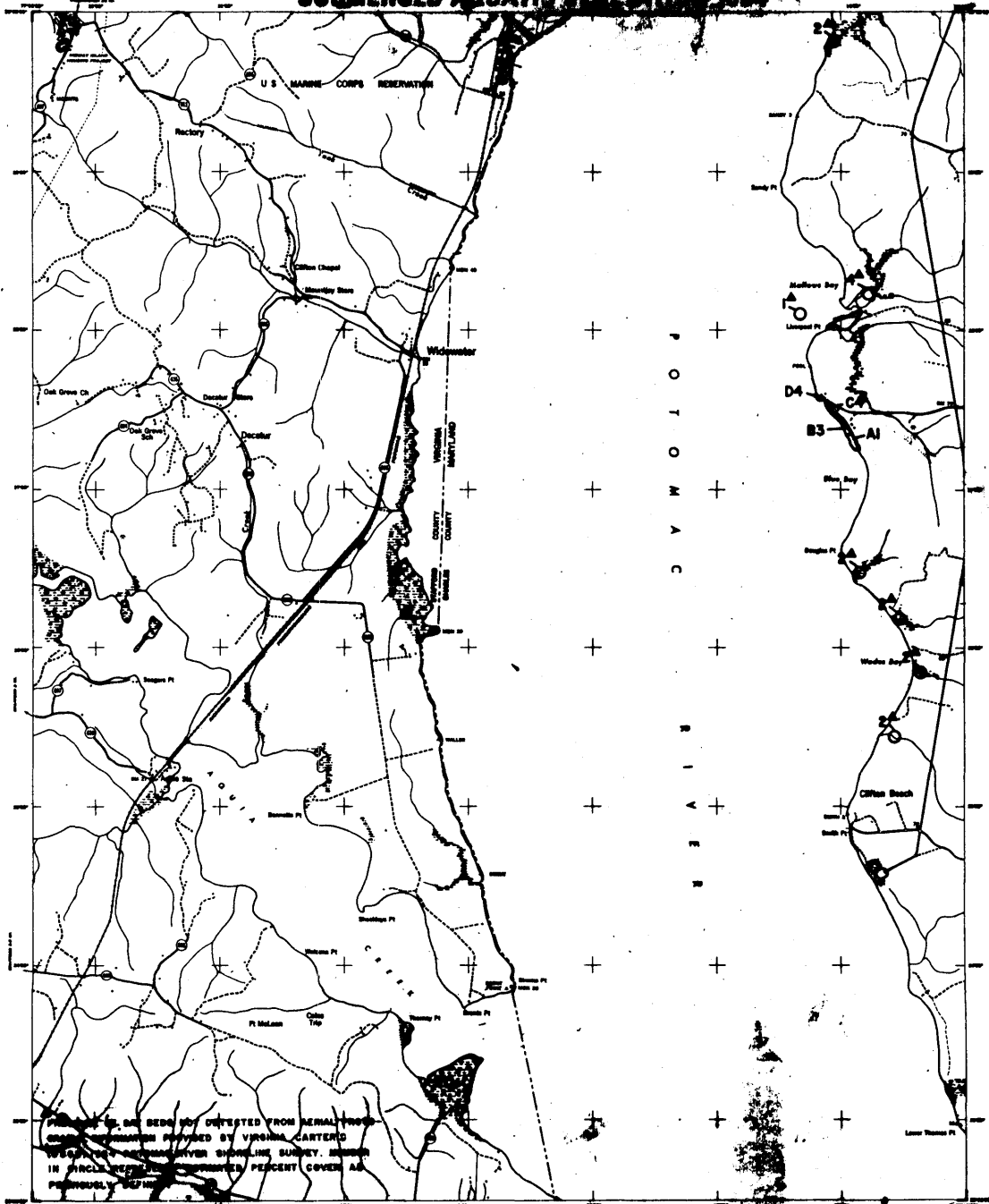


ROAD CLASSIFICATION
Heavy-duty Light-duty
Unimproved dirt
State Road

SHARPS ISLAND, MD.
841 SHARPS ISLAND 1P QUADRANGLE
H-300: W-7615/7.5
1942

VIRGINIA

SUBMERGED AREA, POTOMAC RIVER



THE SHADING ON THIS MAP IS DERIVED FROM AERIAL PHOTOGRAPHS TAKEN IN 1954 AND 1955. THE SHADING IS BASED ON VISUAL OBSERVATION OF SUBMERGED AREAS. THE SHADING IS NOT BASED ON SURVEY DATA. THE SHADING IS NOT BASED ON SURVEY DATA. THE SHADING IS NOT BASED ON SURVEY DATA.

Symbol	Description
[Shaded Box]	Submerged Area
[Dotted Box]	Submerged Area
[Cross-hatched Box]	Submerged Area
[Diagonal Lines Box]	Submerged Area
[Horizontal Lines Box]	Submerged Area
[Vertical Lines Box]	Submerged Area
[Stippled Box]	Submerged Area
[Other patterns]	Submerged Area



SUBMERGED AQUATIC VEGETATION 1984

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

NANJEMOY QUADRANGLE
MARYLAND-CHARLES CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



Map compiled and published by the Geological Survey, U.S. Department of the Interior, from aerial photographs taken in 1977 and other source data. This information was last checked for accuracy in 1978.

NATIONAL GEODETIC SURVEY DATUM OF 1983
FOR SALE BY U.S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092
A FOLDER OF SIMILAR TOPOGRAPHIC MAPS AND STRIPS IS AVAILABLE ON REQUEST

NANJEMOY, MD.
1984
PHOTOGRAPHED 1978
445 1000 00 54 00 00 00

SUBMERGED AQUATIC VEGETATION 1984



Mapped, edited, and published by the Geological Survey in cooperation with Commonwealth of Virginia agencies. Contact to USGS, VACOIS, and USACE. Topography by stereo-photogrammetry from aerial photographs dated 1947 (revised 1968). Submerged area dated 1984. Selected hydrographic data extracted from USCGS Chart 160 (1968). The information is not intended for navigational purposes. Publication number: 1987 North American edition. Horizontal coordinate system: North American datum. Vertical coordinate system: NAVD 83. 1:50,000-scale Universal Transverse Mercator grid (zone 18). Scale in feet. For the method used in selecting areas and field lines shown generally made on aerial photographs. This information is unclassified.

SCALE 1:71,000
CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 1000 FOOT CONTOURS
DATUM IS MEAN SEA LEVEL
DEPTH CURVES ARE INDICATED IN FEET - DATUM IS MEAN LOW WATER
FOR THE DATE OF THE SURVEY AND 1:50,000 SCALE
THIS MAP COMPLETES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20508
AND VIRGINIA DEPARTMENT OF MINING, RESOURCES, AND ENERGY, CHARLOTTESVILLE, VIRGINIA 22904
A PUBLISHED TOPOGRAPHIC MAP AND QUADRANGLE IS AVAILABLE ON REQUEST

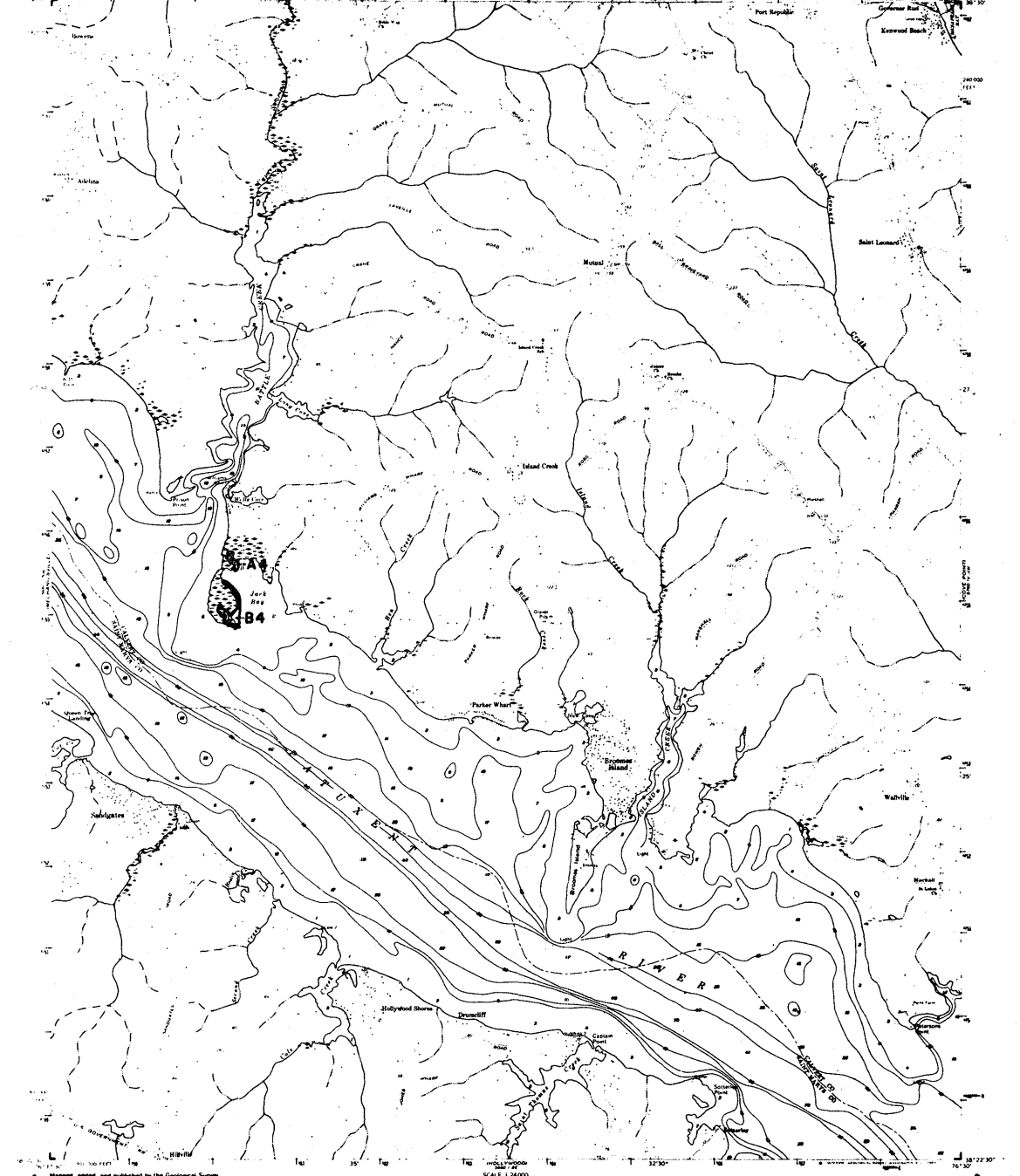
ROAD CLASSIFICATION
Secondary highway all weather Light-duty road all weather
hard surface improved surface
Unimproved road, bar or dry
middle
State Route

MATHIAS POINT, MD and VA.
U.S. GEOLOGICAL SURVEY
1987
1:50,000 SCALE
7.5 MINUTE SERIES

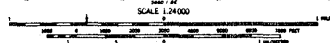
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SUBMERGED AQUATIC VEGETATION 1984

BROOMES ISLAND QUADANGLE
MARYLAND
7.5 MINUTE SERIES
NEAR LONGWATER OF CHESAPEAKE



Map compiled, revised, and published by the Geological Survey
Control by USGS and USCGS
Topography by photogrammetric methods from aerial photographs
taken 1981. Field checked 1983
Selected hydrographic data compiled from USCGS Chart 863 (1958)
The information is not intended for navigational purposes
Polyconic projection. 1987 North American datum
10,000-foot grid based on Meade's reference spheroid
1000-meter Universal Transverse Mercator grid cells,
zone 18, shown in black
Faint red dashed lines indicate selected fence and field lines whose
generally visible in aerial photographs. This information is unclassified

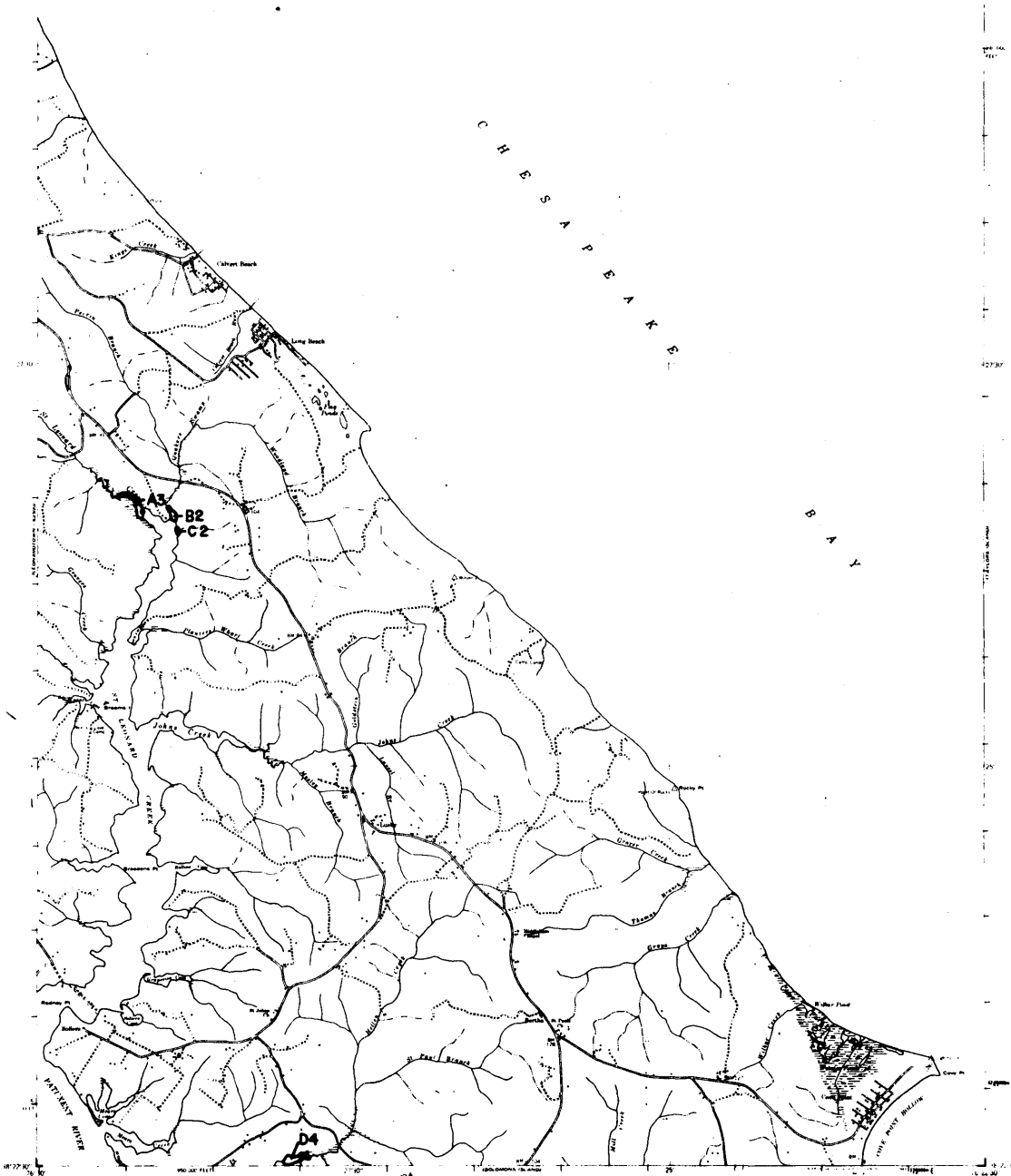


DEPTH VALUES AND SOUNDINGS IN FEET—SHOWN IN WHITE, LIGHT GRAY
AND DARK GRAY ARE NOT TO BE USED FOR NAVIGATION UNLESS SPECIFICALLY
NOTED OTHERWISE ON THIS CHART

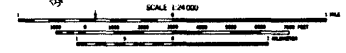


ROAD CLASSIFICATION
 Heavy-duty Light-duty
 Medium-duty Unimproved dirt
 Dotted line
 Dashed line
 Solid line
BROOMES ISLAND, MD.
 BROOKES ISLAND, MD
 NEAR LONGWATER OF CHESAPEAKE
 7.5-MINUTE SERIES
 1983
 AND 1984 / 18-58288 1000

SUBMERGED AQUATIC VEGETATION 1984



Mapped by the Army Map Service
Published for sale use by the Geological Survey
Control by USCGS
Topographic base aerial photographs by photogrammetric methods
and by photostereoscopic survey 1960. Aerial photographs taken 1962
Publication information: 1987 North American datum
NAD 83 datum grid based on National coordinate system
1000-meter Universal Transverse Mercator grid zone,
zone 18, datum to 1983



ROAD CLASSIFICATION
Heavy-duty _____ Light-duty _____
Medium-duty _____ Unimproved dirt _____
State Route _____
COVE POINT, MD.
COVE POINT, MD.
1974 EDITION OF QUADRANGLE
FIGS 25-6-1982 547.5
200

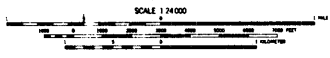
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

TAYLORS ISLAND QUADRANGLE
MARYLAND BOSTON COUNTY
7.5 MINUTE SERIES
NE 1 CORNER POINT OF QUADRANGLE

SUBMERGED AQUATIC VEGETATION 1984



Mapped by the Army Map Service
Published for retail sale by the Geological Survey
Control by USGCS
Topography from aerial photographs by photogrammetric methods
and by photostatic surveys 1962. Aerial photographs taken 1942
Photometric correction: 1927 North American datum
10,000-foot grid based on Maryland coordinate system
1000-meter Universal Transverse Mercator grid lines,
zone 18, shown in blue



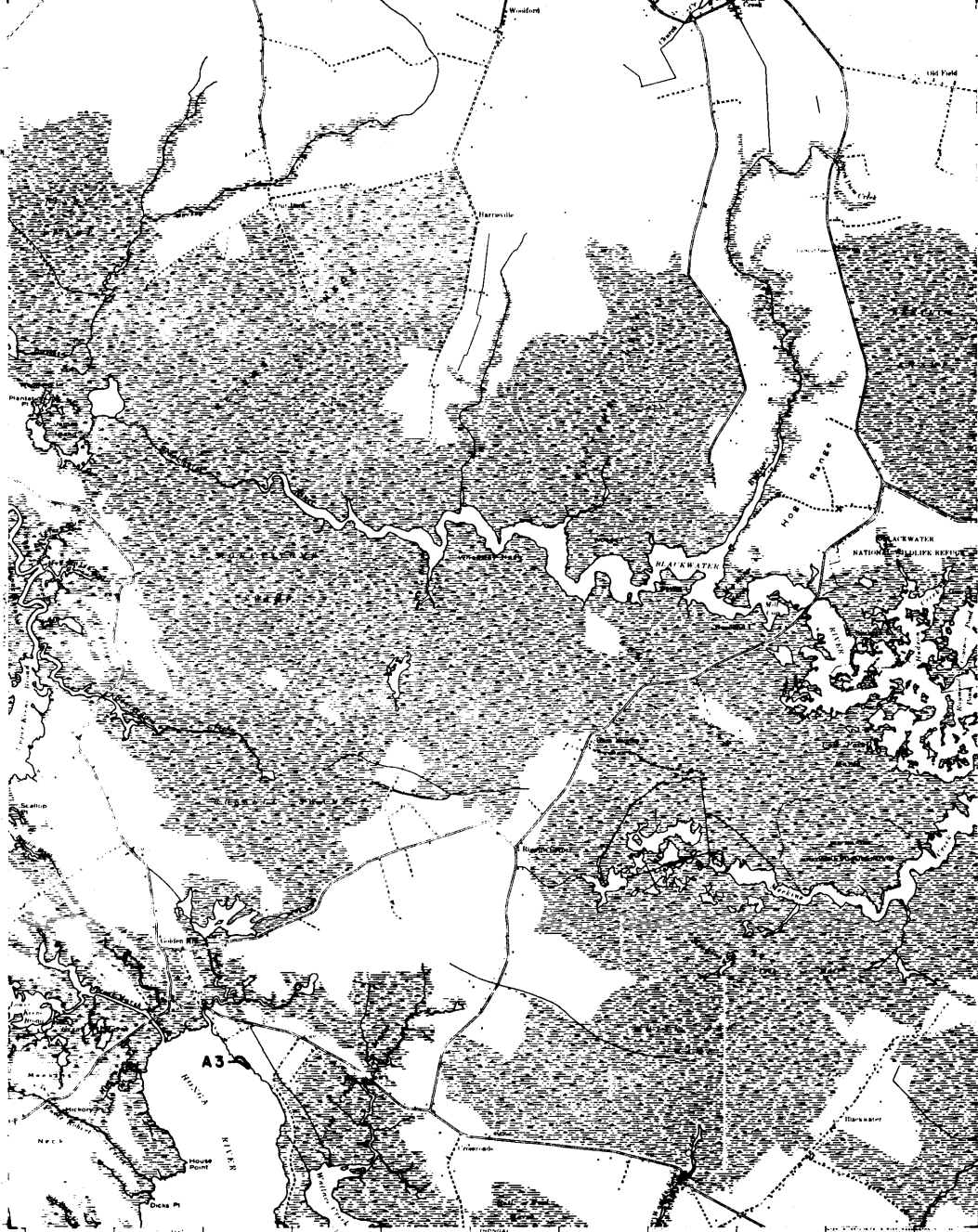
UNIVERSITY MICROFILMS INTERNATIONAL, 300 N ZEEB RD, ANN ARBOR MI 48106

ROAD CLASSIFICATION
Heavy-duty Light-duty
Medium-duty Unimproved dirt
State Route
TAYLORS ISLAND, MD.
TAYLORS ISLAND, MD.
NE 1 CORNER POINT OF QUADRANGLE
83822 3-87615/7.5
1982

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

GOLDEN HILL QUADRANGLE
BAYLARD-DORCHESTER CO.
7.5 MINUTE SERIES
BY /3 GROUP IF AVAILABLE

SUBMERGED AQUATIC VEGETATION 1984



Mapped by the Army Map Service
Published for civil use by the Geological Survey
Control by USGS/ARS
Topography from aerial photographs by photogrammetric methods
and by photostatic surveys 1942. Aerial photographs taken 1942
Photostatic reproduction: 1977 North American Datum
10,000-foot grid based on Maryland coordinate system
1000-meter Universal Transverse Mercator grid lines,
zone 18, shown in blue

