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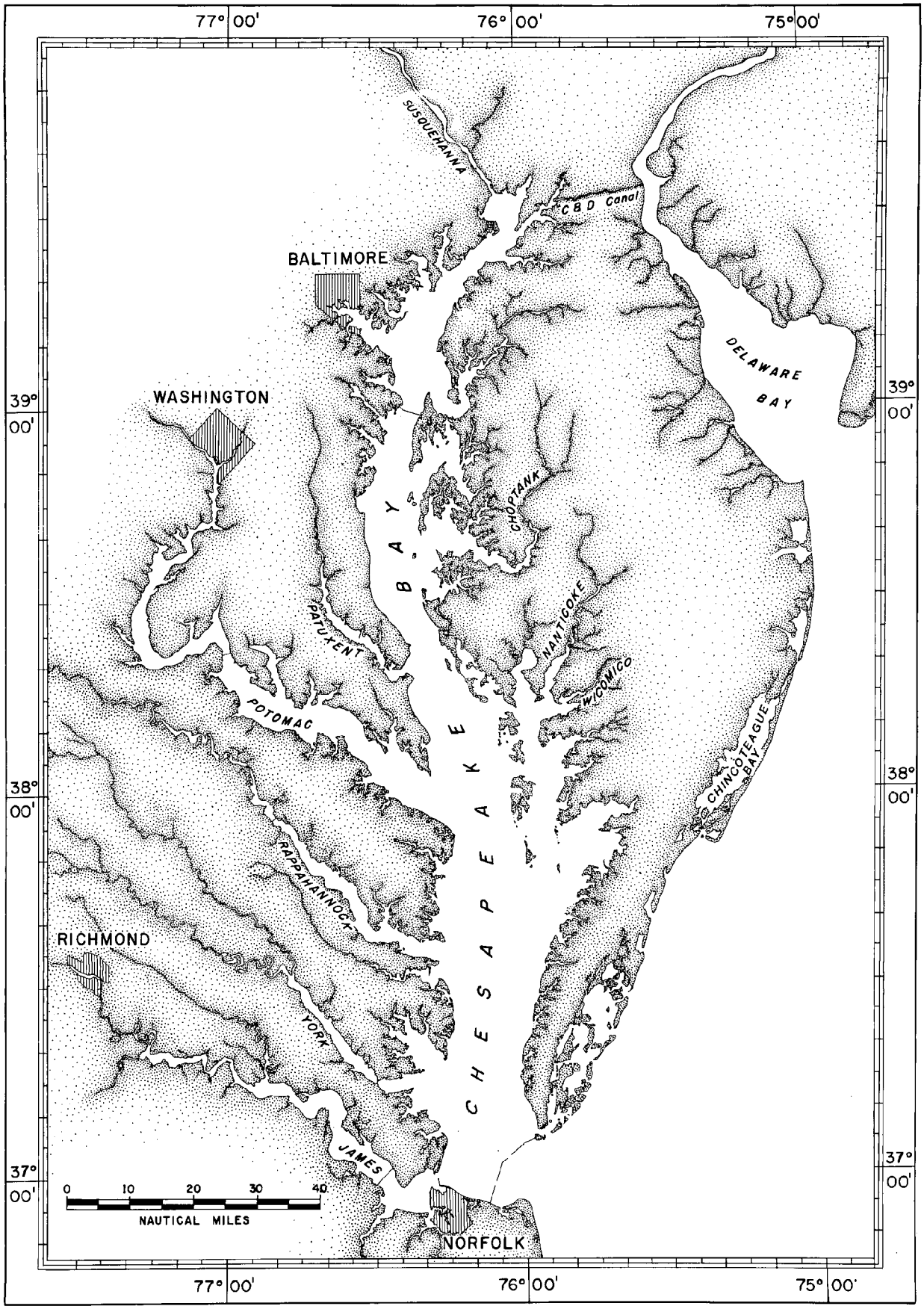
Distribution of Submerged Aquatic Vegetation in the Chesapeake Bay

Virginia Institute of Marine Science
School of Marine Science
The College of William and Mary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Distribution of Submerged Aquatic Vegetation in the Chesapeake Bay and Tributaries and Chincoteague Bay - 1991

by

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Cover Photograph: *Hydrilla verticillata* in the Potomac River. (*Photograph by Nancy Rybicki, USGS.*)
Inside Cover: Map of Chesapeake Bay and Tributaries and Chincoteague Bay.

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EXECUTIVE SUMMARY

The distribution of submerged aquatic vegetation, principally rooted vascular macrophytes, in the Chesapeake Bay, its tributaries, and Chincoteague Bay was mapped during May to October 1991 at a scale of 1:24,000 using black and white aerial photography. SAV bed perimeter information was digitized and stored in a computerized data base. Ground truth information was obtained from the U. S. Fish and Wildlife Service, the University of Maryland Horn Point Environmental Laboratories, the Metropolitan Washington Council of Governments, the Maryland Department of Natural Resources, Harford Community College, Essex Community College SAV Research Group of Baltimore County, National Park Service, Assateague Island, and the College of William and Mary/Virginia Institute of Marine Science/School of Marine Science. Citizen support via the U. S. Fish and Wildlife Service and Chesapeake Bay Foundation provided additional ground truth information.

In 1991, the Chesapeake Bay had 25,623 hectares of SAV, compared to 24,296 hectares in 1990, with 2,158 hectares (8.4%), 11,664 hectares (45.5%), and 11,802 hectares (46.1%) occurring in the Upper, Middle, and Lower Bay zones, respectively (Figs. 1, 2, and 3).

In 1991 seventy-eight percent (1,684 hectares) of the SAV within the Upper Bay zone was located in the Susquehanna Flats (Section 1). Eight species of SAV were documented by ground truth surveys in this section, with *Myriophyllum spicatum* being dominant. A recently introduced exotic species, *Hydrilla verticillata,* was found in the Flats but occurred in small isolated beds. Overall abundance of SAV declined from the 1990 (1,773 hectares) level, but the density of beds increased slightly from 1990. Eighty-nine percent of all SAV beds in the Flats were classified as very sparse (0-10% coverage), and 7% of beds were classified as dense (70-100% coverage). This is a slight improvement over 1990 coverage when 92% were very sparse and 5% of beds were classified as dense. In the Upper Eastern Shore (Section 2) there were 326 hectares of SAV (95 hectares less than in 1990) located principally in the Elk and lower Sassafras rivers, and Swan, Stillpond, and Churn creeks, with many of the same species as reported in the Susquehanna Flats section. The Upper Western Shore (Section 3) had 91 hectares of SAV, primarily *M. spicatum* and *Vallisneria americana,* concentrated in Saltpeter and Dundee creeks. This is similar to 1990 when there were 90.47 hectares. In the Chester River (Section 4) SAV abundance (57 hectares) was down 10 hectares from 1990. SAV was most abundant adjacent to Eastern Neck, Eastern Neck Island, and in the lower Chester River. In this region *Ruppia maritima* was the most abundant of seven species reported.

In 1991 forty-nine percent (5,707 hectares) of the SAV in the Middle Bay zone was found in the Mid-Bay Island Complex (Section 13) which includes the broad shoal area between Smith and Tangier Islands. This is an increase of 310 hectares over 1990. The two dominant species were *R. maritima* and *Zostera marina.* Nineteen percent (2,178 hectares) of the SAV in this zone was present in the Middle Eastern Shore (Section 12), primarily in the Barren Island-Honga River area, the Big and Little Annemessex rivers, and the lower section of the Manokin River, with *R. maritima* being the dominant species reported. Little