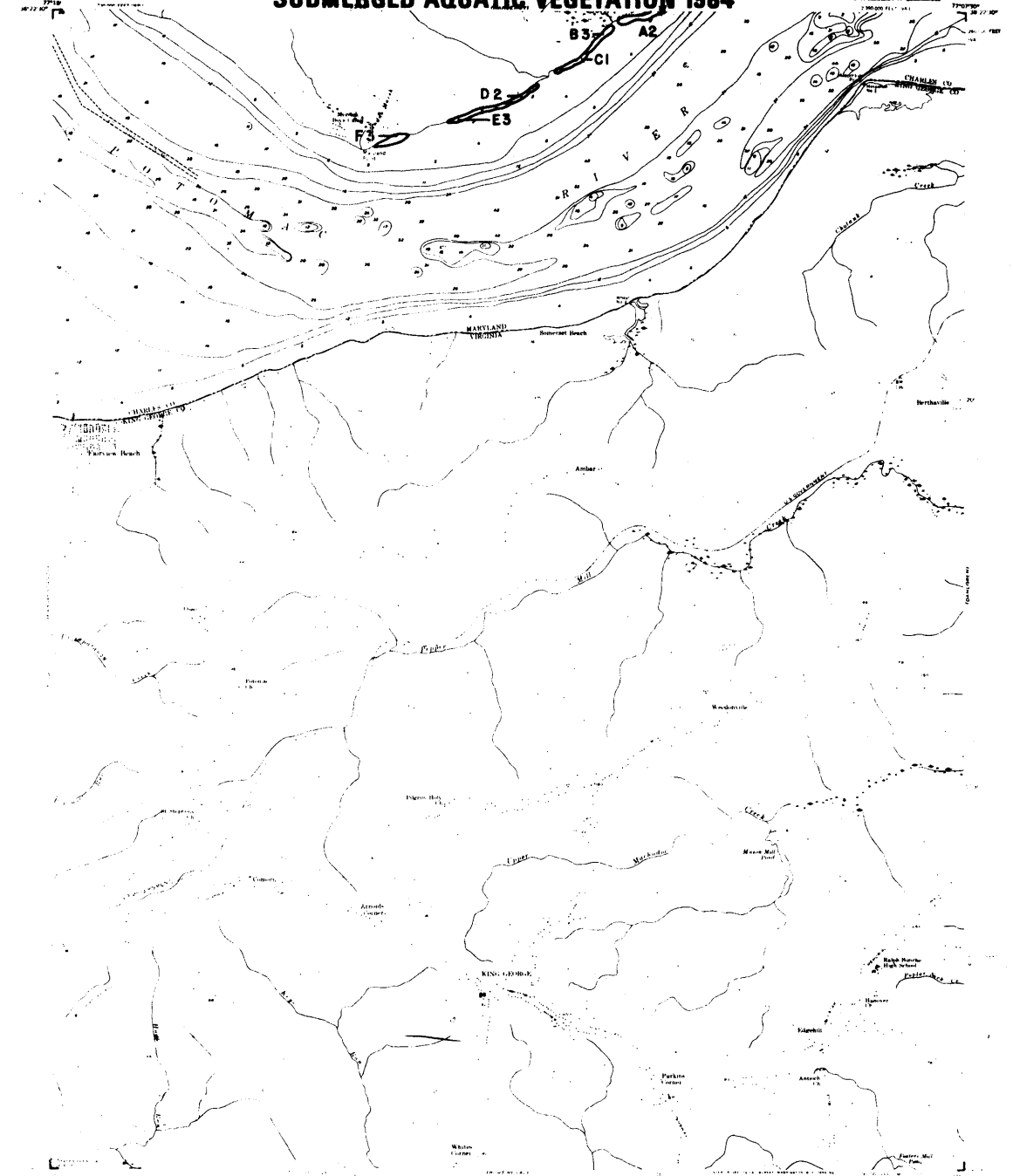


ROAD CLASSIFICATION
Highway ——— Light-duty ———
Medium-duty ——— Unimproved dirt ———
State Road ———
GOLDEN HILL, MD.
GOLDEN HILL, MD.
BY /3 GROUP IF AVAILABLE
1984

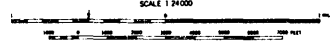
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SUBMERGED AQUATIC VEGETATION 1984

KING GEORGE QUADRANGLE
VIRGINIA-MARYLAND
7.5 MINUTE SERIES
250,000 SCALE



Mapped, edited, and published by the Geological Survey
Control by USGS, USCGO, and USFI
Topography from aerial photographs by multiple methods
Aerial photographs taken 1962 - Fall since 1966
Hydrography from USCGO charts 1868 dated 1962
Hydrographic information 1927 North American datum
10,000-foot grid based on Virginia coordinate system,
north zone, and Maryland coordinate system



DEPTH CURVES AND SOUNDINGS IN FEET. MEANS OF MEAN LOW WATER
INDICATED BY A SHORTER LINE. SOUNDING CURVE OF MEAN LOW WATER
AND MEAN WATER OF TIDE IS 1.1 FEET

ROAD CLASSIFICATION

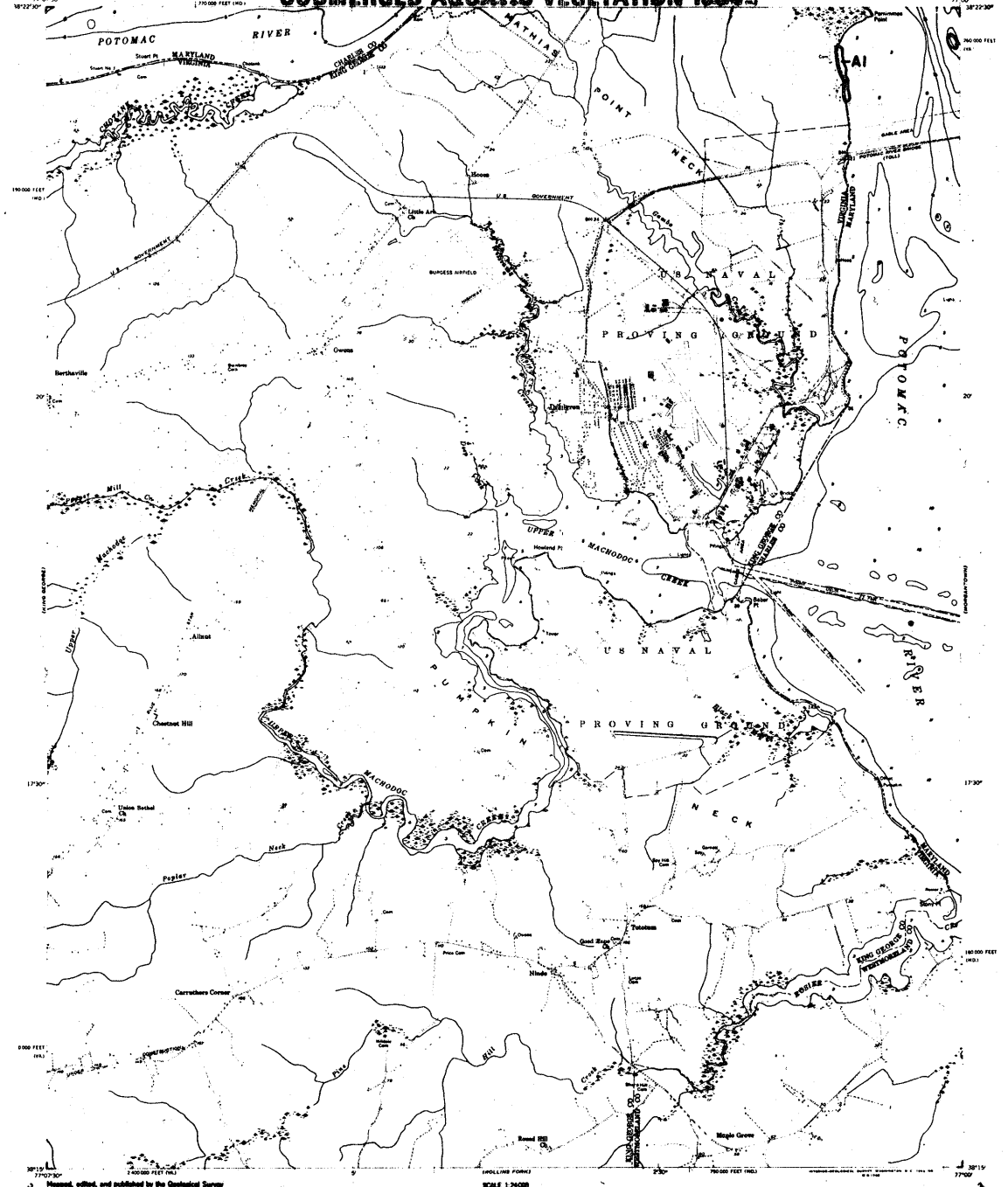
Heavy duty	Light duty
Medium duty	Unimproved dirt
U.S. Road	State Road

KING GEORGE, VA—MD.
BY A BRANCH OF THE BUREAU OF
GEOLOGICAL SURVEY
1988

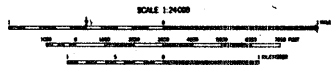
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SUBMERGED AQUATIC VEGETATION 1984

DAHLGREN QUADRANGLE
VIRGINIA-MARYLAND
7.5 MINUTE SERIES
SIXTH EDITION OF QUADRANGLE



Map prepared, edited, and published by the Geological Survey
Compiled by USGS and USN
Topography from aerial photography by satellite
method. Aerial photography taken 1963. Field check 1986
Hydrography from USGS charts 1863 and 1864, dated 1961.
Potomac projection. 1987 North American datum.
10,000-foot grid based on Virginia coordinate system,
with area and Maryland coordinate system.

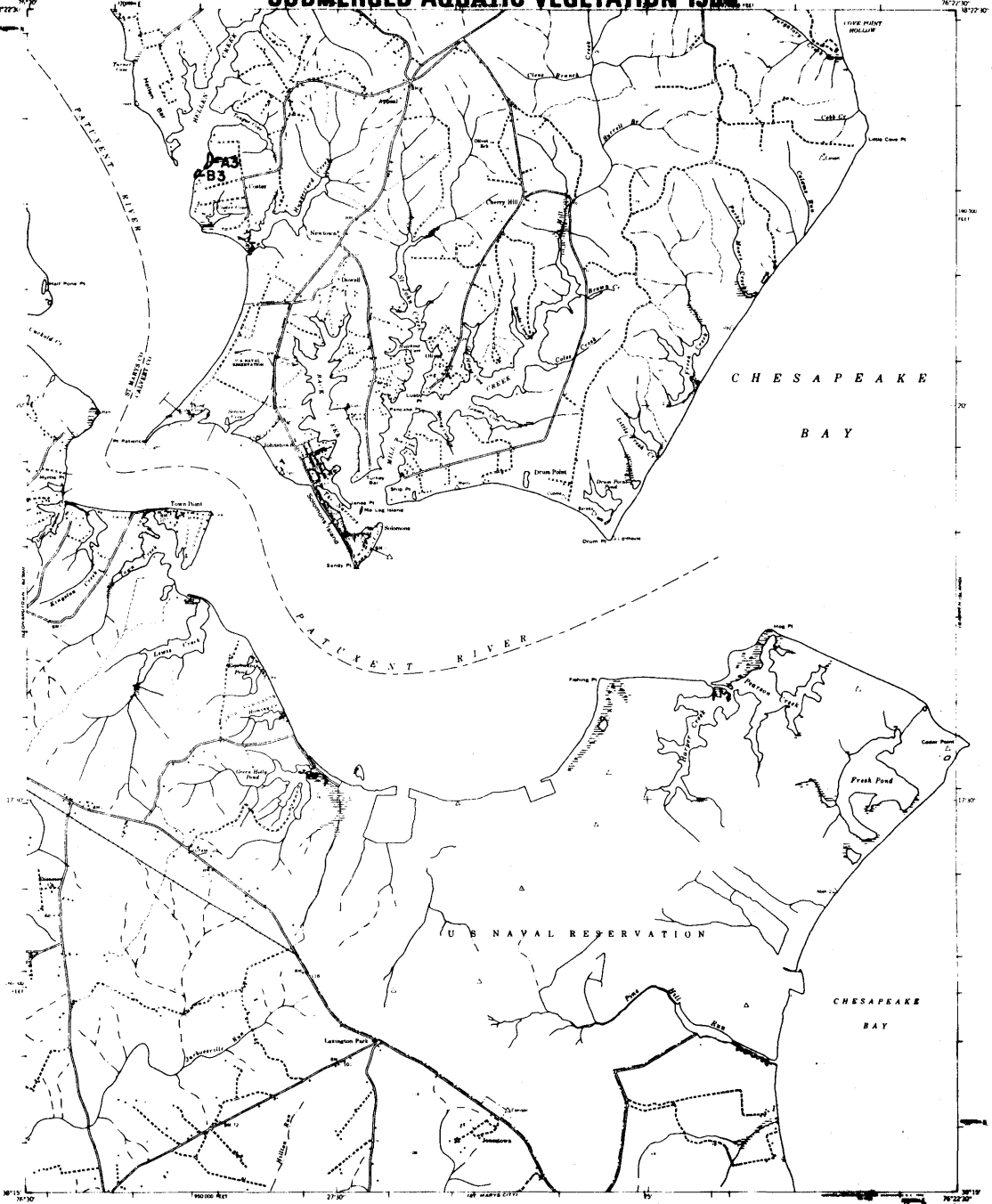


8500 CLASSIFICATION
Map Scale: 1:24,000
U.S. State: Virginia
DAHLGREN, VA. MD.
DAHLGREN, VA. MD.
SIXTH EDITION OF QUADRANGLE
8255-87700/7.5

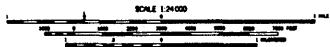
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SOLOMONS ISLANDS QUADRANGLE
MARTLAND
7.5 MINUTE SERIES (TOPOGRAPHIC)
80% (SEE PAGE 17) QUADRANGLE

SUBMERGED AQUATIC VEGETATION 1984



Prepared by the Army Map Service
Published for distribution by the Geological Survey
Controlled by USGS and USCGS
Topography from aerial photographs by photogrammetric
methods and by plane-table survey 1944
Aerial photographs taken 1939 and 1946
Projection projection: 1987 North American datum
1:50,000-foot grid based on Maryland coordinate system
1000-meter Universal Transverse Mercator grid data,
zone 18, mean to high



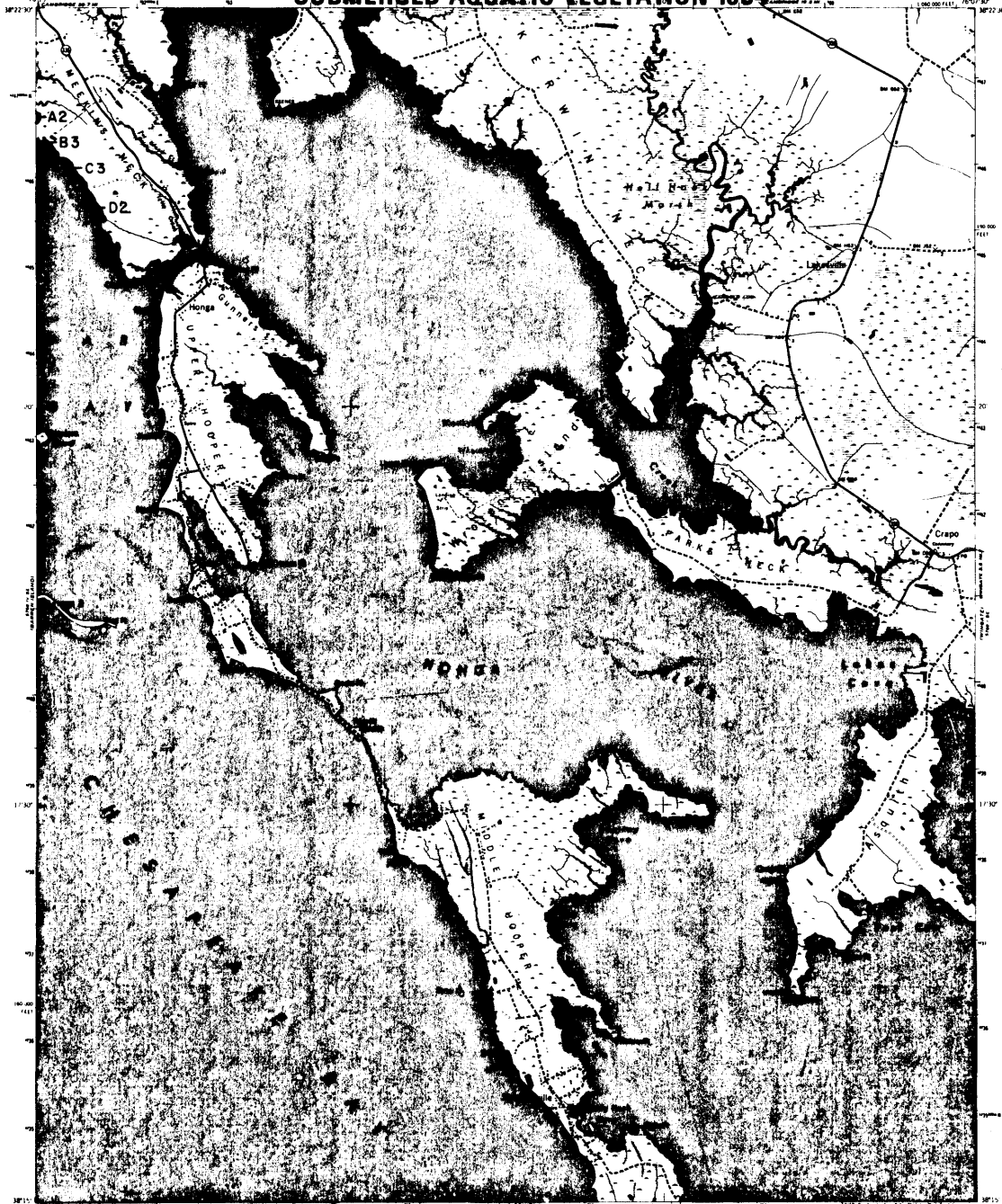
SOLOMONS ISLANDS, MD.
CHESAPEAKE BAY, MD.
1984

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WAR DEPARTMENT
CORPS OF ENGINEERS, U. S. ARMY

HONGA QUADRANGLE
MARYLAND-DORCHESTER CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

SUBMERGED AQUATIC VEGETATION 1984



Mapped and edited by the U. S. Coast and Geodetic Survey
as part of the War Department mapping project
Published for civil use by the Geological Survey
Control to USCGS

Planimetry by photogrammetric methods from aerial photographs
taken 1962. Topography by aneroid surveys and tide gauges 1942

Reference projection 1927 North American datum
15,000-foot grid based on Maryland coordinate system
1000-meter Universal Transverse Mercator grid 1983
zone 18, sheet 10-D

Boundaries shown in purple compiled by the Geographer's Survey from
aerial photographs taken 1974. This information not field checked

1716 8260 AND 1974 MAGNETIC NORTH
DECLINATION AT STATE OF MARYLAND

SCALE 1:24,000
MAXIMUM GROUND ELEVATION 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR DATA BY U. S. GEOLOGICAL SURVEY REGIONAL DIVISION, 1999
A FOLDER OF SIMILAR TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

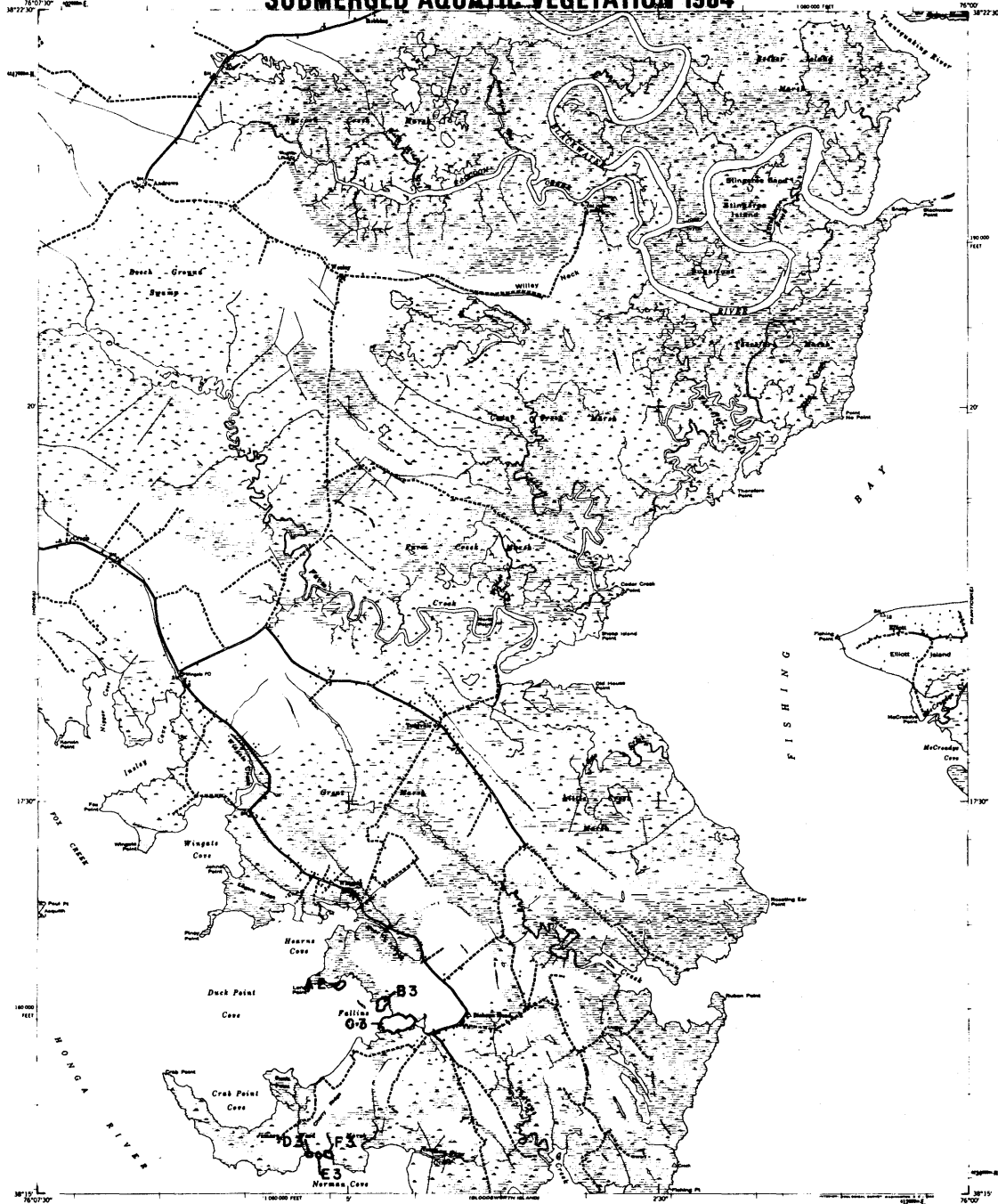
ROAD CLASSIFICATION
Primary highway all weather Light duty road all weather
hard surface unpaved surface
Secondary highway all weather Unimproved road fair or dry
hard surface weather
State Route

HONGA, MD.
HONGA, MD.
H.3815-W7607 5/75
1942
PHOTOREPRODUCED 1974
AMS 5740 BY SERIES 1933

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WINGATE QUADRANGLE
MARYLAND DORCHESTER CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
SIXTH EDITION OF QUADRANGLE

SUBMERGED AQUATIC VEGETATION 1984



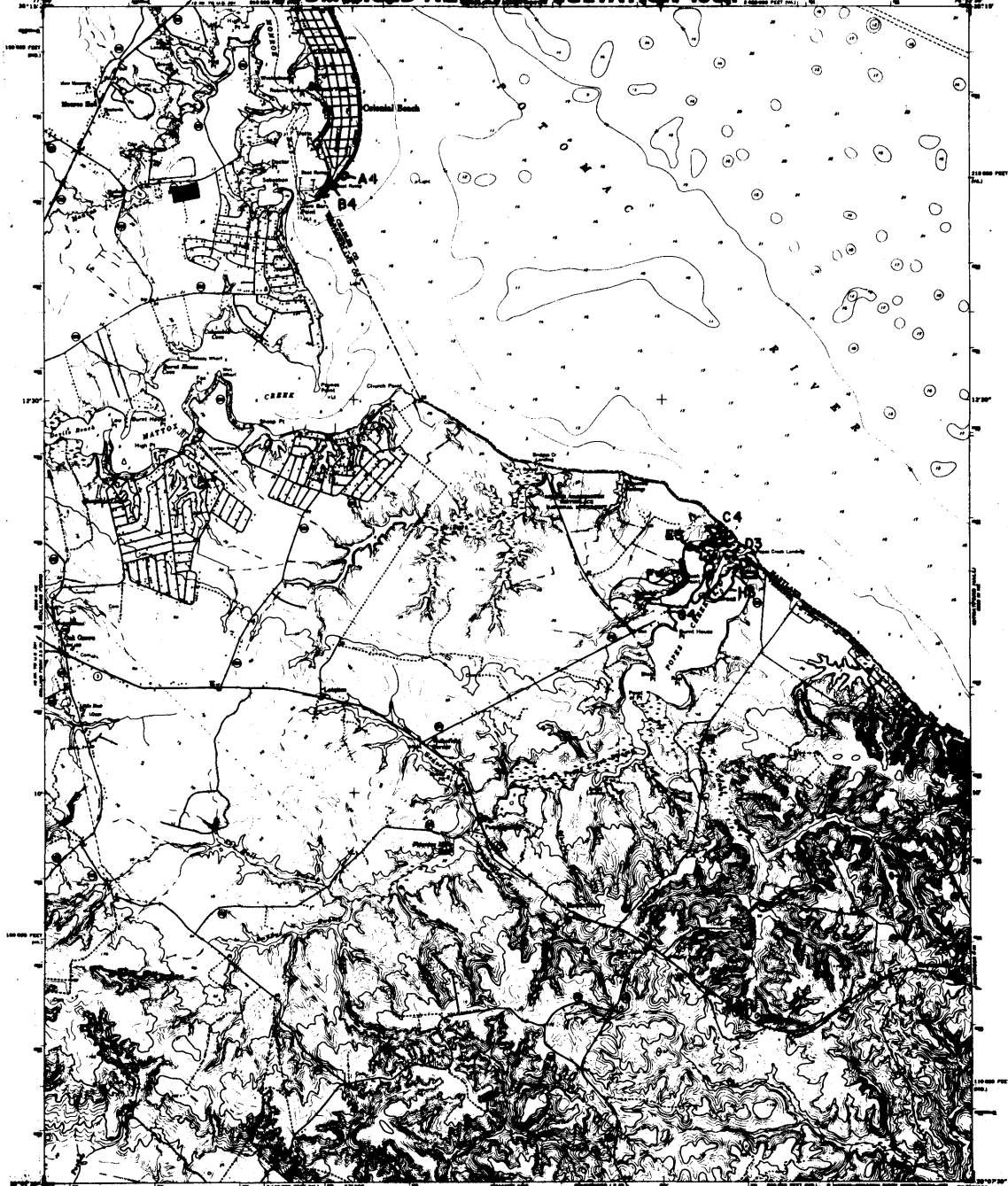
Map made by the Army Map Service
Published for civil use by the Geological Survey
Control by USCGAS
Topography by photogrammetric methods from aerial
photographs taken 1942 and photostatic survey 1942
Polygonic projection 1973 North American datum
10,000-foot grid based on Maryland coordinate system
1000-meter Universal Transverse Mercator grid ticks,
zone 18, shown in blue



SCALE 1:24,000
HORIZONTAL EL ELEVATION IN FEET
DATUM IS MEAN SEA LEVEL
SHOWING WATER REPRESENTS THE APPROPRIATE LINE OF MEAN TIDE WATER
TO THE POINT OF THE QUADRANGLE 1:24,000
THIS MAP COPIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C.
A POLAR PROJECTION HYPOGEOGRAPHIC MAP AND PROBLEMS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION
Highway
Unimproved rd
WINGATE, MD.
WINGATE, MD.
SIXTH EDITION OF QUADRANGLE
1985-87/75
1982

SUBMERGED AQUATIC VEGETATION 1984



Revised, edited, and published by the Geological Survey
under its 1862 and 1897 charters.
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information storage and retrieval system without the written
permission of the United States Geological Survey.



SCALE 1:4000
CONTOUR INTERVAL, 40 FEET
SPERMAL LINES REPRESENT 2-FEET CONTOURS
SHOWN AT 100-FOOT INTERVALS, UNLESS NOTED
OTHERWISE. CONTOUR INTERVAL, UNLESS NOTED
OTHERWISE, IS 40 FEET. UNLESS NOTED
OTHERWISE, CONTOUR INTERVAL IS 20 FEET.
THE 100-FOOT CONTOUR INTERVAL IS USED FOR
ELEVATIONS ABOVE 100 FEET.
FOR THIS MAP, A 10-METER CONTOUR INTERVAL WAS
USED FOR ELEVATIONS ABOVE 100 METERS.
A NORTH ARROW AND GRAPHIC SCALE ARE PROVIDED ON SHEETS.

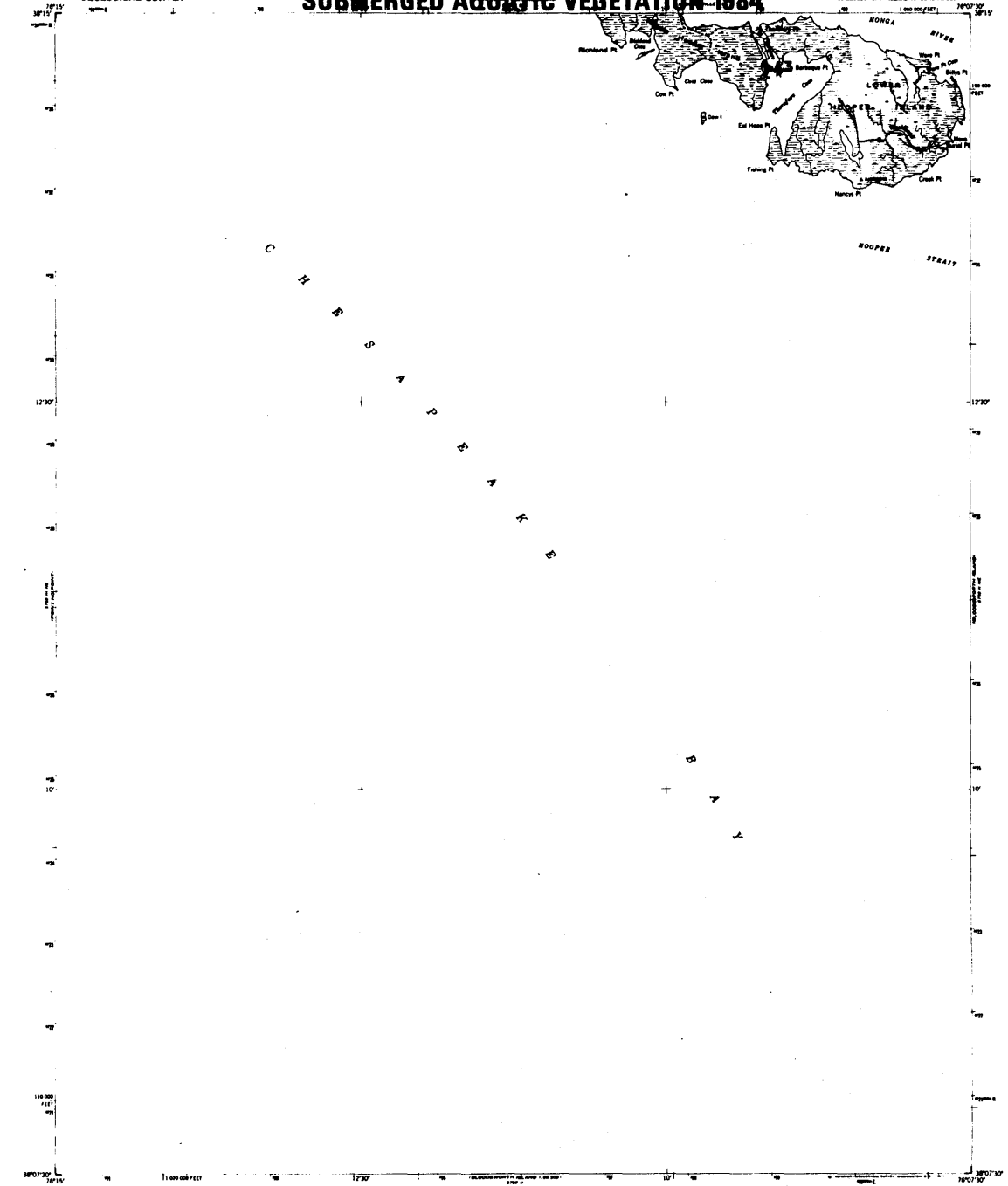
ROAD CLASSIFICATION
Primary highway, all weather. Light-gray fill, all weather.
hard surface. Light-gray fill, all weather.
Secondary highway, all weather. Unshaded road, fill or dry
hard surface. Dotted line.
State Route. Circle with number.

COLONIAL BEACH SOUTH, VA - MD
18507 2-7508 5/73
PROPOSED 1988
MAP 548 IN 80-20000 1000

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

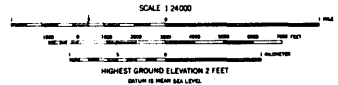
UNITED STATES
DEPARTMENT OF THE INTERIOR
SUBMERGED AQUATIC VEGETATION-1984

RICHLAND POINT QUADRANGLE
MARYLAND-DORCHESTER CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
PPA BLOSSOMSBY ISLAND 14 QUADRANGLE



Maped by the Army Map Service
Published for cart use by the Geological Survey
Control by USCGS
Culture and drainage in part compiled from aerial photographs
taken 1942. Topography by stadia survey, 1942.
Polyconic projection, 1927 North American datum.
10,000-foot grid based on Maryland coordinate system.
1000-meter Universal Transverse Mercator grid data,
zone 18, shown in blue.

THIS MAP AND THE BATTERY LIGHT
REPLACES THE LIGHT OF 1927



THIS MAP COMPILED WITH NATIONAL MAP FREQUENCY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, WASHINGTON, D. C. 20542
A POLAR GRAPHIC TOPOGRAPHIC MAP AND SYMBOLS IS AVAILABLE ON REQUEST

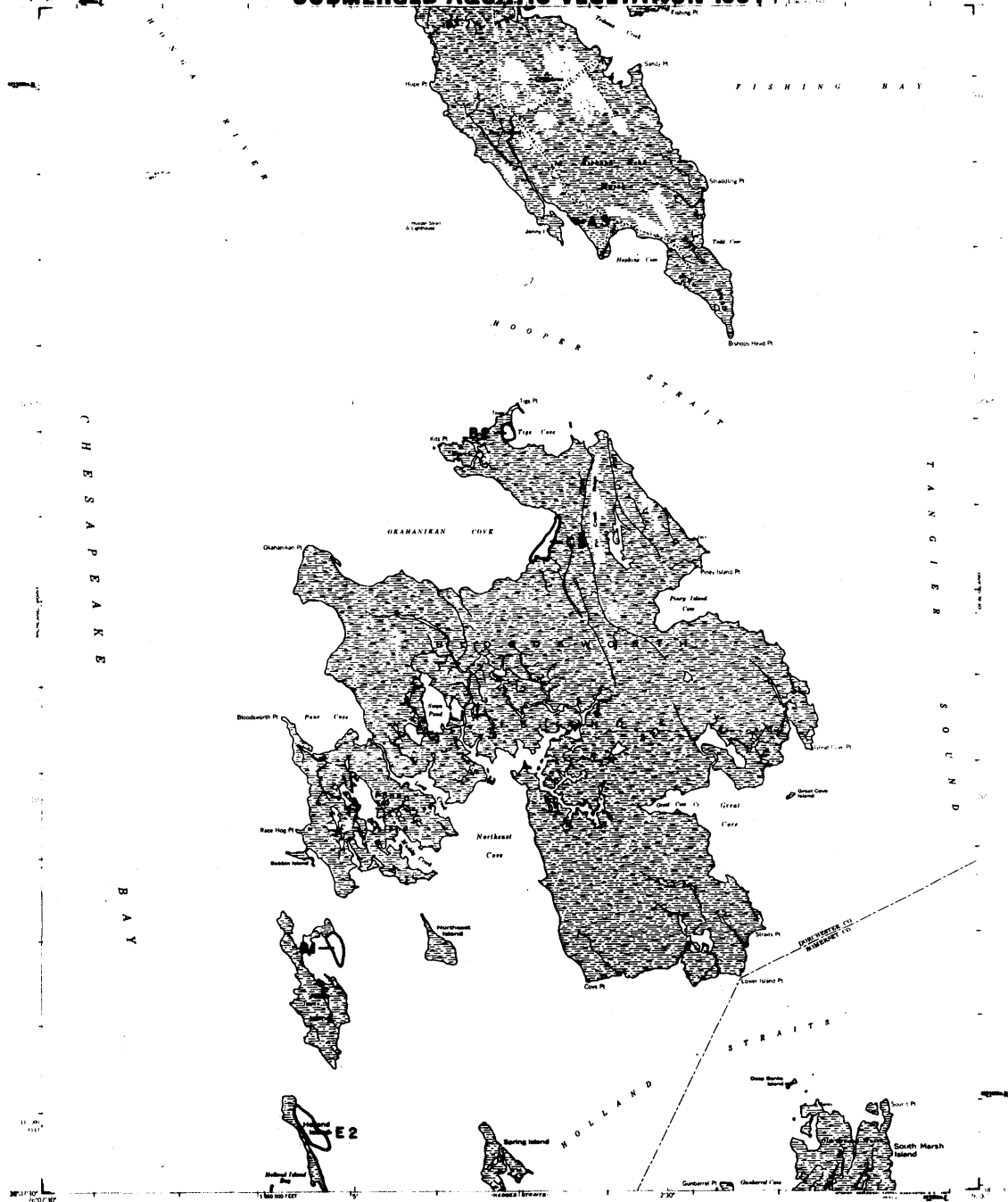
UNPUBLISHED
QUADRANGLE LOCATION

ROAD CLASSIFICATION
Unimproved dirt
RICHLAND POINT, MD.
RICHLAND POINT, MD.
PPA BLOSSOMSBY ISLAND 14 QUADRANGLE
R3207 5-NR7501 5-17.5
1942
AND 5700 IS HW-SERIES 1943

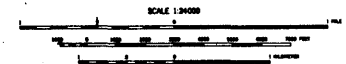
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES
SUBMERGED AQUATIC VEGETATION 1984

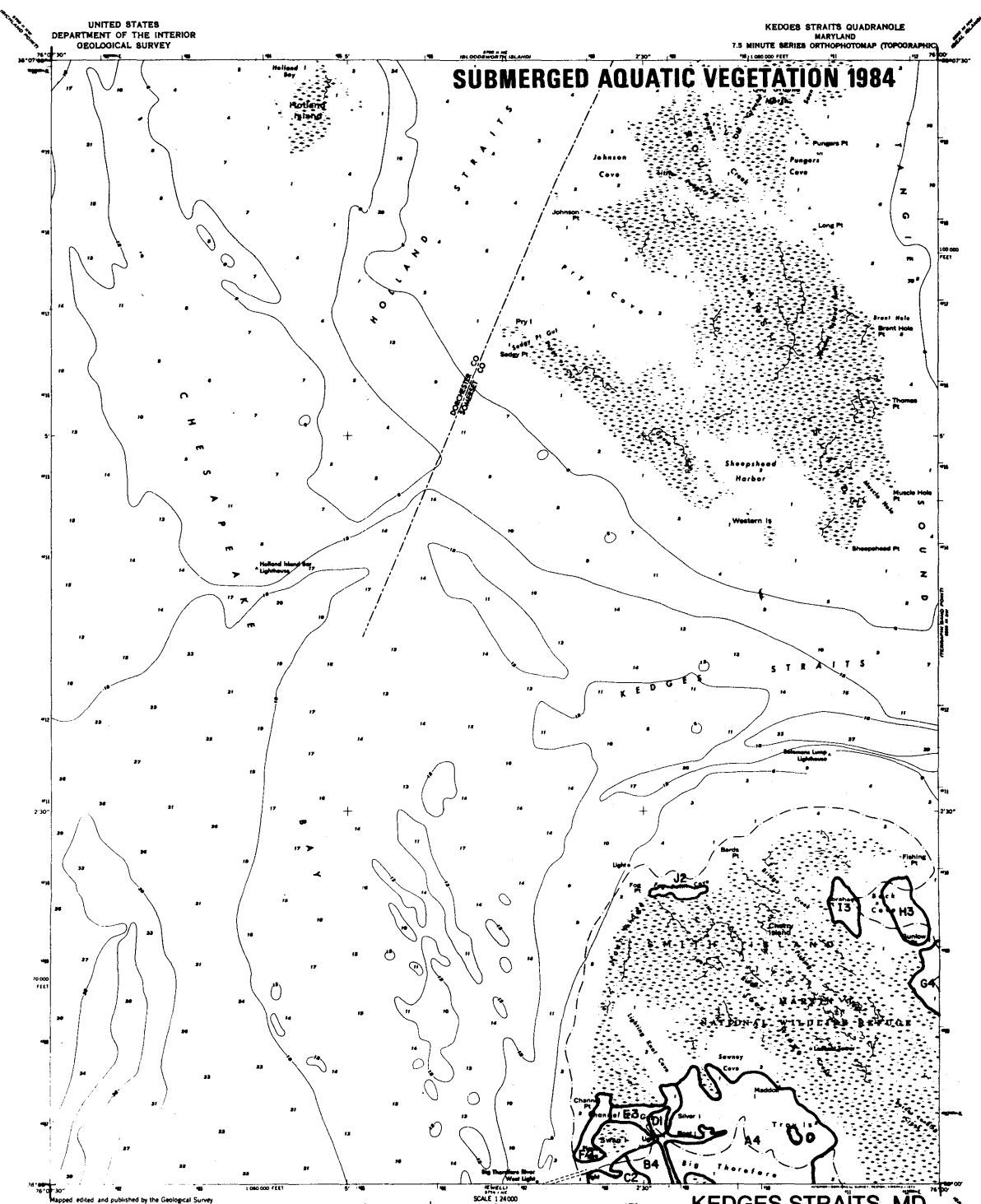
BLOODSWORTH ISLAND GUADRANGLE
MARYLAND
7.5 MINUTE SERIES
NEAR BLOODSWORTH ISLAND IF QUADRANGLE



Approved by the Army Map Service
Published for field use by the Geological Survey
Control by USCGMS
Colors and drawings by field sketches from aerial photographs
taken 1967. Transcribed by photostatic means 1984
Polymer printed, 1987 North American datum
1:100,000 scale grid based on Maryland coordinate system
1000 contour (adjusted to mean sea level) grid data,
zone 18, datum to 1984
No derivation to north magnetic lines, declination,
magnetic and isotropic readings



ROAD CLASSIFICATION
Unimproved dirt Trail
BLOODSWORTH JAIL, MD.
BLOODSWORTH ISLAND, MD.
NEAR BLOODSWORTH ISLAND IF QUADRANGLE
15000 5-NOT6857 5
1982



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

KEDGES STRAITS QUADRANGLE
MARYLAND
7.5 MINUTE SERIES ORTHOPHOTOGRAPH (TOPOGRAPHIC)

SUBMERGED AQUATIC VEGETATION 1984

Mapped, edited, and published by the Geological Survey
Control by USGS and USCGS
Orthophotomaps prepared from aerial photograph taken
April 5, 1972. Film received 1972
Supersedes Aerial Photo Service map dated 1942
Selected bathymetric data compiled from USCGS Chart 555 (1972)
This information is not intended for navigational purposes
Projection and 12,000-foot grid ticks. Mapped
coordinate system: Lambert conformal conic
1:500,000 Universal Transverse Mercator grid ticks
Zone 18 shown in blue 1927 North American datum



KEDGES STRAITS, MD.

ROAD CLASSIFICATION
No roads or trails in this area

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, RESTON VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

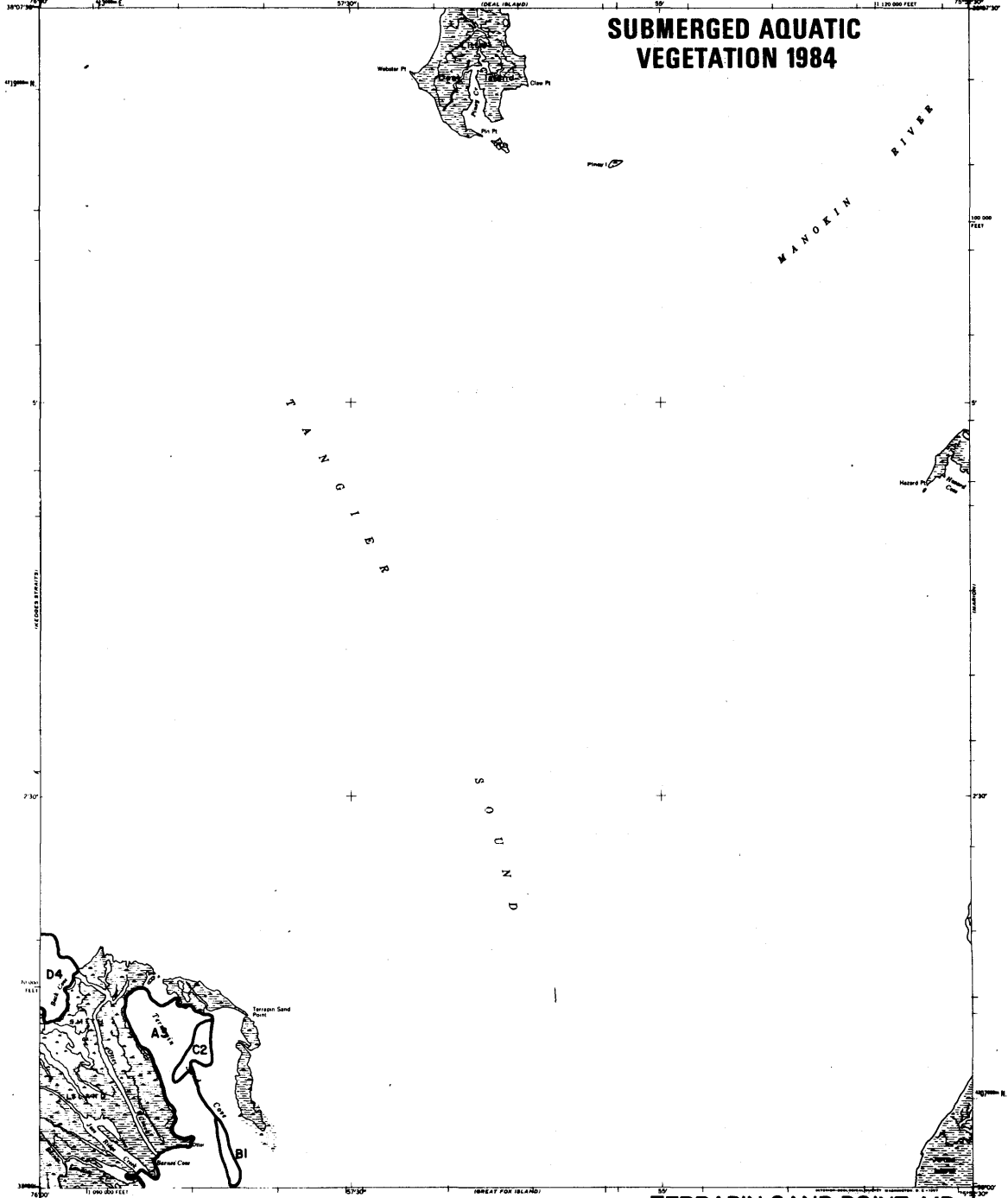
KEDGES STRAITS, MD.
N 3800—W 7600/7.5
1972
ANN 3700 II BE—SERIES YEAR

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS

TERRAPIN SAND POINT QUADRANGLE
MARYLAND-SHIMMERSET CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
8974 DEAL ISLAND 14' QUADRANGLE
1:120,000 FEET

SUBMERGED AQUATIC VEGETATION 1984



Map made by the Army Map Service
Published for civil use by the Geological Survey
Control by USCGS
Culture and drainage in part compiled from aerial photographs
taken 1962. Topography by aneroid survey 1962.
Photographic projection. 1927 North American datum.
10,000-foot grid based on Maryland coordinate system.
1000 meters U.S. vertical datum. Mercator projection.
Zone 18, shown in blue.



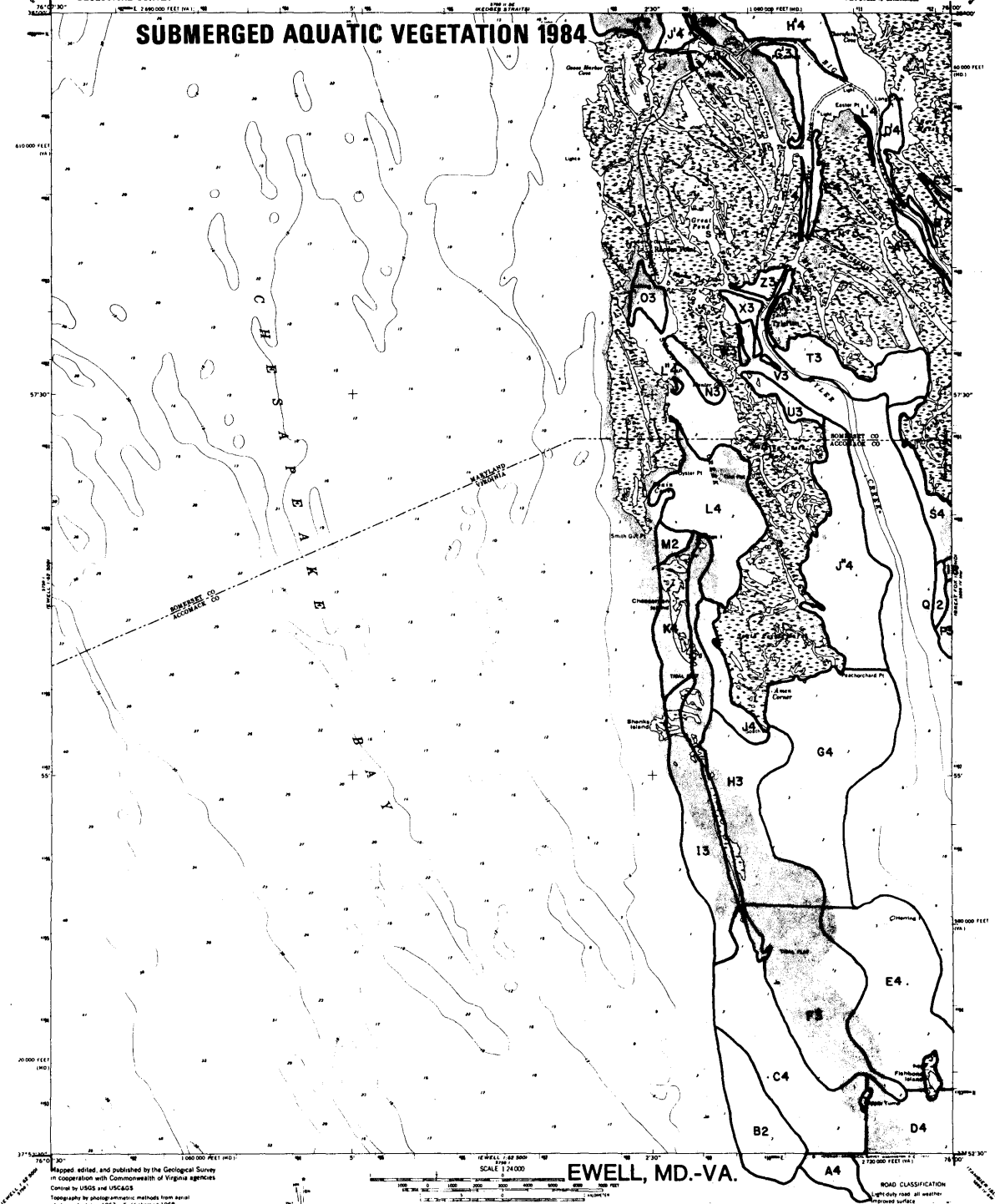
TERRAPIN SAND POINT, MD.

ROAD CLASSIFICATION
No roads or paths in this area

TERRAPIN SAND POINT, MD.
8974 DEAL ISLAND 14' QUADRANGLE
13800-47552.5/7.5
1984

THIS MAP COMPLES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON 20508, D. C.
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

SUBMERGED AQUATIC VEGETATION 1984



Mapped, edited, and published by the Geological Survey
in cooperation with Commonwealth of Virginia agencies
Control by USGS and USC&GS
Topography by photogrammetric methods from aerial
photographs taken 1967. Field checked 1968
Supersedes Army Map Service map H-2042
Specialized hydrographic data compiled from USCGS Chart 548 (1969)
This information is not intended for navigational purposes
Publication 1987 North American Datum
10,000 foot grid based on Maryland coordinate system
and Virginia coordinate system, south zone
1000 meter Universal Transverse Mercator grid cells
zone 18 shown in blue

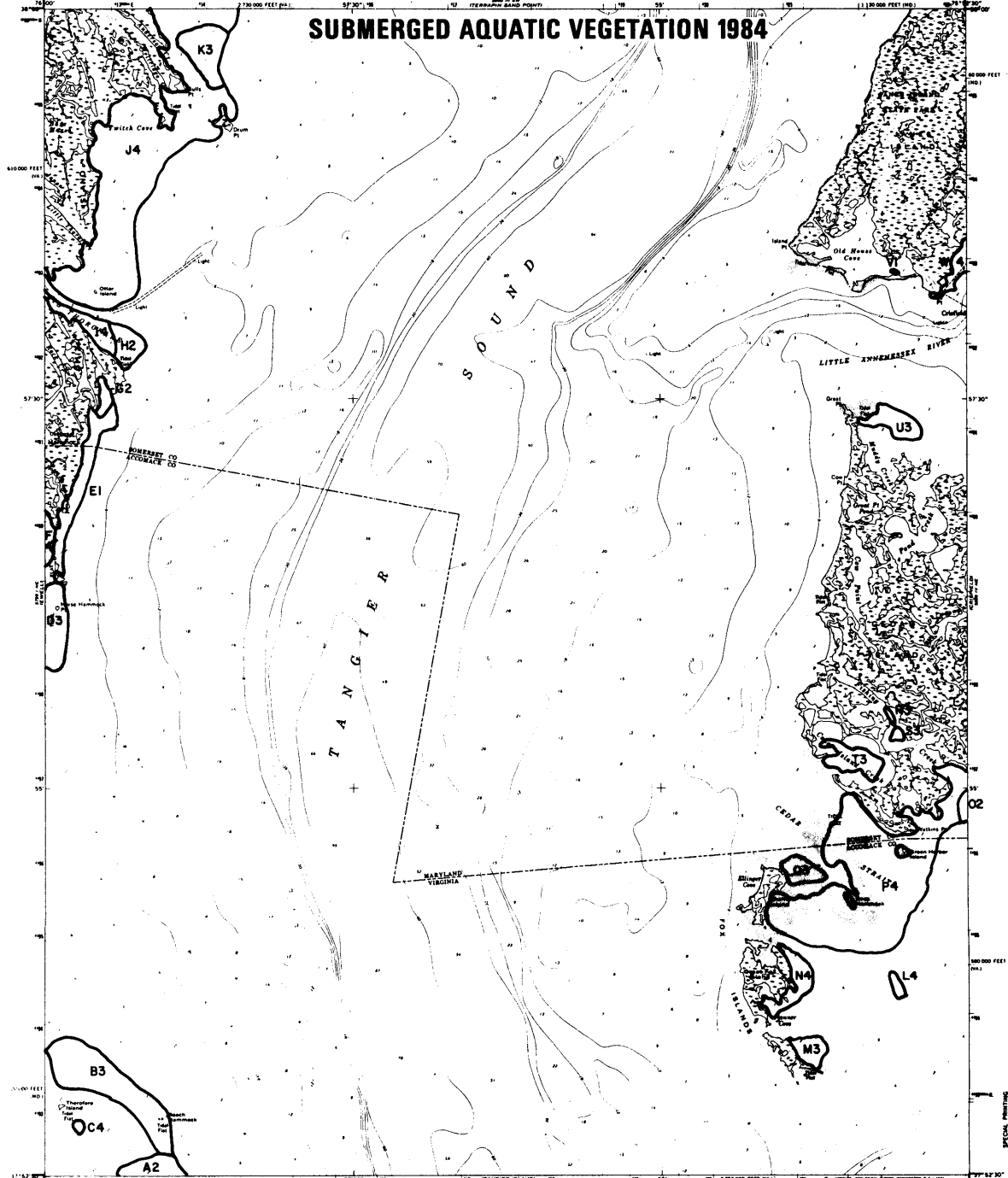
EWELL, MD.-VA.
SCALE 1:24,000
CONTOUR INTERVAL 5 FEET
DATHUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET - DATUM IS MEAN LOW WATER
FOR INFORMATION OF USER, THIS MAP IS NOT TO BE USED AS A NAVIGATIONAL CHART
THIS MAP COMPLETES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20242
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTEVILLE, VIRGINIA 22903
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST



ROAD CLASSIFICATION
1-1/2" only road, all weather,
improved surface

EWELL, MD.-VA.
HEX EWELL 10 QUADRANGLE
N3752 S. - W7600 7.5
1980
AMS 5791 1 HE-SERIES 1984

SUBMERGED AQUATIC VEGETATION 1984



Mapped, edited and published by the Geological Survey in cooperation with Commonwealth of Virginia agencies in cooperation with USGS and USCGS
Control by USGS and USCGS
Topography by photogrammetric methods from aerial photographs taken 1967. First checked 1968. Supplemental data: Map Service map dated 1962.
Selected hydrographic data compiled from USCGS Chart 568 (1969).
This information is not intended for navigational purposes.
Projection: 1927 North American datum.
10,000 foot grid based on Maryland coordinate system, and Virginia coordinate system, south over 1000 meter Universal Transverse Mercator grid ticks, zone 18, shown in blue.

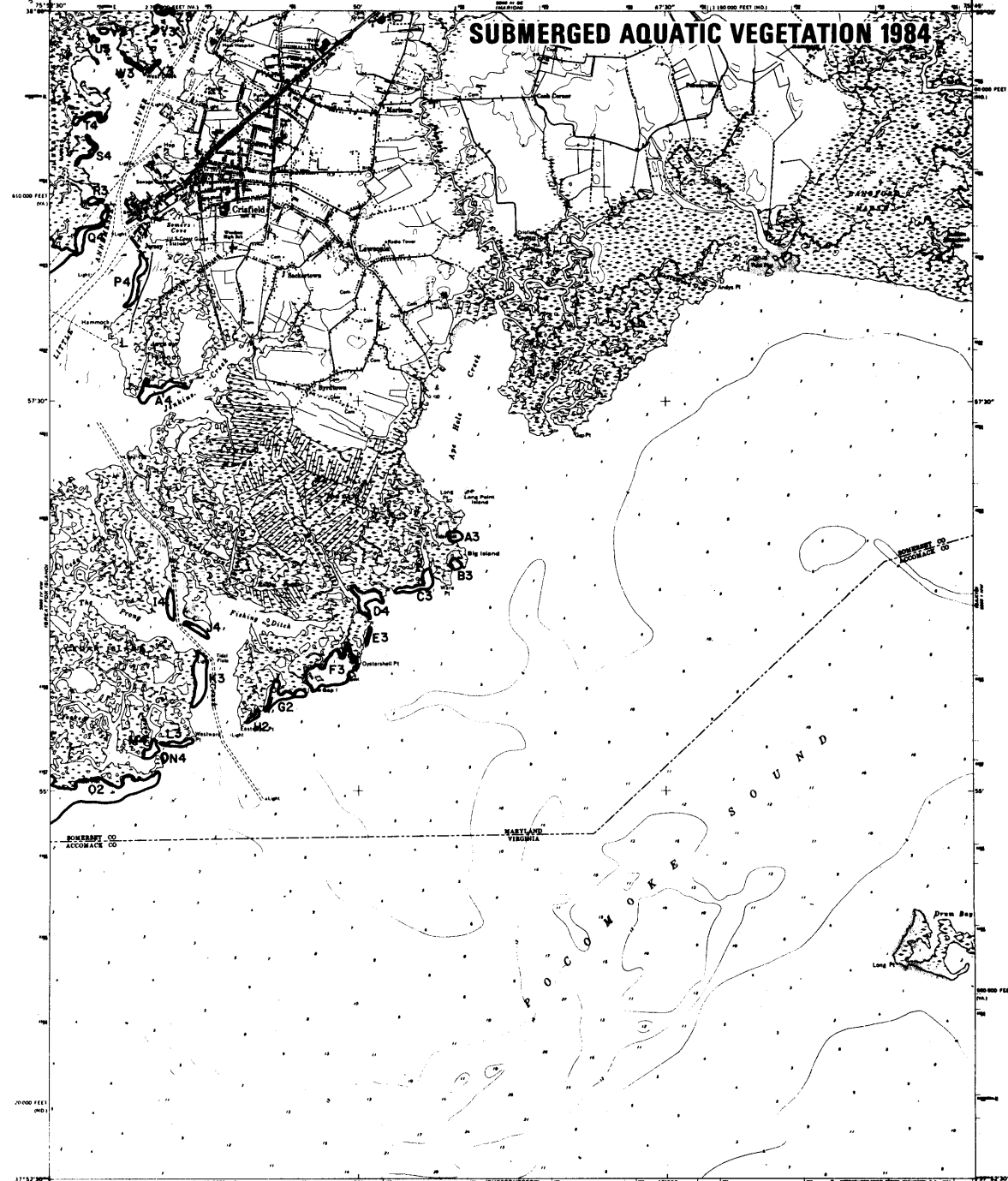
CONTOUR INTERVAL 5 FEET
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
SOUNDINGS SHOW DEPTHS TO THE NEAREST FOOT OF MEAN LOW WATER
THE MEAN RANGE OF THE TIDE IS APPROXIMATELY 12 FEET

SCALE 1:24,000
THIS MAP COMPLETES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20508
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA 22908
A POLYMER-BINDING TOPOGRAPHIC MAP AND SYMBOLS IS AVAILABLE ON REQUEST



GREAT FOX ISLAND, MD.-VA.
WWW.GPO.COM/19-508-108-108
1984
AMS 3000-17-RV-SERIES 1984

SUBMERGED AQUATIC VEGETATION 1984

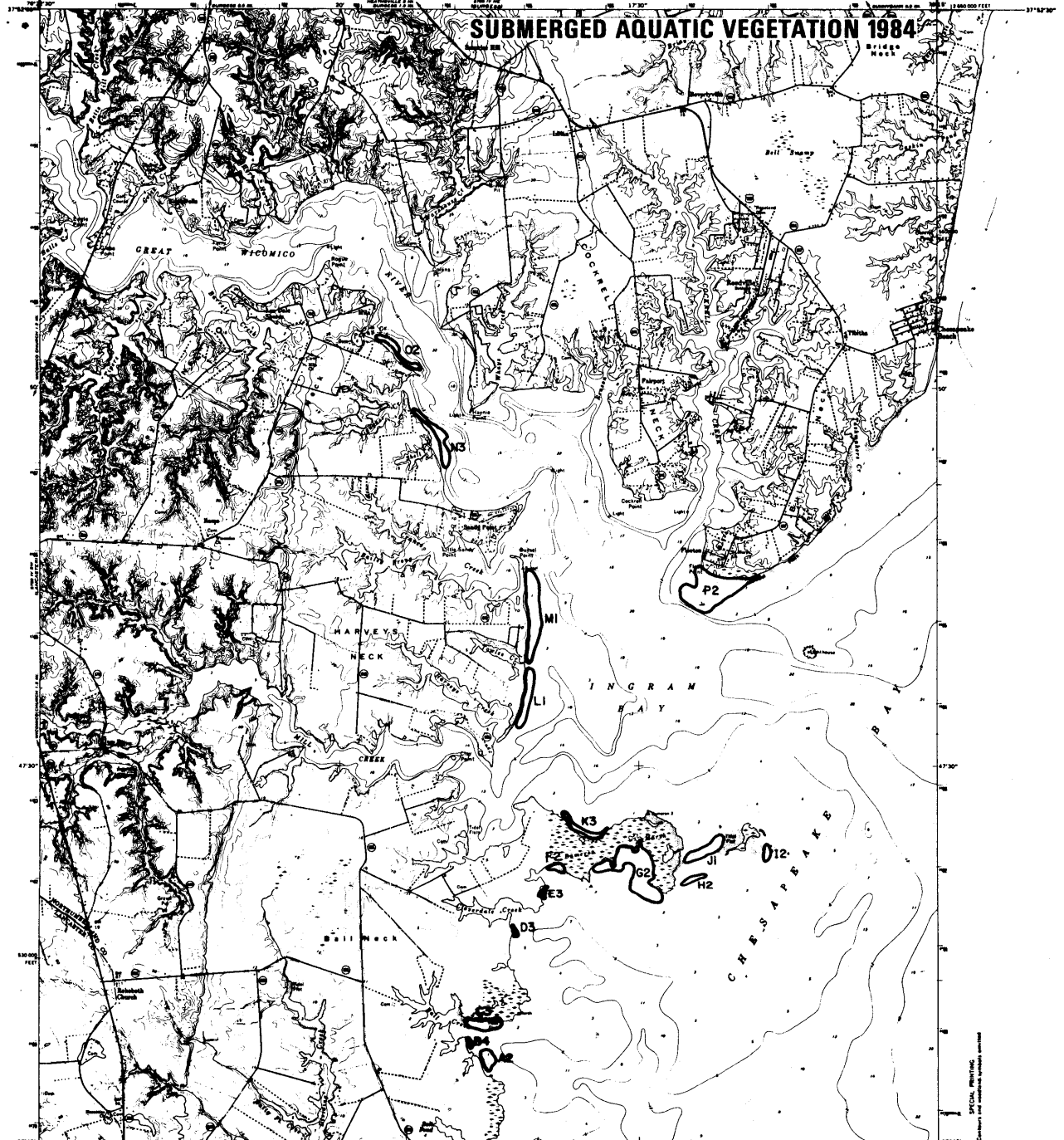


Map compiled and published by the Geological Survey in cooperation with Commonwealth of Virginia agencies. Control by USGS and USCGS. Topography by photogrammetric methods from aerial photographs taken 1967. Field checked 1968. Submerged Aquatic Vegetation data compiled from USCGS Chart 568 (1968). This information is not intended for navigational purposes. Photocentric projection. 1927 Mean American Datum. 10,000-foot grid based on Maryland coordinate system, and Virginia coordinate system, south zone. 1000-meter Universal Transverse Mercator grid ticks, zone 18, shown in blue. Fine red dashed lines indicate section fence and field lines where generally visible on aerial photographs. This information is uncorrected. Short dashed blue lines indicate electrical line outlines as visible on aerial photographs.

CONTOUR INTERVAL 5 FEET
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET - DATUM IS MEAN LOW WATER
IMPROVED SURFACE
UNIMPROVED SURFACE
STATE ROUTE
CRISFIELD, MD.-VA.
1:24,000
1980
ANN 8008 IV RE-CHECKS 1983



CRISFIELD, MD.-VA.
7.5 MINUTE SERIES (TOPOGRAPHIC)
MAP COMPILED BY QUADRANGLE
1980
ANN 8008 IV RE-CHECKS 1983



Revised, edited, and published by the Geological Survey
Control by USGS and USCAS
Topography by photogrammetric methods from aerial
photographs taken 1967. Tide charted 1968
Supersedes Army Map Service map 64544 1964
Selected hydrographic data compiled from USCAS Chart 534 (1969)
This information is not intended for navigational purposes
Polyconic projection. 1987 North American datum
10,000-foot grid based on Virginia coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks,
zone 18, shown in blue
Faint red dashed lines indicate selected fence and field lines where
generally visible on aerial photographs. This information is uncharted

SCALE 1:74,000
CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
DITTO IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DITTO IS MEAN LOW WATER
SHOWING FROM SOUNDINGS OF 10 FEET TO 100 FEET
THIS MAP COMPLETES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20508
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA, 22908
A POLAR PROJECTION TOPOGRAPHIC MAP AND GRID IS AVAILABLE ON REQUEST



REEDVILLE
Primary Highways, 60 meters, Light-blue road, 40 meters,
hard surface Improved surface
Unimproved road, 40 or 60
meter
U.S. Route State Route
REEDVILLE, VA.
SEA LEVEL/FAHLE IF QUADRANGLE
83745—W7615/7.5
1988
AND WITH IT BY SEA-LEVEL YEAR

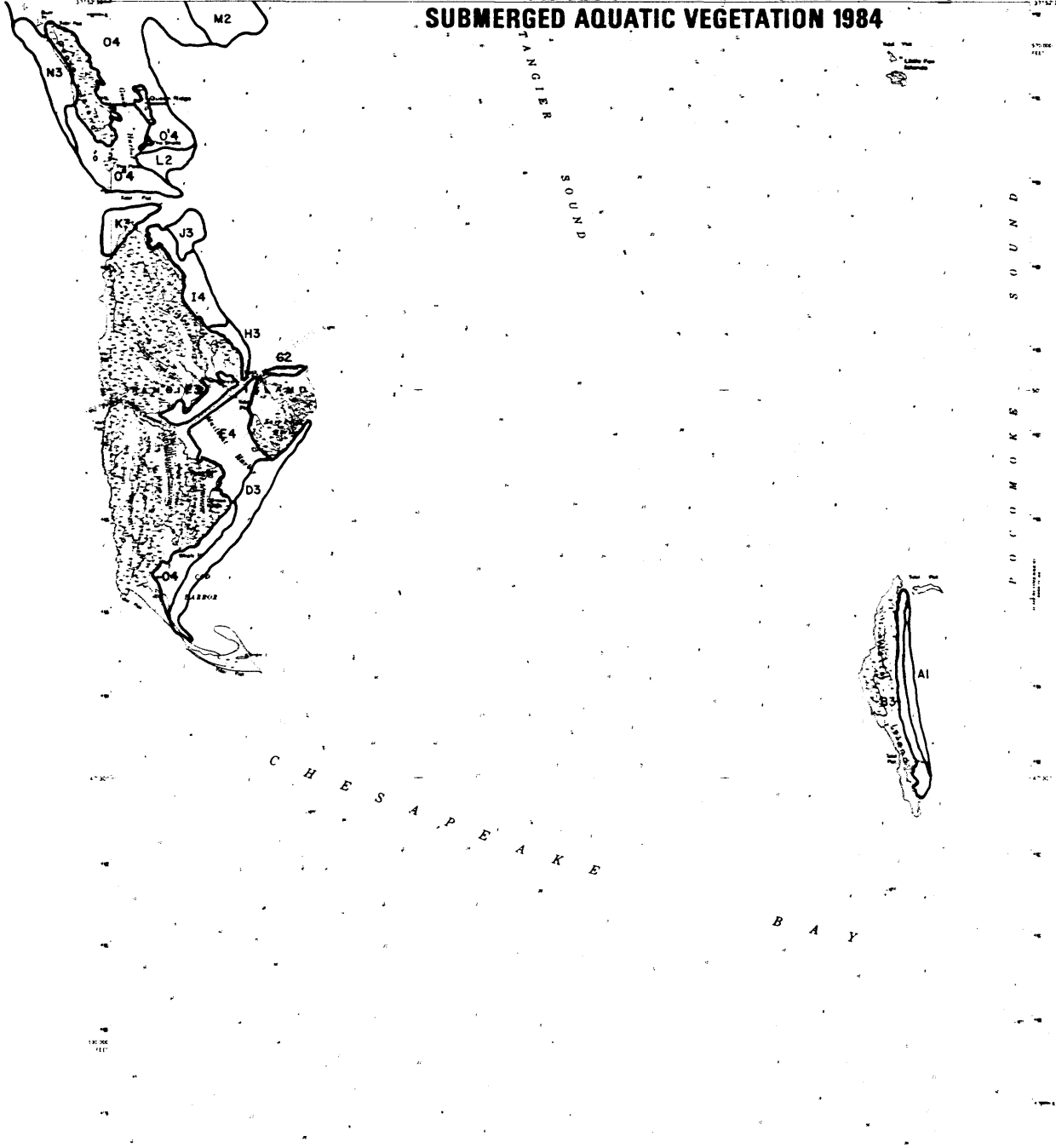
SPECIAL PRINTING
CONTAINS 100 UNCHARTED SYMBOLS

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
JAMES L. CALVERT, STATE GEOLOGIST

TANGIER ISLAND QUADRANGLE
VIRGINIA - ACCORACK CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
GPO: 1984-0-244-940-000

SUBMERGED AQUATIC VEGETATION 1984



Revised edition published by the Geological Survey
Series in 1953 and 1965
Revisions to photogrammetric methods from aerial photographs
used 1961 and checked 1968
Supervision by the State Service was done 1961
Sounding hydrographic data compiled from 1952-53 Chart 148, 1969
This information is not intended for navigational purposes
Horizontal projection - 1927 North American datum
1:25,000 feet and based on Virginia coordinate system, zone 18
1:250,000 horizontal projection for grid forms zone 18
shown in blue

SCALE 1:25,000
CONTROLLING INTERVAL 1:25,000
DEPTH INTERVALS AND SOUNDINGS IN FEET
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20541
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA 22902
A POLYMERIZABLE, TRANSPARENT, COPY AND STENCIL IS AVAILABLE ON REQUEST

TANGIER ISLAND

ACAC CLASSIFICATION
LIGHTS AND BUOYS
MUTUAL SURFACE

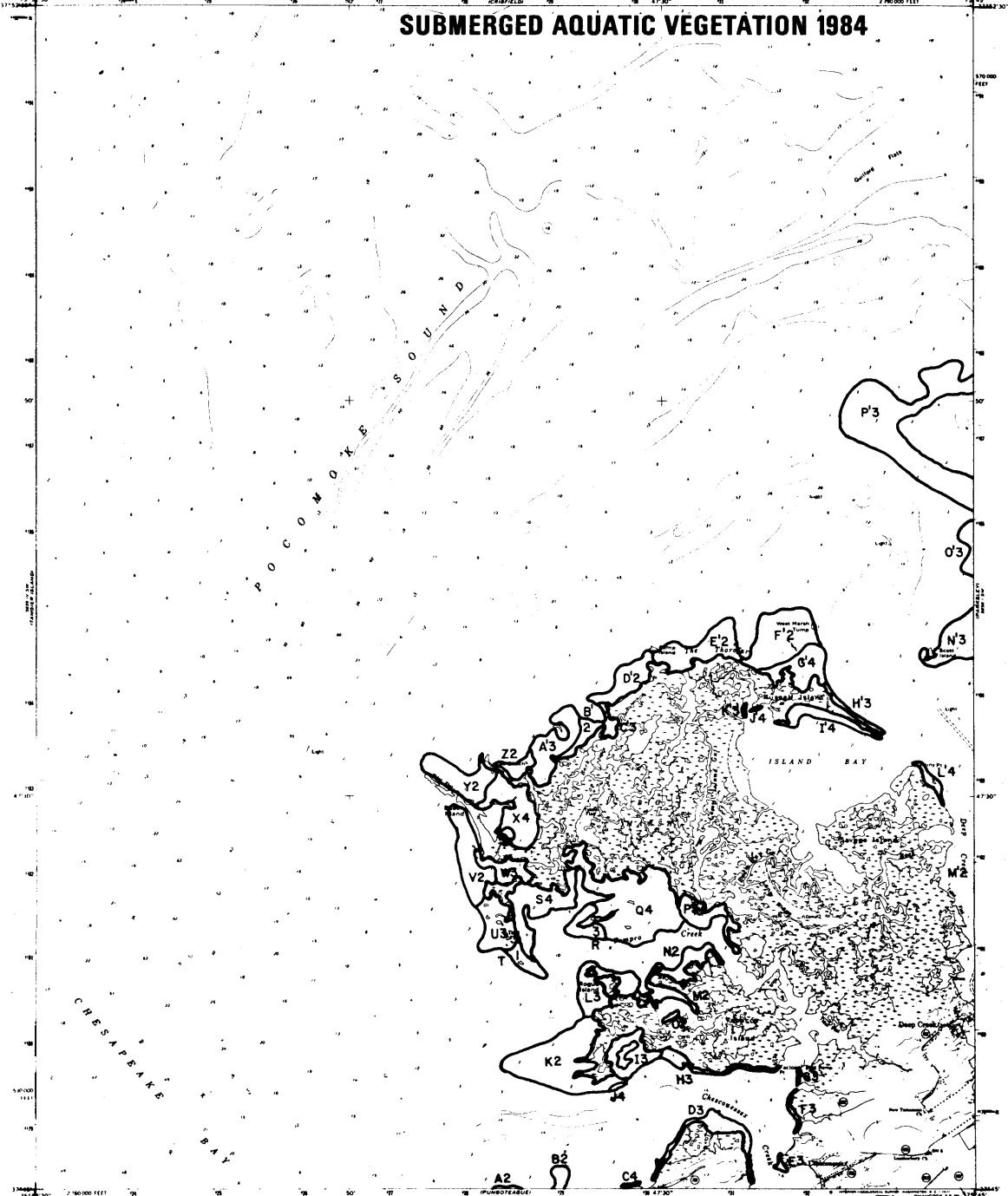
TANGIER ISLAND, VA
1984
1:25,000
AND 1984-1-244-940-000

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
JAMES L. CALVER, STATE GEOLOGIST

CHESCONESSEX QUADRANGLE
VIRGINIA—ACCOMACK CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
SEA CHANGELIER 14 QUADRANGLE
2,500,000 FEET

SUBMERGED AQUATIC VEGETATION 1984



Mapped, edited, and published by the Geological Survey
Control by USGS and USCGS
Topography by photogrammetric methods from aerial photographs
June 1967, June 1968, 1968
Supersedes Army Map Service map dated 1942
Selected hydrographic data compiled from USCGS Chart 568 (1969)
This information is not intended for navigational purposes
Projection, projection, 1927 North American datum
10,000 feet grid based on Virginia coordinate system, south zone
1,000-meter Universal Transverse Mercator grid, zone 18
Chart 11-100
Shore dashed blue lines indicate elliptical bay outlines
visible on aerial photographs

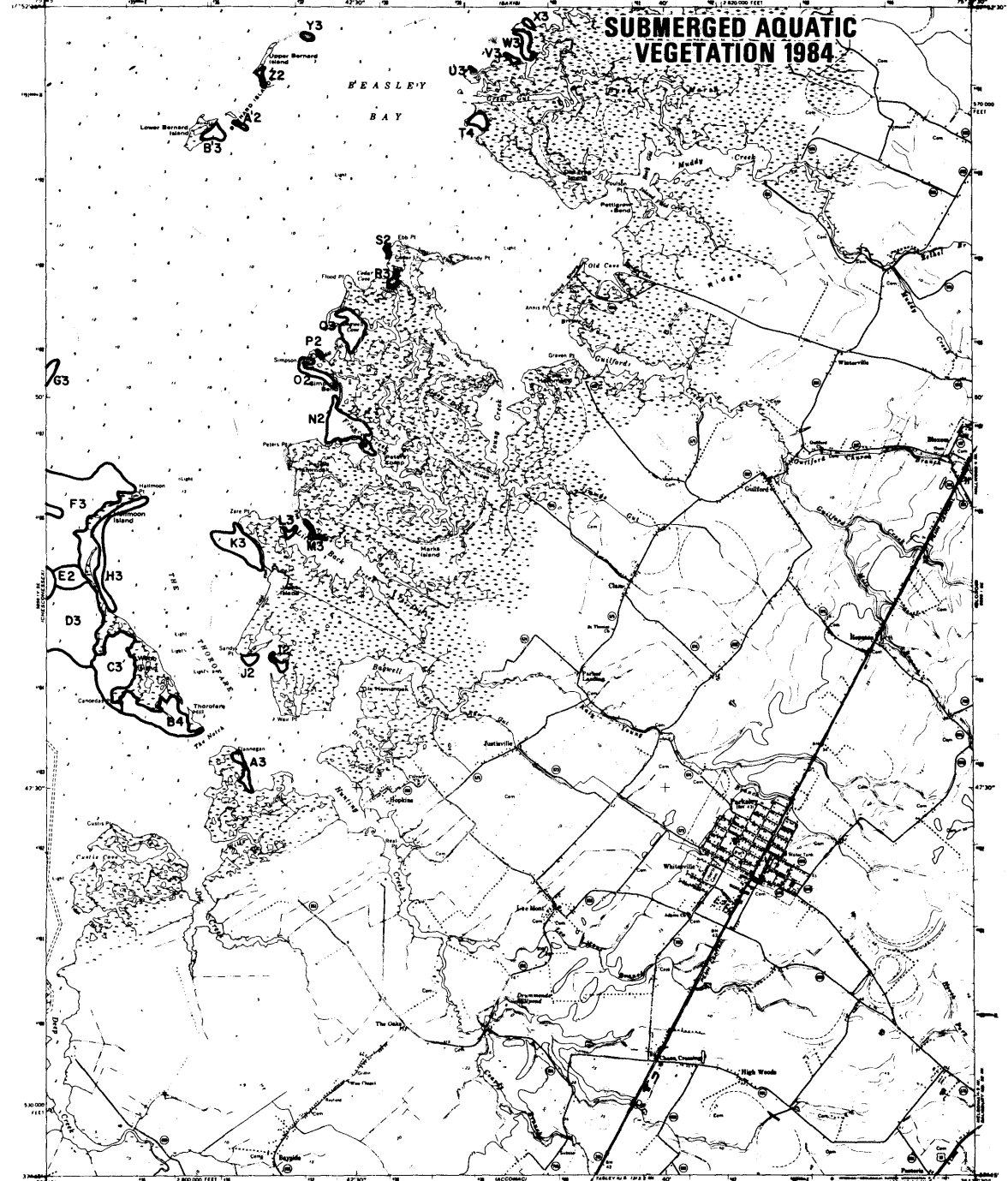
THIS MAP AND THE BATHYMETRIC DATA
HEREON ARE THE PROPERTY OF THE
GEOLOGICAL SURVEY



CONTOUR INTERVAL, 5 FEET
DATION IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DATION IS MEAN LOW WATER
THIS MAP COMPLETES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY WASHINGTON, D.C. 20242
AND VIRGINIA DIVISION OF MINERAL RESOURCES CHARLOTTEVILLE, VIRGINIA 22902
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

CHESCONESSEX
Light duty road, all weather
Unimproved road, fair or dry
weather
State Route

CHESCONESSEX, VA.
SEA CHANGELIER 14 QUADRANGLE
N3745—W7545/7.5
1984
ANN 5009 14 SE—SERIES 1984



Mapped, edited and published by the Geological Survey
Control by USGS and USCGS
Topography by photogrammetric methods from aerial
photographs taken 1967. Field checked 1968.
Supersedes Army Map Service map dated 1942.
Selected hydrographic data compiled from USCGS Chart 568 (1969).
This information is not intended for navigational purposes.
Publication projection: 1927 North American datum.
10,000-foot grid based on Virginia coordinate system, south zone.
1000-foot Universal Transverse Mercator grid ticks, zone 18,
shown in blue.
Five red dashed lines indicate selected fence and hotel lines where
generally visible on aerial photographs. This information is unselected.
Short dashed blue lines indicate electrical bay outlines
-made on aerial photographs.

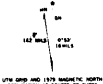
SCALE 1:24,000
CONTOUR INTERVAL 5 FEET
DEPTH CURVES AND SOUNDINGS IN FEET - DATUM IS MEAN SEA LEVEL
IMPROVED SURFACE
UNIMPROVED ROAD, BAR OR DRY
WATER SURFACE
U.S. ROAD
STATE ROAD
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20542
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTEVILLE, VIRGINIA 22908
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND STRANDS IS AVAILABLE ON REQUEST

PARKSLEY
PARKSLEY, VA.
83745-WP537575
1986
ANN 568-1 SW - SERIES 5454

SUBMERGED AQUATIC VEGETATION 1984



Mapped, edited, and published by the Geological Survey
Contract to USGS and USCGS
Topography by photogrammetric methods from aerial
photographs taken 1967. Field checked 1968
Supersedes U. S. Coast and Geodetic Survey map dated 1946
Selected hydrographic data compiled from USCGS Chart 534 (1969)
Reference elevation: 1929 Mean American Datum
10,000-foot grid based on Virginia coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks,
zone 18, shown in blue
To place on the projected North American Datum 1983
move the projection lines 10 meters south and
29 meters west as shown by dashed corner ticks
Faint not dashed lines indicate selected fence and road lines where
generally visible on aerial photographs. This information is unclassified

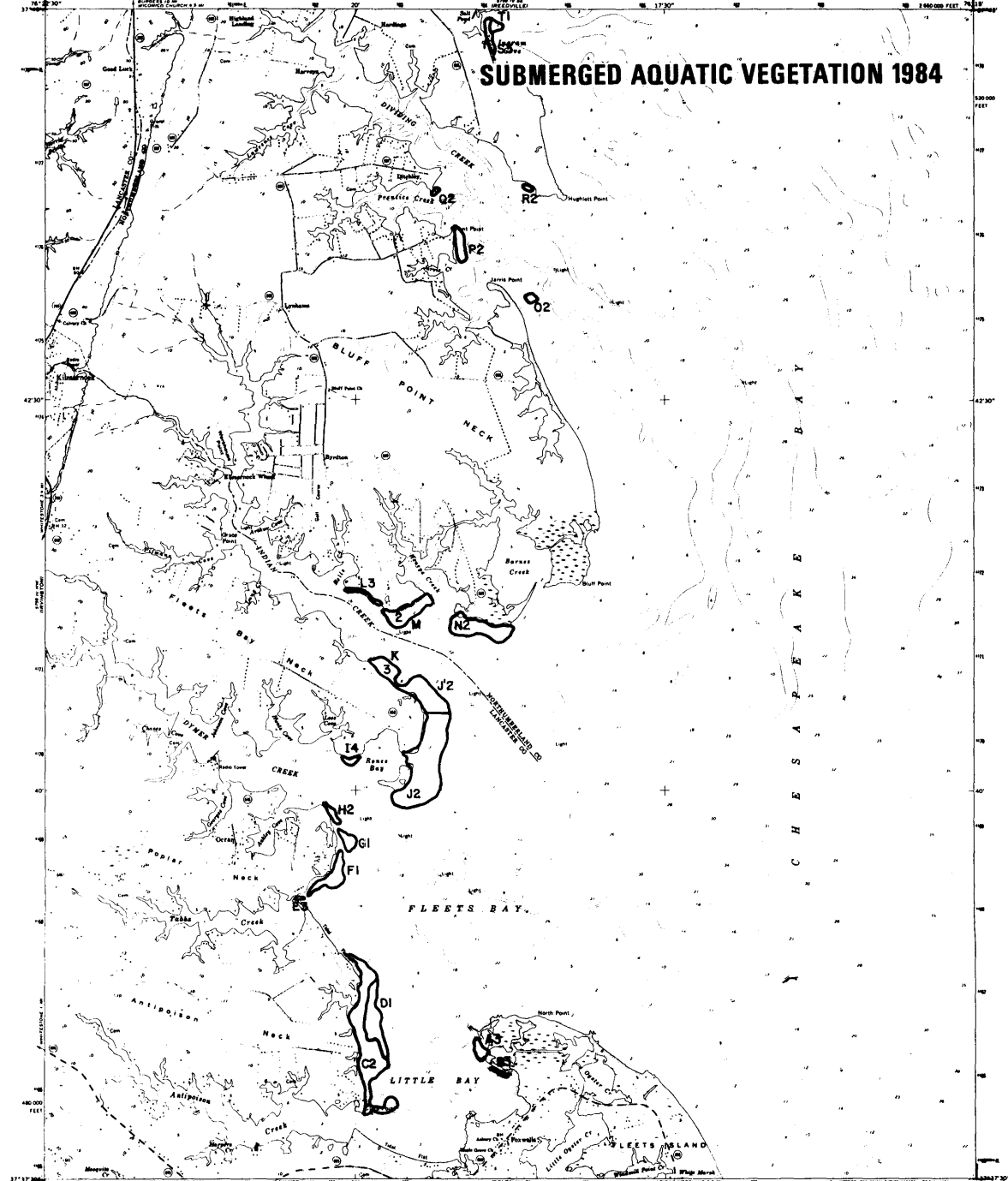


SCALE 1:24,000
CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5 FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET-DATUM OF MEAN LOW WATER
LOCALITY NAMES ARE NOT SHOWN IN PURSUE TO THE
POLAR PROJECTIONS OF THE BUREAU OF OCEANOGRAPHY
THIS MAP COMPLETES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTEVILLE, VIRGINIA 22903
A FOLDER DISSEMINATING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

IRVINGTON
Primary highway all weather hard surface
Secondary highway all weather hard surface
Unimproved road, fair or dry weather
State Route

IRVINGTON, VA.
H37373-47622 3/75
1:500
PHOTOGRAPHED 1978
DMA 5799 01 874-SERIES 1544

SUBMERGED AQUATIC VEGETATION 1984



Mapped, edited and published by the Geological Survey
Control by USGS and NOS/NOAA
Topography by photogrammetric methods from aerial
photographs taken 1967. Tied to chart 1968
This information is not intended for navigational purposes
Position projection: 10,000-foot grid in GCS based on
Virginia coordinate system, North zone
1000-meter Universal Transverse Mercator grid (zone
18) shown in blue. 1927 North American Datum
To place on projected North American Datum 1983
repeat the projection zone 18 meters south and
29 meters west as shown by dashed corner ticks
Map discontinued 1978
No major cultural or drainage changes observed

SCALE 1:24,000
CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5 FOOT CONTOURS
NATIONAL GEODETIC DATUM OF 1983
DEPTH CURVES AND SOUNDINGS IN FEET-DATUM IS MEAN LOW WATER
AND SOUNDINGS IN METERS-DATUM IS MEAN LOW WATER
SHORELINE SOUNDINGS REPRESENT THE JANUARY 1984 OR NEAREST WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 1.1 FEET
THIS MAP COMPLETES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22089
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTEVILLE, VIRGINIA 22088
A POLAR GRID COORDINATE MAP AND SYMBOLS IS AVAILABLE ON REQUEST

FLEETS BAY
Primary highway, all weather Light-duty road, all weather
Hard surface Improved surface
Secondary highway, all weather Unimproved road, wet or dry
Hard surface weather
State Route

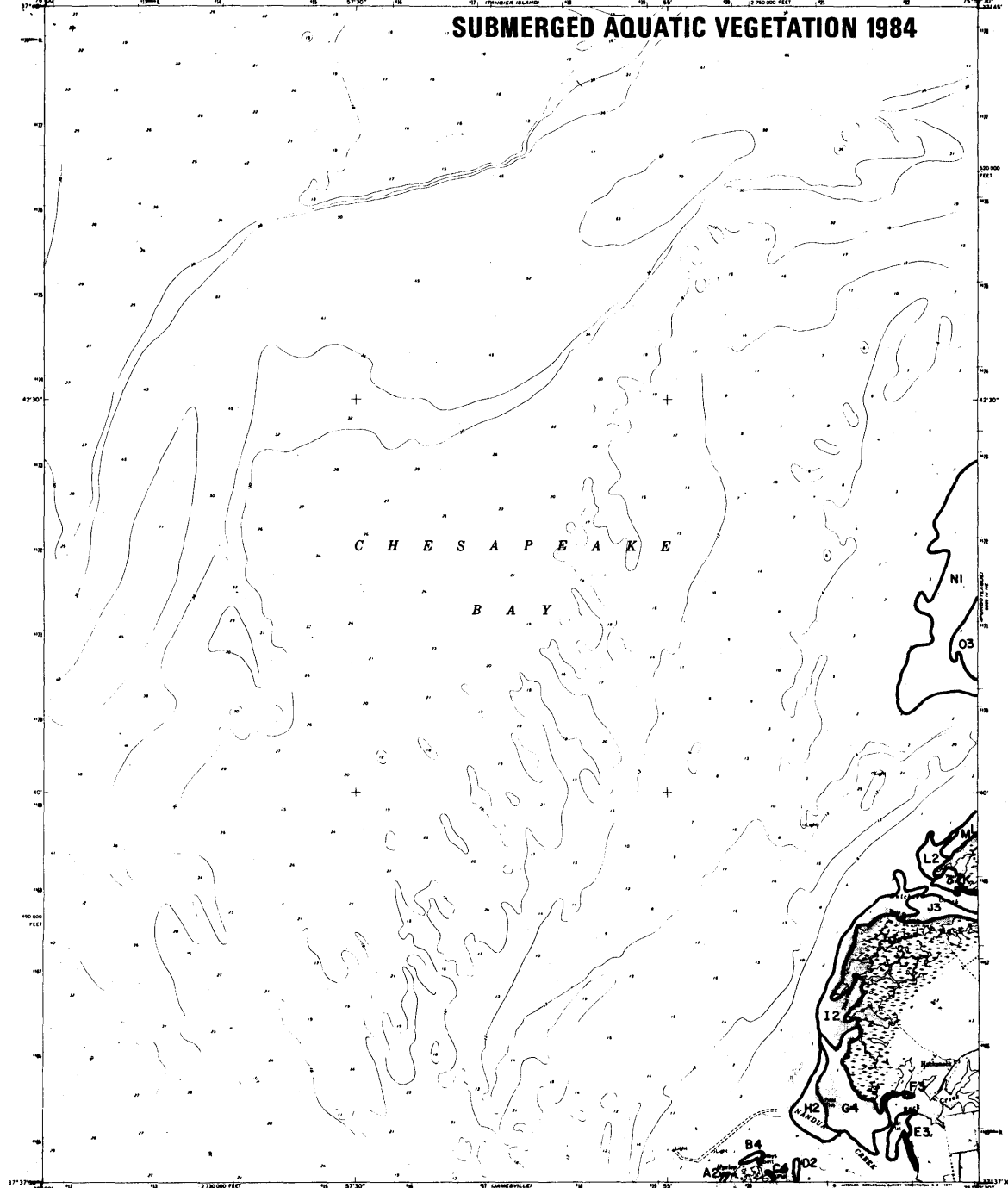
FLEETS BAY, VA
H3737.5-W7615.7.5
1988
PHOTOGRAPHICALLY DERIVED 1978
DMA 576 IN PRE-SERIES 1988

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
JAMES L. CALVER, STATE GEOLOGIST

NANDUA CREEK QUADRANGLE
VIRGINIA—ACCOMACK CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

SUBMERGED AQUATIC VEGETATION 1984



Mapped, edited, and published by the Geological Survey
Control by USGS and USCGS
Topography by photogrammetric methods from aerial photographs taken 1963. Field checked 1968
Supersedes Army Map Service map dated 1942
Selected bathymetric data compiled from USCGS Charts 564 (1968) and 568 (1969). This information is not intended for navigation purposes.
Projection: conic, 1927 North American datum
10,000 foot grid based on Virginia coordinate system, with zone 1800-north Universal Transverse Mercator grid ticks, zone 18, shown in blue

ONE INCH TO THE HORIZONTAL
EQUATION TO CENTER OF MASS

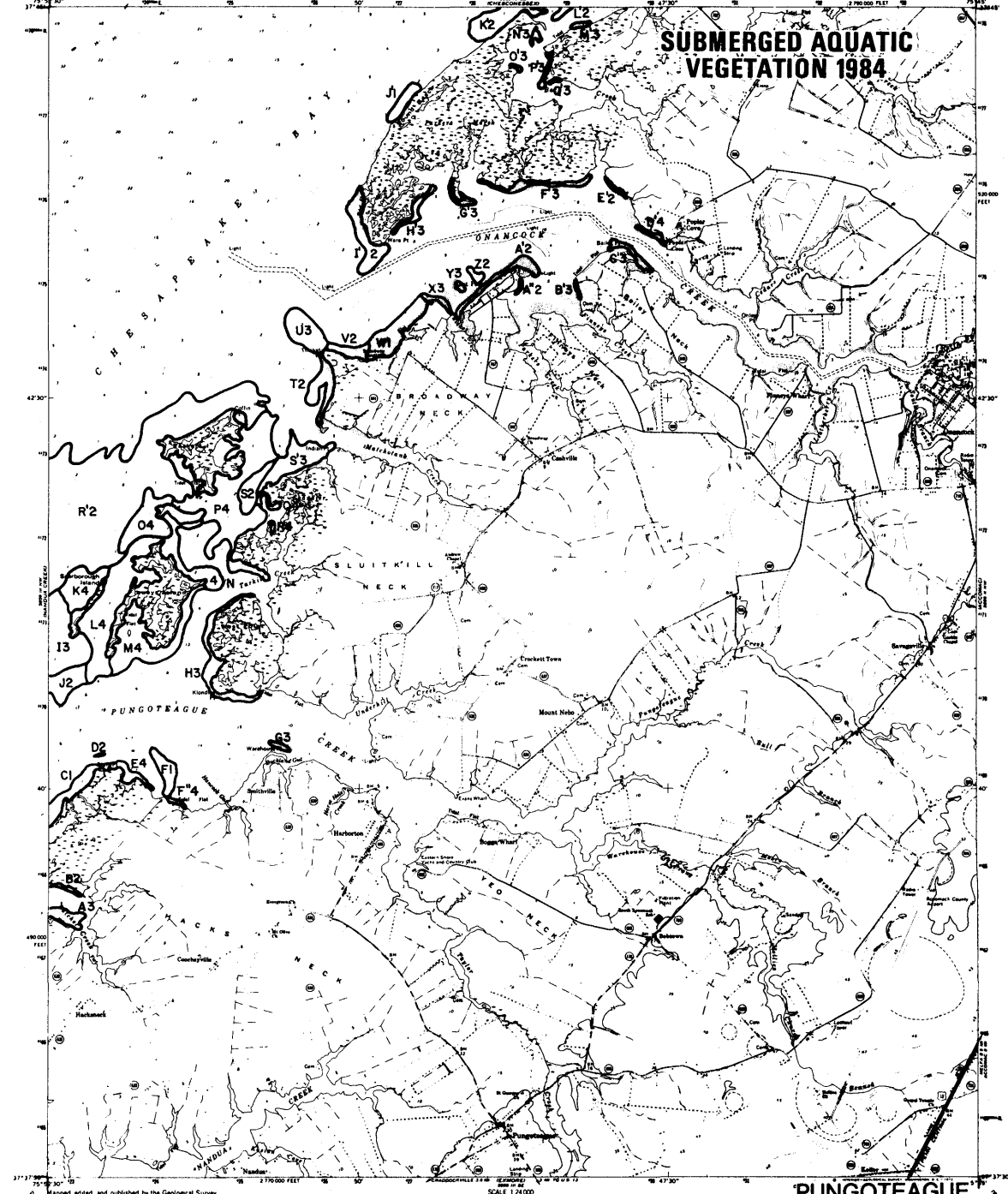
SCALE 1:2000
QUANTUM INTERVAL: 5 FEET
DEPTH IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DASHES IN FEET—DASHES IN FEET—DASHES IN FEET
SOUNDINGS IN FEET—DASHES IN FEET—DASHES IN FEET
THIS MAP COMPLEYS WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20508
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA 22908
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND STANDARDS IS AVAILABLE ON REQUEST



NANDUA CREEK

Light-duty road, all weather. Unimproved road, fair or dry weather.

NANDUA CREEK, VA.
N3307.5—W552.57.5
1988
AND 5050 IN HWY-SERIES 1004



Map compiled and published by the Geological Survey
Control by USGS and USCGS
Topography by photogrammetric methods from aerial photographs
taken 1967. First checked 1968
Substrate Army Map Service map dated 1943
Selected hydrographic data compiled from USCGS Charts
264 (1970) and 568 (1968). This information is not intended
for navigational purposes
Projection project on 1927 North American datum
10,000-foot grid based on Virginia coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 18
shown on map
Short dashed blue lines indicate altitudes by outlines, based on
aerial photographs

SCALE 1:24,000

CONTOUR INTERVAL 5 FEET
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET-DATUM MEAN LOW WATER
UNLESS OTHERWISE INDICATED
THIS MAP COMPLEYS WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20542
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTEVILLE, VIRGINIA 22903
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

PUNGOEAGUE
Primary highway
hard surface
Secondary highway
hard surface
Unimproved road
Interstate Route
U.S. Route
State Route

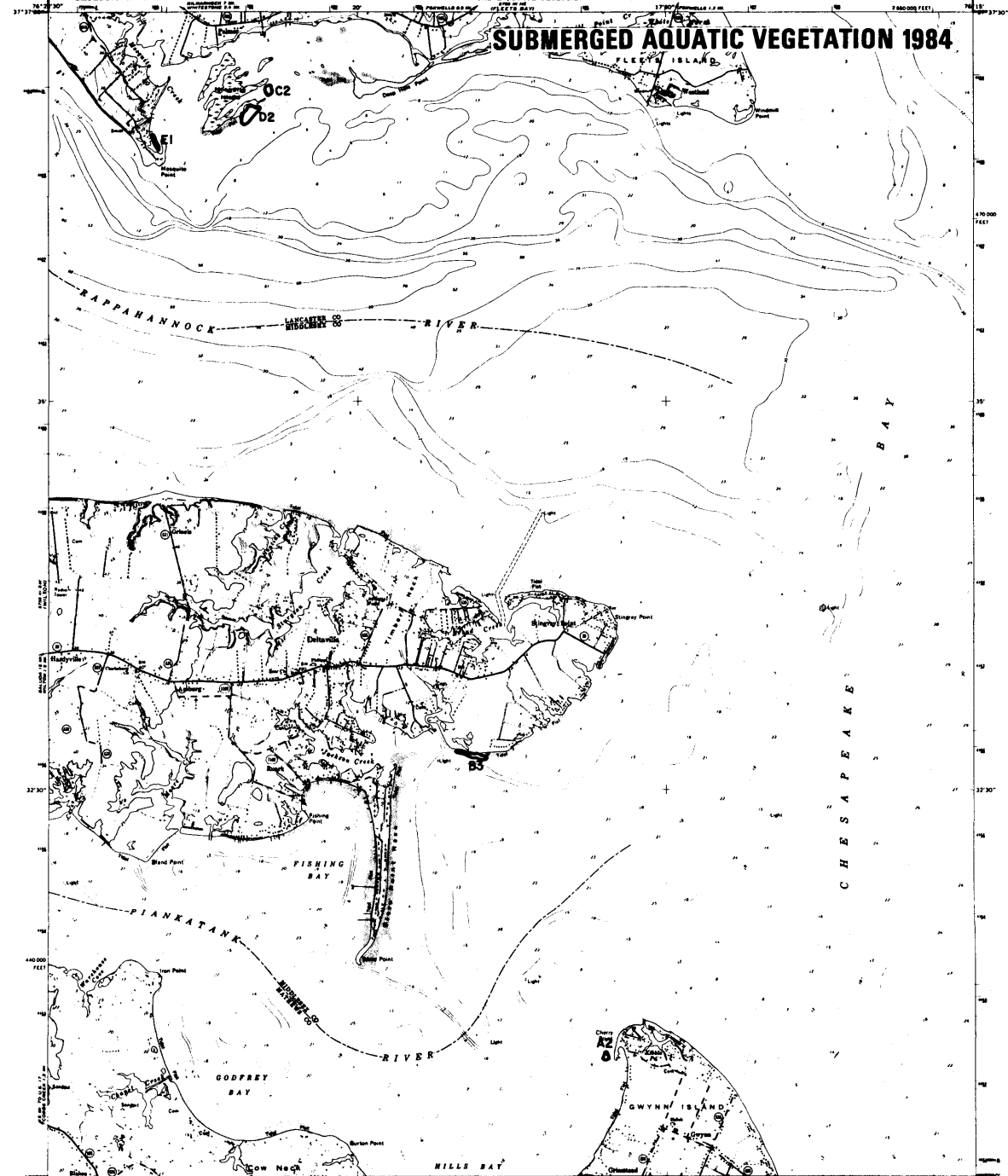
PUNGOEAGUE, VA.
437375-7565/75
1988
ANN 508 IN 114-SERIES 7504

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
JAMES L. CALVER, STATE GEOLOGIST

DELTAVILLE QUADRANGLE
VIRGINIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
SEA DATUM: MEAN LOW WATER

SUBMERGED AQUATIC VEGETATION 1984

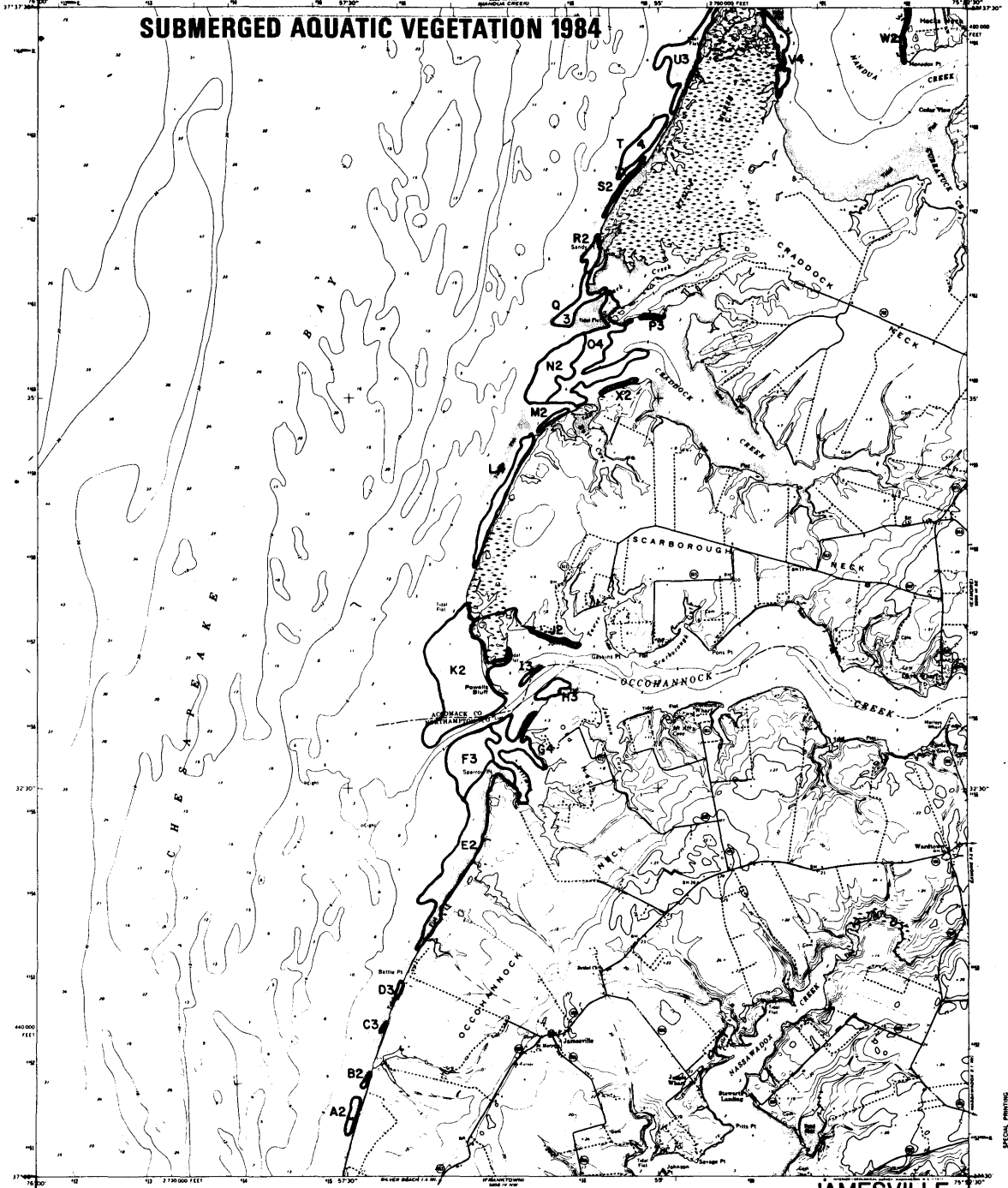


Map compiled and published by the Geological Survey
Control by USGS, USCGAS and USCE
Topography by photogrammetric methods from aerial
photographs taken 1963. Field checked 1964.
Supersedes U. S. Coast and Geodetic Survey map dated 1948.
Selected hydrographic data compiled from USCGAS Chart 534 (1964).
This information is not intended for navigational purposes.
Polaric projection. 1927 North American datum.
10,000-foot grid based on Virginia coordinate system, south zone.
1000-meter Universal Transverse Mercator grid ticks.
Zone 18 shown in blue.
Fine red dashed lines indicate selected fence and field lines where
generally visible on aerial photographs. This information is uncorrected.

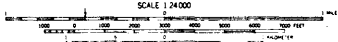
SCALE 1:24,000
CONTOUR INTERVAL: 5 FEET
DEPTH IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—CALCULATED FROM MEAN LOW WATER
SHOULDER LINES REPRESENT THE APPROXIMATE LINE OF MEAN LOW WATER
THE MEAN TIDE OF THE A TROPICALLY TIDE
THIS MAP COMPLETES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, WASHINGTON, D. C. 20508
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

DELTAVILLE
Heavy duty Light duty
Medium duty Unimproved dirt
Sole Route
DELTAVILLE, VA
SEA DATUM: MEAN LOW WATER
H1730-W7615/75
1984
ANS 579-11 SE-SERIES 1934

SUBMERGED AQUATIC VEGETATION 1984



Mapped, edited and published by the Geological Survey
Control by USGS and USCGS
Topography by photogrammetric methods from aerial
photographs taken 1967. Field checked 1968
Supersedes Army Map Service map dated 1963
Selected bathymetric data compiled from USCGS Chart 564 (1968)
This information is not intended for navigational purposes
Planetary coordinates: 1983 North American datum
10,000 foot grid based on Virginia coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks
Zone 18, shown in blue
Fine red dashed lines indicate selected fence and trap lines where
generally visible on aerial photographs. This information is unclassified



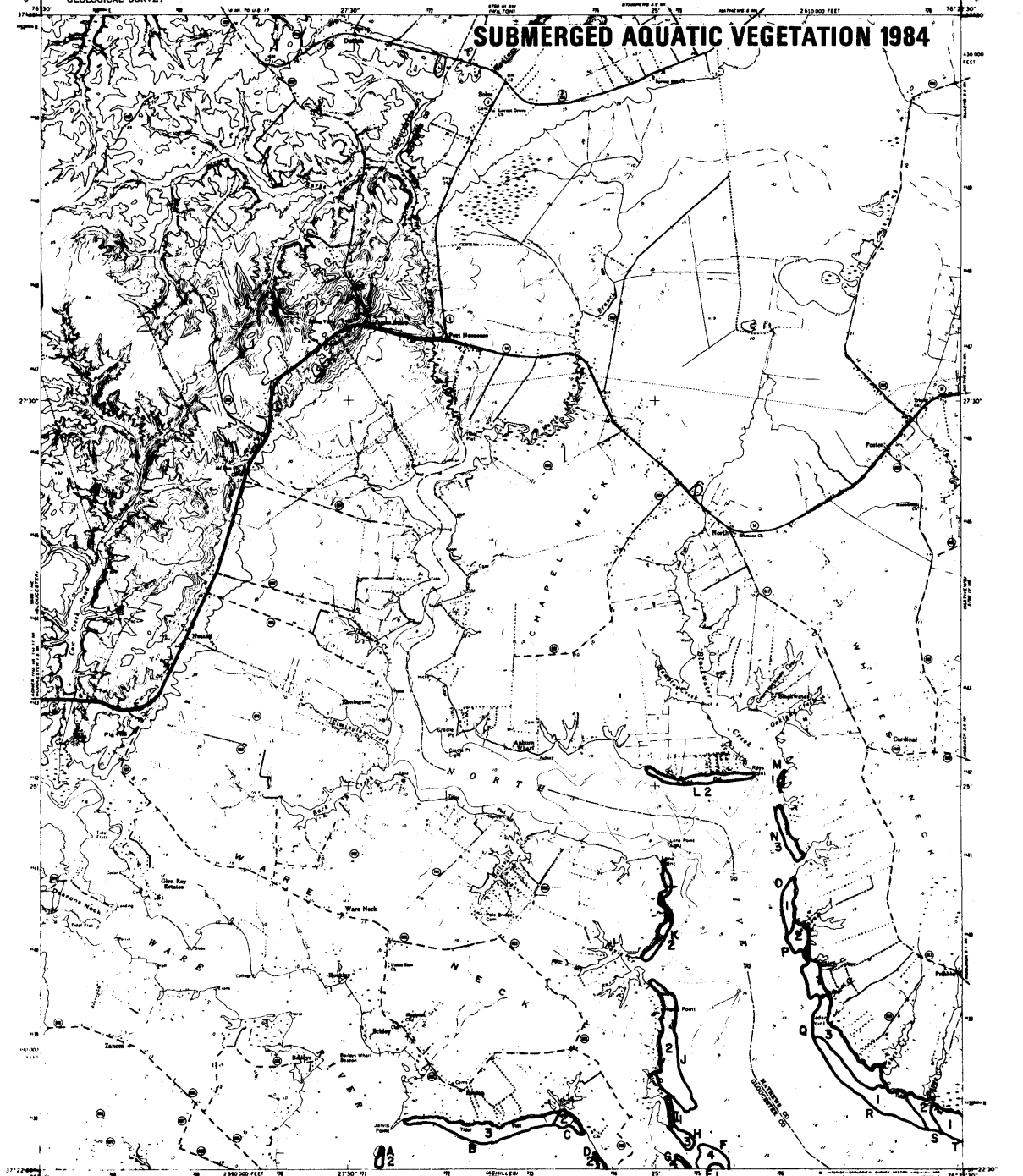
CONTOUR INTERVAL 5 FEET
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
NOTE: NEAR SOUNDINGS TO BE INTERPRETED AS FEET UNLESS NOTED OTHERWISE

THIS MAP COMPLETES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20242
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA 22903
A COLOR ENLARGING TOPOGRAPHIC MAP AND SYMBOLS IS AVAILABLE ON REQUEST

JAMESVILLE
Secondary highway all month Light duty road all weather
hard surface Improved surface
Unimproved road fair or dry
weather
State Route

JAMESVILLE, VA
83730-W7552 5/75
1968
ANS 5000 11 SW-SERIES V434

SUBMERGED AQUATIC VEGETATION 1984



Mapped, edited, and published by the Geological Survey
Control by USGS, NOS/NOAA, and Virginia Fisheries Commission
Topography by photogrammetric methods from aerial
photographs taken 1962. Field checked 1965. Supplement
U. S. Coast and Geodetic Survey map dated 1948
Selected bathymetric data compiled from NOS/NOAA Chart 494 (1964)
This information is not intended for navigational purposes
Graphic projection: 10,000-foot grid based on
Virginia coordinate system, North zone
1,000-meter Universal Transverse Mercator grid 18N
Zone 18N shown on base 1927 North American Datum
10 miles on the projected North American Datum 1983
more the projection zone 10 meters north and
79 meters west as shown by dashed center ticks
For not detailed from original aerial photos and field notes unless
generally visible on ground photographs. This information is unclassified

VERTICAL DATUM: MEAN SEA LEVEL
ELEVATION AT CENTER OF SHEET
Contours shown in purple compiled in cooperation
with Commonwealth of Virginia agencies from aerial
photographs taken 1972 and other source data.
This information not field checked. Map dated 1980

SCALE 1:24,000
CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1989
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
THE RELATIONSHIP BETWEEN THE TWO DATUMS IS UNKNOW
SOUNDING DEPTH REPRESENTS THE APPROPRIATE USE OF MEAN LOW WATER
THE UNDATED RANGE OF FOG IS APPROXIMATELY 15 FEET
THIS MAP COMPLETES THE NATIONAL MAP COORDINATE STANDARD
FOR SALE BY U. S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 20192
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA 22902
A FOUR-DIGIT TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

WARE NECK
Virginia
Neighb. only Unimproved d.t.
State Road

WARE NECK, VA.
N3722 5 - W7622 5-7 9
1986
PHOTOGRAPHIC 1980
064 1316 (V. 06) - SERIES 114

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
JAMES L. CALVERT STATE GEOLOGIST

MATHEWS QUADRANGLE
VIRGINIA—MATHEWS CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
FROM MATHEWS 19 QUADRANGLE

SUBMERGED AQUATIC VEGETATION 1984



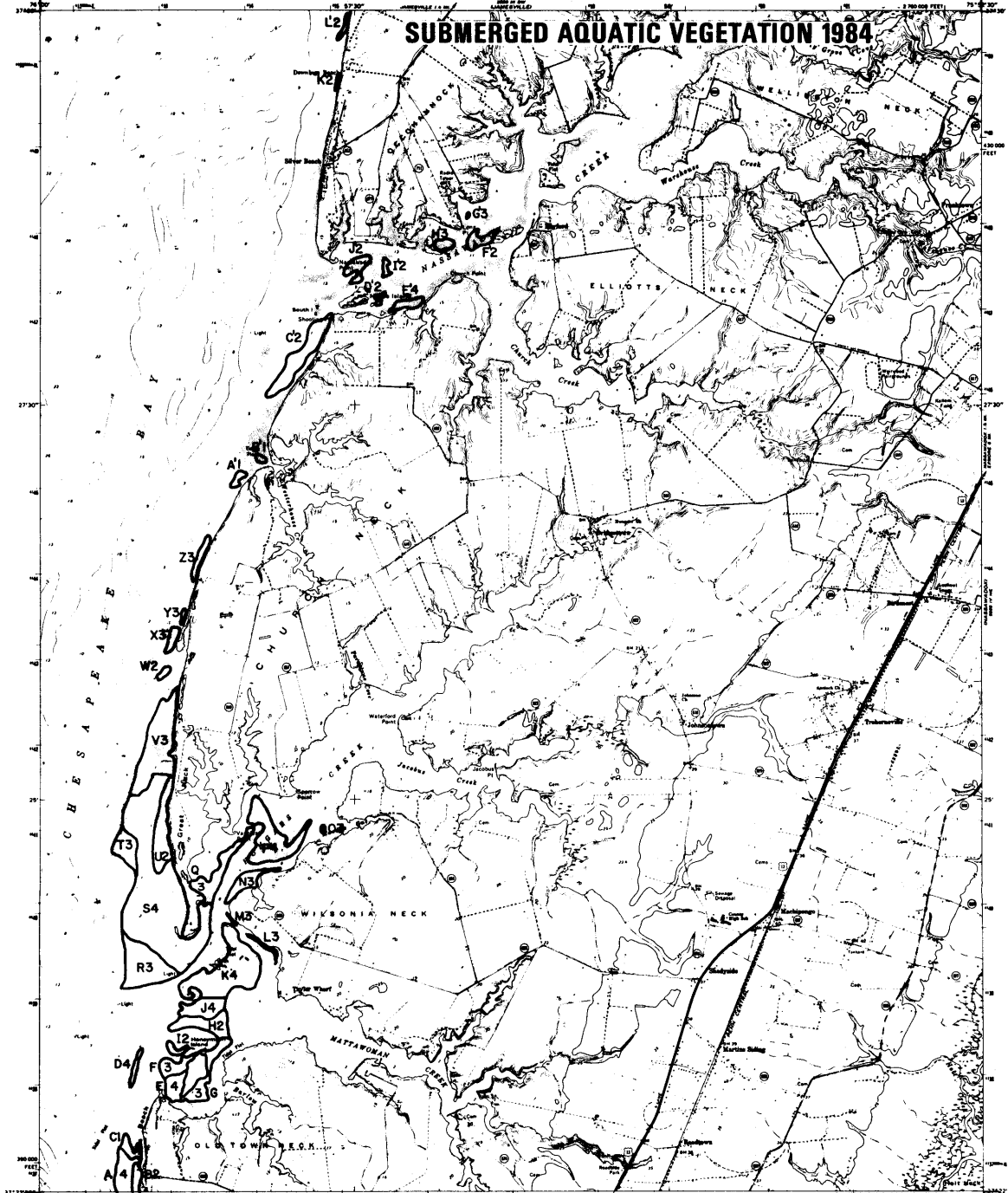
Mapped, edited, and published by the Geological Survey
Control by USGS, USCGS, and Virginia Fisheries Commission
Topography by photogrammetric methods from aerial photographs
taken 1963. Field checked 1965.
Submerged USCGS map dated 1968.
Selected hydrographic data compiled from USCGS Charts 496 and
534 (1964). This information is not intended for navigational purposes.
Projection: projection - 1927 North American datum
10 000-foot grid based on Virginia coordinate system, south zone
1000 meter Universal Transverse Mercator grid ticks,
zone 18 shown in blue.
F-m red dashed lines indicate surveyed fence and field lines where
generally visible on aerial photographs. This information is unchecked.



SCALE 1:24,000
CONTOUR INTERVAL 5 FEET
DEPTH CURVES AND SOUNDINGS IN FEET-DATUM IS MEAN LOW WATER
SHOWING SOME SOUNDINGS TO UNPUBLISHED LINE OF MEAN-LOW-WATER
THE MEAN TIDE OF TIDE IS APPROXIMATELY 1.8 FEET
THIS MAP COMPLETS WITH NATIONAL MAP ACCURACY STANDARDS 9
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20506
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTEVILLE, VIRGINIA 22903
A FOLDER CONTAINING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

MATHEWS
Heavy-duty Light-duty
Medium-duty Unimproved on
State Route
MATHEWS, VA.
MATH MATHEWS IS QUADRANGLE
847225-187617.5
1986
AMS 8750 IV PE-SERIES V58A

SUBMERGED AQUATIC VEGETATION 1984



Mapped, edited, and published by the Geological Survey
Copies by USGS and USCGS
Topography by photogrammetric methods from aerial photographs taken 1967. Field checked 1968.
Soundings from Map Service data dated 1963.
Selected hydrographic data compiled from USCGS Chart 566 (1968).
This information is not intended for navigational purposes.
Datum: geoid 1929 North American datum.
10,000-foot grid based on Virginia coordinate system, south zone.
1000-meter Universal Transverse Mercator grid ticks.
NAD 83, Zone 18, UTM in Meters.
Five red dashed lines indicate selected areas and field lines where ground truth is used in photogrammetry. This information is unclassified.
Short dashed blue lines indicate digital data by outlines visible on aerial photographs.

SCALE 1:24,000
CONTOUR INTERVAL 5 FEET
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET-DATUM IS MEAN LOW WATER
SOUNDING INTERVAL IS 10 FEET UNLESS OTHERWISE NOTED
THIS MAP COMPLETES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20542
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA 22903
A FOLDER RESUME (TOPOGRAPHIC MAPS AND PRODUCTS) IS AVAILABLE ON REQUEST

FRANKTOWN
Primary highway all weather hard surface
Secondary highway all weather hard surface
U.S. Route
State Route
Light-duty road all weather improved surface
Unimproved road fair or dry weather
1968
FRANKTOWN, VA.
437225-7552 5/75
AMS 850 1/1 W-7552 5/75



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

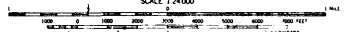
COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
JAMES L. CALVER, STATE GEOLOGIST

ACHILLES QUADRANGLE
VIRGINIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

SUBMERGED AQUATIC VEGETATION 1984

Mapped, edited, and published by the Geological Survey
Control by USGS, USFWS, and Virginia Fisheries Commission
Topography by photogrammetric methods from aerial
photographs taken 1962. Field checked 1969
Supersedes Army Map Service map dated 1957
Selected bathymetric data compiled from USGS Charts 492 and
494 (1944). This information is not intended for navigational purposes.
Datum: 1929 North American datum
10,000-foot grid based on Virginia coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks,
zone 18, shown in blue
Fine red dashed lines indicate selected fence and fold lines where
generally visible on aerial photographs. This information is unchecked.
Map photoreproduced 1973
No major culture or drainage changes observed

VIRGINIA STATE GEOLOGICAL SURVEY
DECLARATION OF STATUS OF SURVEY



CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET - DATUM 5 FEET LOW WATER
SOUNDING CURVES REPRESENT THE PROPORTION OF THE AREA UNDER WATER
THE SEASIDE OF THE 'R' IS APPROXIMATELY 1:1000

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY RESTON VIRGINIA 22092
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE VIRGINIA 22903
A FOLDER CONTAINING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

ACHILLES

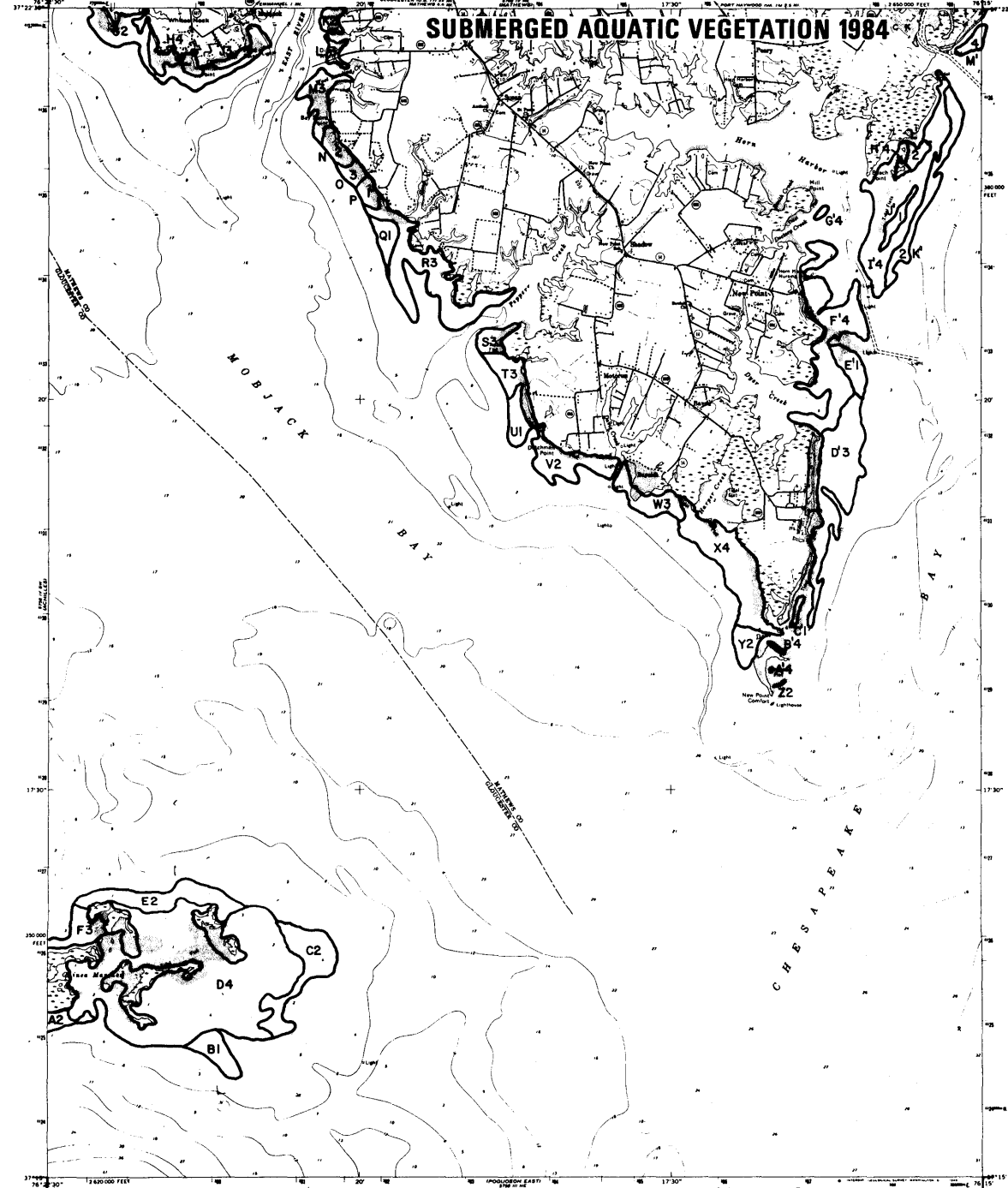
Heavy-duty ——— Light-duty
Medium-duty ——— Unimproved dirt
U.S. Route ——— State Route

ACHILLES, VA.
H3315...W7622 5/75
1964
PHOTOINSPECTED 1973
AND 1974 BY SC-16283/1524

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
JAMES L. CALVER, STATE GEOLOGIST

NEW POINT COMFORT QUADRANGLE
VIRGINIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
SEA METER IN QUADRANGLE



Mapped, edited, and published by the Geological Survey
Control by USGS, USCGS, and Virginia Fisheries Commission
Topography by photogrammetric methods from aerial
photographs taken 1963. Field checked 1964.
Supersedes Army Map Service map dated 1957.
Selected hydrographic data compiled from USCGS Chart 494 (1964).
This information is not intended for navigational purposes.
Polyconic projection. 1927 Mean American datum.
10,000 foot grid based on Virginia coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 18,
shown in blue.
Fine red dashed lines indicate selected fence and light areas where
generally visible on aerial photographs. This information is unclassified.

15° 59' 00" and 15° 58' 00" magnetic north
inclination at center of sheet

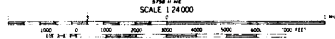
SCALE 1:24,000
CONTOUR INTERVAL 5 FEET
DOTTED IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET - DOTTED IS MEAN LOW WATER
SOUNDINGS IN FEET - DOTTED IS MEAN LOW WATER
THIS MAP CONFORMS WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20242
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

NEW POINT COMFORT
Harbor, Light, Unimproved dirt, State Route
NEW POINT COMFORT, VA.
SEA METER IN QUADRANGLE
1927-1954 7.5
1964
AMS 5704 IV SE-SERIES 1984

SUBMERGED AQUATIC VEGETATION 1984



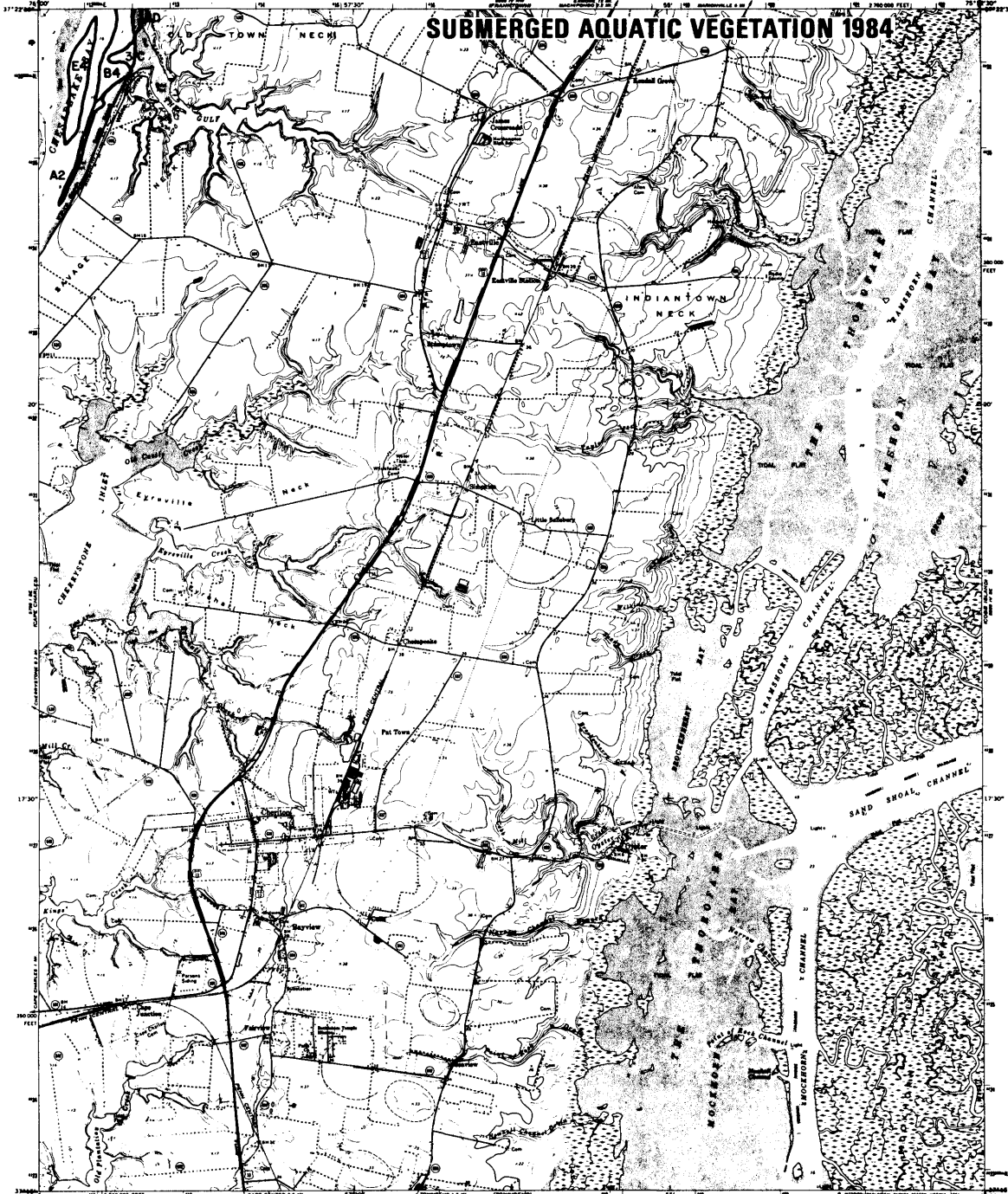
Mapped, edited, and published by the Geological Survey
Compiled by USGS, USACE, and USCG
Aerial photography by photogrammetric methods from aerial photographs
taken 1967, 1968, and 1969
Contour interval 5 feet
Vertical datum: Mean Sea Level
Horizontal datum: North American Datum 1983
Scale: 1:24,000
Projection: UTM
Zone: 18N
Datum: NAD 83
Units: Meters



CONTOUR INTERVAL 5 FEET
SCALE 1:24,000
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20542
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTEVILLE, VIRGINIA 22903
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

CAPE CHARLES
Primary highway at weather
Light duty road at weather
Hard surface unpaved surface
Unpaved road for or dry
weather
State Route

CAPE CHARLES, VA.
13115-17600-75
1988
ANSI Z39.48 SERIES 1934



Mapped, edited, and published by the Geological Survey

Control by USGS and USACE

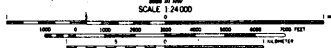
Topography by photogrammetric methods from aerial photographs taken 1957. Field checked 1968

Polyconic projection. 10,000-foot grid ticks based on Virginia coordinate system, south zone. 1000-meter Universal Transverse Mercator grid ticks, zone 18, shown in blue. 1927 North American Datum. Tick lines on the projected North American Datum 1983, shown in black. Projection lines 10 meters apart and 50 meters wide as shown by dashed corner ticks.

Shaded blue lines indicate elliptical bay outlines visible on aerial photographs.

UTM GRID AND THE POLYCONIC GRID
(CONVERSION BY TABLE OF METERS)

This photomosaic is 1973. No major
changes or drainage changes observed.



CONTOUR INTERVAL 5 FEET
NATIONAL GEODESIC SYSTEM, DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
THE SEPARATION BETWEEN THE TWO DATUMS IS UNKNOWABLE
SOUNDING SOUNDING DEPTH—PROCESSED LINE IS MEAN LOW WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 3.3 FEET IN CHARLES RIVER
AND 4 FEET IN OTHER TIDE CHANNELS

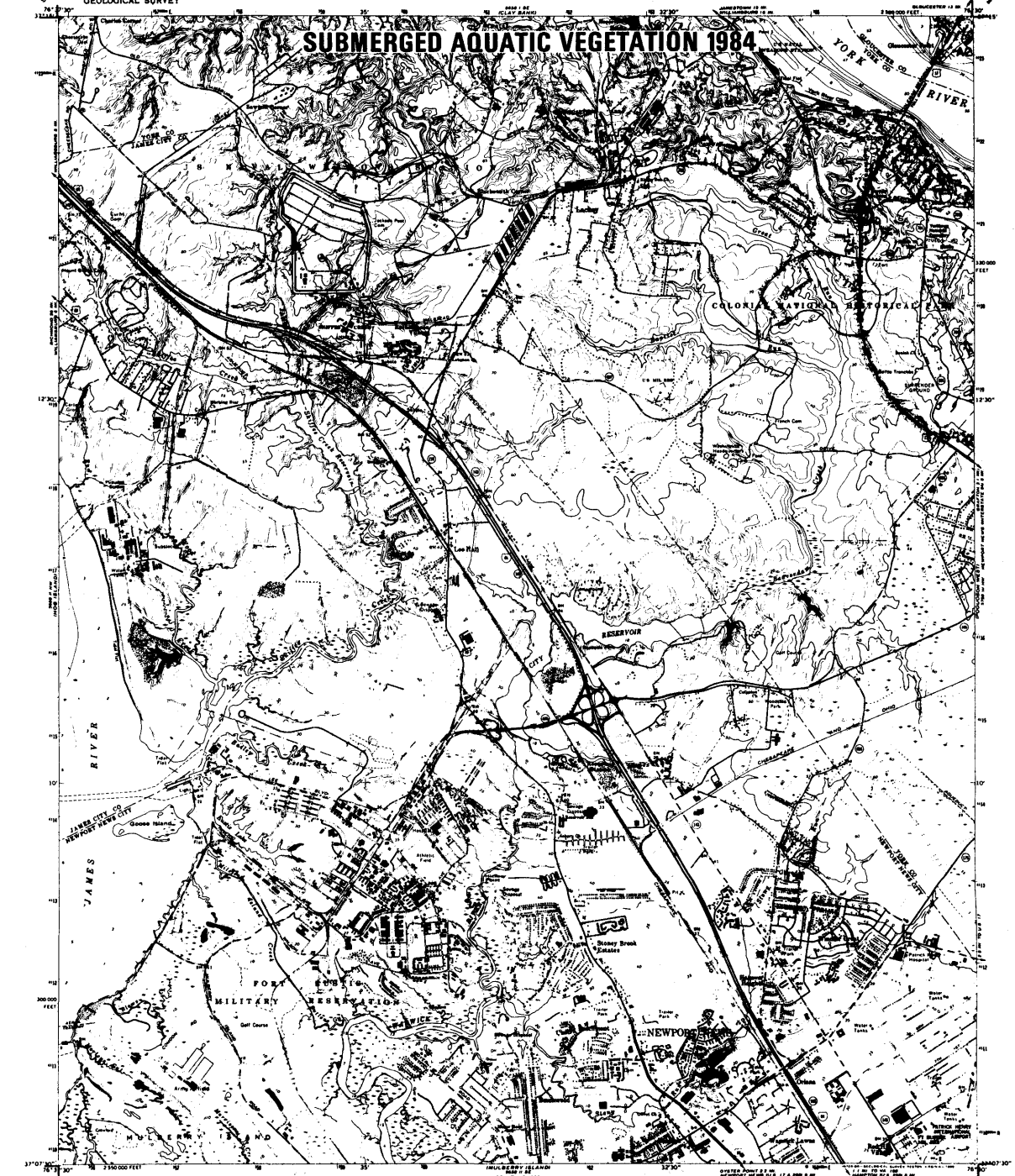
THIS MAP COMPLETES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 20192
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTEVILLE, VIRGINIA 22802
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

CHERITON

Primary highway, all weather, improved surface
Secondary highway, all weather, unimproved surface, bar or dry
hard surface
U S Route
State Route

CHERITON, VA.
N3715-W7552 5/7.5
PHOTOMAP-DICTED 1973
1968
ANS 1008-11 BY 69-1584

SUBMERGED AQUATIC VEGETATION 1984



Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA
Photographs by photogrammetric methods from aerial
photographs taken 1963. Field checked 1965.
Supersedes Army Map Service map dated 1957.
Selected topographic data compiled from NOS/NOAA Charts
#92 (1964) and 529 (1964). This information is not intended for
navigational purposes.
Pseudocylindrical projection, 10,000-foot grid based on
Virginia coordinate system, south zone.
1000-meter Universal Transverse Mercator grid ticks,
zone 18, shown in blue. 1927 North American Datum
to which is the projected North American Datum 1983
near the projection lines 11 meters south and
29 meters east as shown by dashed corner ticks.

Five red dashed lines indicate selected fence and field stake areas
generally visible on aerial photography. This information is unclassified.
There may be private landings within the boundaries of
the National Air Station reservation shown on this map.

SCALE 1:24,000
CONTOUR INTERVAL 10 FEET
DATED JUNE 1984
NATIONAL GEODESIC VERTICAL DATUM OF 1973
DEPTH CURVES AND SOUNDINGS IN FEET DATUM IS MEAN LOW WATER
IN RELATIONSHIP BETWEEN THE TWO DATUMS IS APPROXIMATELY
0.5 METERS (1.6 FEET) AT THE APPROXIMATE LINE OF MEAN LOW WATER
IN RELATIONSHIP BETWEEN THE TWO DATUMS IS APPROXIMATELY
0.5 METERS (1.6 FEET) AT THE APPROXIMATE LINE OF MEAN LOW WATER
THIS MAP COMPLETES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA 22902.
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST.

YORKTOWN
VIRGINIA
Medium-Gully Unimproved U.S. Route State Route
Interstate Route U.S. Route State Route
YORKTOWN, VA.
83707 5 - W76307 3
1988
PHOTOGRAPHED 1964
104 500 0 00 - SERIES 1944

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES

POQUOSON WEST QUADRANGLE
VIRGINIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

SUBMERGED AQUATIC VEGETATION 1984



Maped, edited, and published by the Geological Survey
Control by USGS and USCGS
Topography by photogrammetric methods from aerial photographs
taken 1963. Field checked 1969.
Substrate Army Map Service Marine Grove Map dated 1955.
Bathymetric data compiled from USCGS Charts 492 and
494 (1964). This information is not intended for navigational purposes.
Projection: 1927 North American datum.
10 000 foot grid based on Virginia coordinate system, south zone.
1000 meter Universal Transverse Mercator grid ticks
every 1/8 inch on base.
To step on the projected North American Datum 1983
scale the projection lines 11 meters south and
32 meters east as shown by dashed corner ticks.
There may be ground readings within the boundaries
of the feature or data relationships shown on this map.

CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET; DATURE OF MEAN LOW WATER
THE BELLWATER BETWEEN THE TWO DATUMS IS SUBSTANTIAL.
SOUNDING DEPTH INDICATES THE APPROPRIATE LINE OF MEAN LOW WATER
DATE 1984.
THIS MAP COMPLETES THE NATIONAL MAP ACCURACY STANDARDS
JOB SALES BY U. S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 20192
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA 22902
A POLAR PROJECTION TOPOGRAPHIC MAPS AND SPREADS IS AVAILABLE ON REQUEST

POQUOSON WEST, VA.
H3707 S-17623 S-7 15
1984
PHOTOREPRODUCED 1979
GSA 1750-S-17623-15A

SUBMERGED AQUATIC VEGETATION 1984



Map edited and published by the Geological Survey.
 Control by USGS and USCGS
 Topography by photogrammetric methods from aerial photographs taken 1953. Field checked 1966.
 Supersedes Army Map Service Measick map dated 1956.
 Selected hydrographic data compiled from USCGS Chart 494 (1964). This information is not intended for navigational purposes.
 Polyconic projection - 1927 North American datum
 10,000-foot grid based on Virginia coordinate system, south zone 1000-meter Universal Transverse Mercator grid ticks
 49° 18' 00" N
 To place on the projected North American Datum 1983 move the projection lines 10 meters south and 30 meters west as shown by dashed control lines.
 There may be private landholdings within the boundaries of the National or State reservations shown on this map.

1:24,000 SCALE

CONTOUR INTERVAL 5 FEET
 NATIONAL GEODETIC VERTICAL DATUM OF 1929
 DEPTH CURVES AND SOUNDINGS IN FEET-DIGITS IN FEET-DEEP WATER
 TO BE UNDERSTOOD THAT THE 100-FOOT DEPTH CURVE IS NOT A TRUE DEPTH CURVE BUT A 100-FOOT DEPTH CURVE WITH A 10-FOOT TIDE RANGE
 THE MEAN RANGE OF TIDES IS APPROXIMATELY 3.3 FEET

THIS MAP COMPLETES WITH NATIONAL MAP ACCURACY STANDARDS FOR SALE BY U.S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 20192 AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA 22903 A POLAR PROJECTION TOPOGRAPHIC MAP AND TRIMBLE IS AVAILABLE BY REQUEST

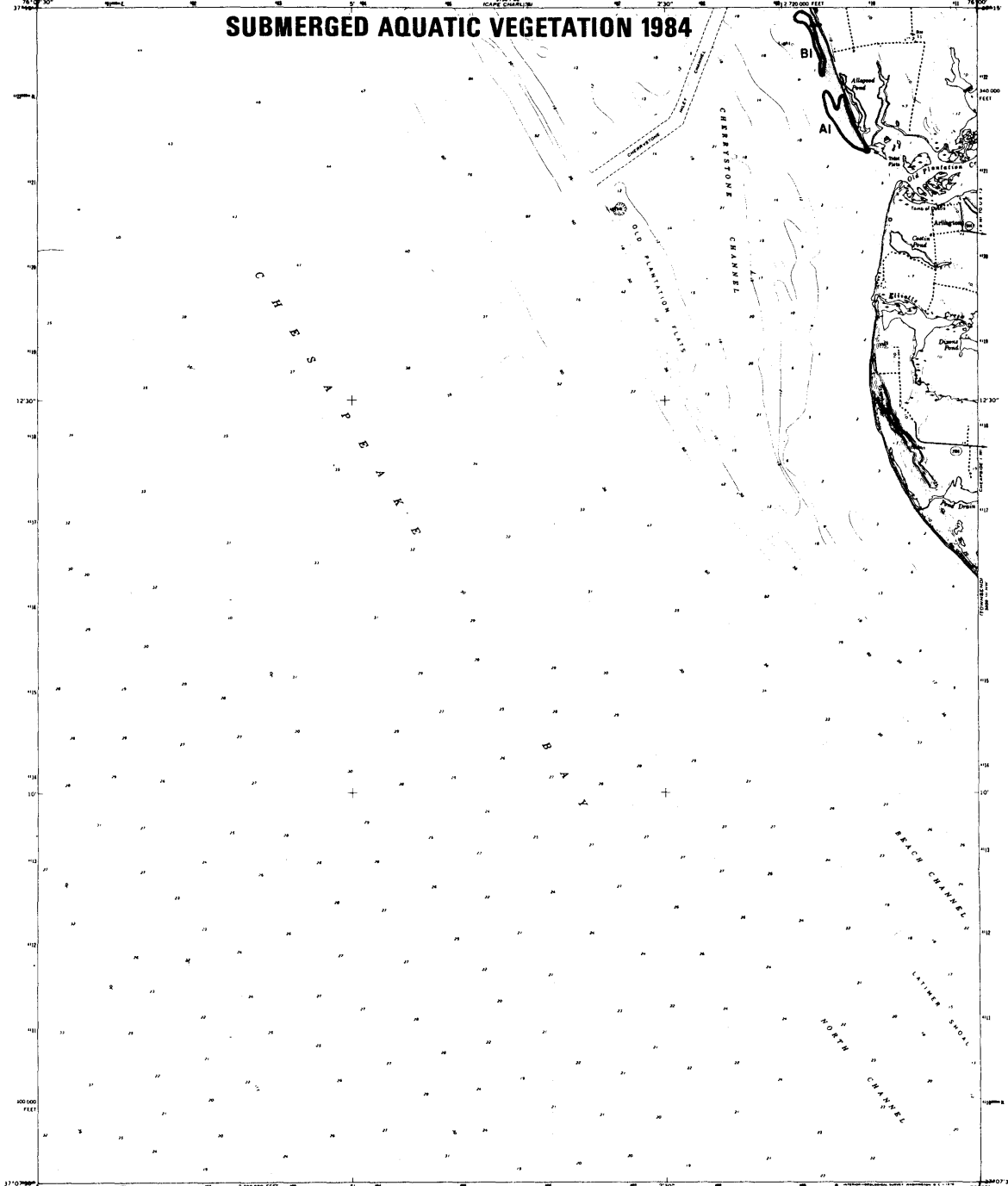
POQUOSON EAST, VA.
 H37075-9-76/15/75
 1984
 PHOTOGRAPHED 1979
 104 578 IN 9E-SERIES 75A

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
JAMES L. CALVERT, STATE GEOLOGIST

ELLIOTTS CREEK QUADRANGLE
VIRGINIA - NORTHAMPTON CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

SUBMERGED AQUATIC VEGETATION 1984



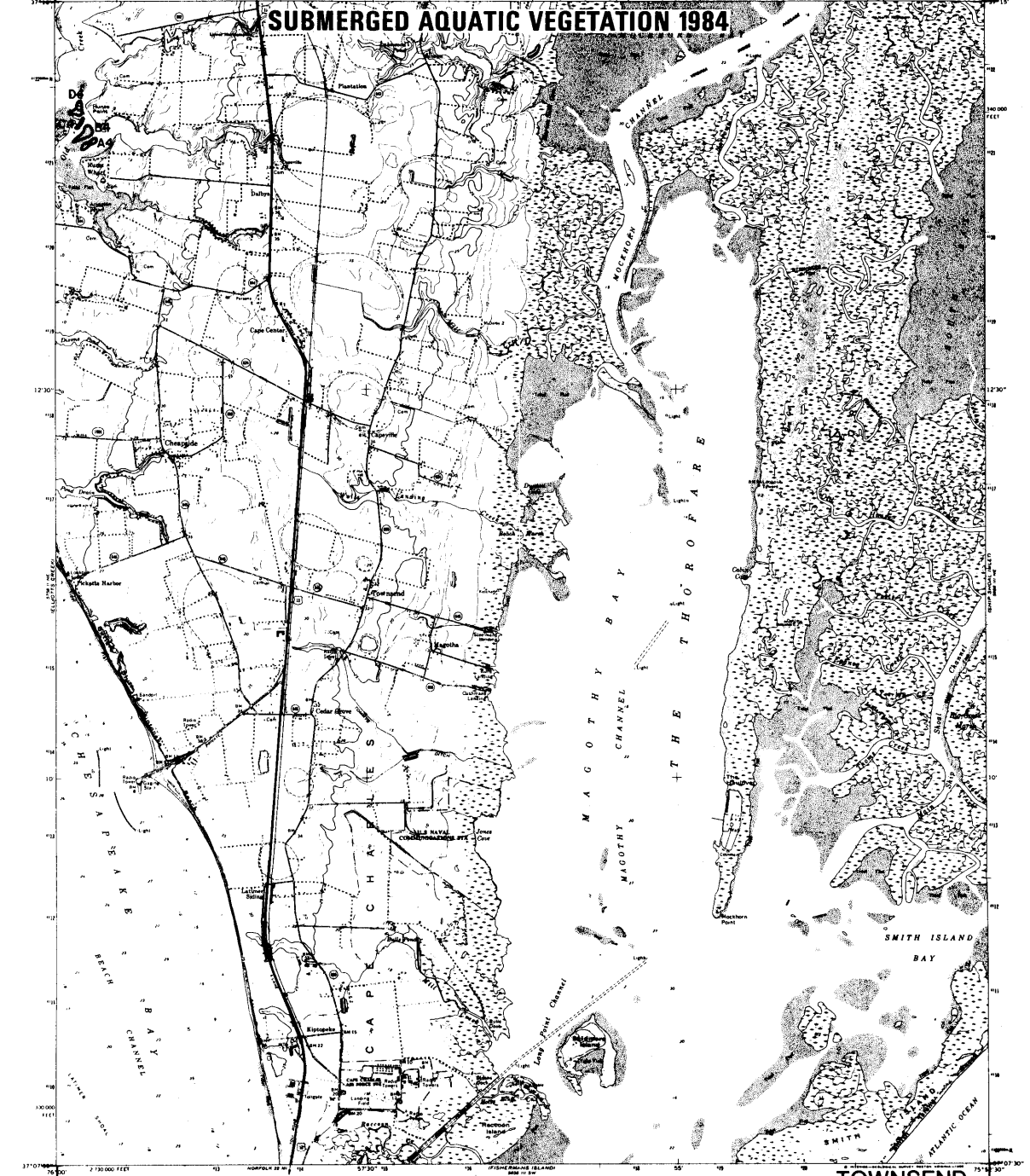
Mapped, edited, and published by the Geological Survey
Control by USGS, USCGS, and USCE
Topography by photogrammetric methods from aerial photographs
taken 1967. Field check 1968.
Submerged Elliotts Creek map dated 1955.
Special hydrographic data compiled from USCGS Chart 563 (1969).
This information is not intended for navigational purposes.
Photonic projection - 1927 North American datum.
10,000-foot grid based on Virginia's coordinate system. South zone.
1000 meter Universal Transverse Mercator grid ticks
given in 100-meter intervals.

SCALE 1:24000
CONTOUR INTERVAL 5 FEET
EARTH IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET - DASH IS MEAN LOW WATER
LOWEST TIDE SHOWN IS 1.0 METER BELOW MEAN LOW WATER
THE MEAN RANGE OF TIDE AT ALL LOCATION SHOWN IS APPROXIMATELY 2.4 FEET
THIS MAP COMPLETES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY WASHINGTON D. C. 20543
AND VIRGINIA DIVISION OF MINERAL RESOURCES CHARLOTTESVILLE VIRGINIA 22903
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

ELLIOTTS CREEK
Lightly used, all weather
improved road, fair or city
weather
State Route

ELLIOTTS CREEK, VA.
N37075-W760075
1968
AMS 574 H HE - SERIES V334

SUBMERGED AQUATIC VEGETATION 1984

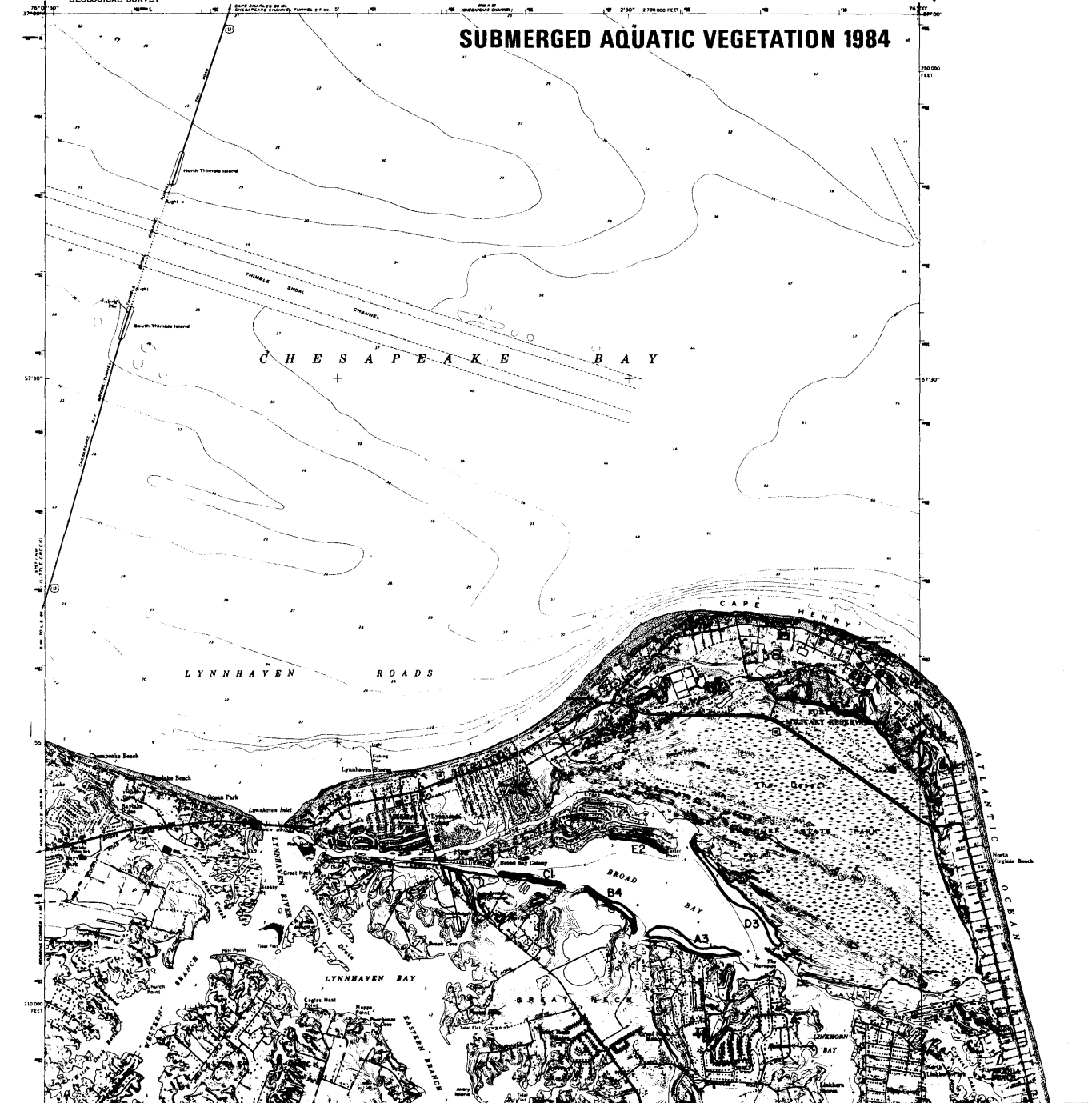


Mapped, edited, and published by the Geological Survey
 Control by USGS and INDONDA
 Topography by photogrammetric methods from aerial
 photographs taken 1967. Field checked 1968.
 Selected hydrographic data compiled from HCS chart 563 (1969).
 This information is not intended for navigational purposes.
 Photocopy projection: 10,000-foot grid based on Virginia coordinate
 system, south zone (1000-meter Universal Transverse Mercator grid
 ticks, zone 18, zone 18, zone 18, 1987 North American Datum).
 To place on the uncorrected North American Datum 1983,
 make the projection lines 12 meters south and
 30 meters west as shown by dashed corner ticks.
 Five red dashed lines indicate selected fence and field lines where
 accurate records on aerial photographs. This information is uncorrected.
 Short dashed blue lines indicate electrical bay outlines
 visible on aerial photographs.
 There may be precise intertidal within the boundaries
 of the Nation or State reservations shown on this map.

SCALE 1:24,000
 METERS
 0 100 200 300 400 500 600 700 800 900 1000 FEET
 CONTOUR INTERVAL 5 FEET
 NATIONAL GEODETIC VERTICAL DATUM OF 1985
 DEPTH CURVES AND SOUNDINGS IN FEET-DATUM IS MEAN LOW WATER
 THE REFERENCE POINT FOR THE DATUM OF SOUNDINGS
 SHORLINE SOUNDINGS REPRESENTS THE APPROXIMATE LINE OF MEAN LOW WATER
 THE MEAN RANGE OF TIDE IS APPROXIMATELY 1.7 METERS AT CHESAPEAKE BAY
 AND 1.5 FEET AT ATLANTIC OCEAN
 THIS MAP COMPLETES THE NATIONAL MAP ACCURACY STANDARDS
 FOR SALE BY U.S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092
 AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA 22903
 A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST
 Resound shown in general obtained in cooperation with Commonwealth
 of Virginia agencies from aerial photographs taken 1978 and other
 source data. This information not field checked. Map dated 1980.

TOWNSEND
 Primary highway, all weather
 hard surface
 Secondary highway, all weather
 Unimproved road, fair or dry
 weather
 U.S. Route
 State Route
 TOWNSEND, VA.
 43°20' S - 75°52' W / 7.5
 1984
 PHOTO REPRODUCED 1980
 Data used in 1984 - SERIES 1314

SUBMERGED AQUATIC VEGETATION 1984



Mapped, edited, and published by the Geological Survey
Control by USGS, USCGS, and USNCGS
Topography by photogrammetric methods from aerial
photographs taken 1963. Faded charted 1964
Sustained Army Map Service map dated 1965
Selected hydrographic data compiled from USCGS Charts 481 and 562 (1964)
This information is not intended for navigational purposes
Reference projection: 1927 North American datum
10,000-foot grid based on Virginia coordinate system, south zone
1000-foot Universal Transverse Mercator grid cells,
zone 18, shown in blue
To show on the projected North American Datum 1983
move the projection lines 10 meters south and
50 meters east as shown by dashed lines
This map is printed on recycled paper. The information on this map
is the National or State representation shown on this map

SCALE 1:24,000
CONTOUR INTERVAL 5 FEET
NATIONAL DATUM: NORTH AMERICAN DATUM OF 1927
DEPTH CURVES AND SOUNDINGS IN FEET-DATUM IS MEAN LOW WATER
THE RELATIONSHIP BETWEEN THE TWO DATUMS IS VARIABLE
SHOULDER (SOUNDING) IS THE DEPTH OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 3 FEET
THIS MAP CONFORMS WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20502
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA, 22903
A FOLDER (CONTAINING) TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

CAPE HENRY
Medium duty Unimproved dirt
U.S. Route State Route
CAPE HENRY, VA.
H3652-S-77600/7.5
1984
PHOTOCOPYED 1978
064 5781 1-HE-SERIES Y434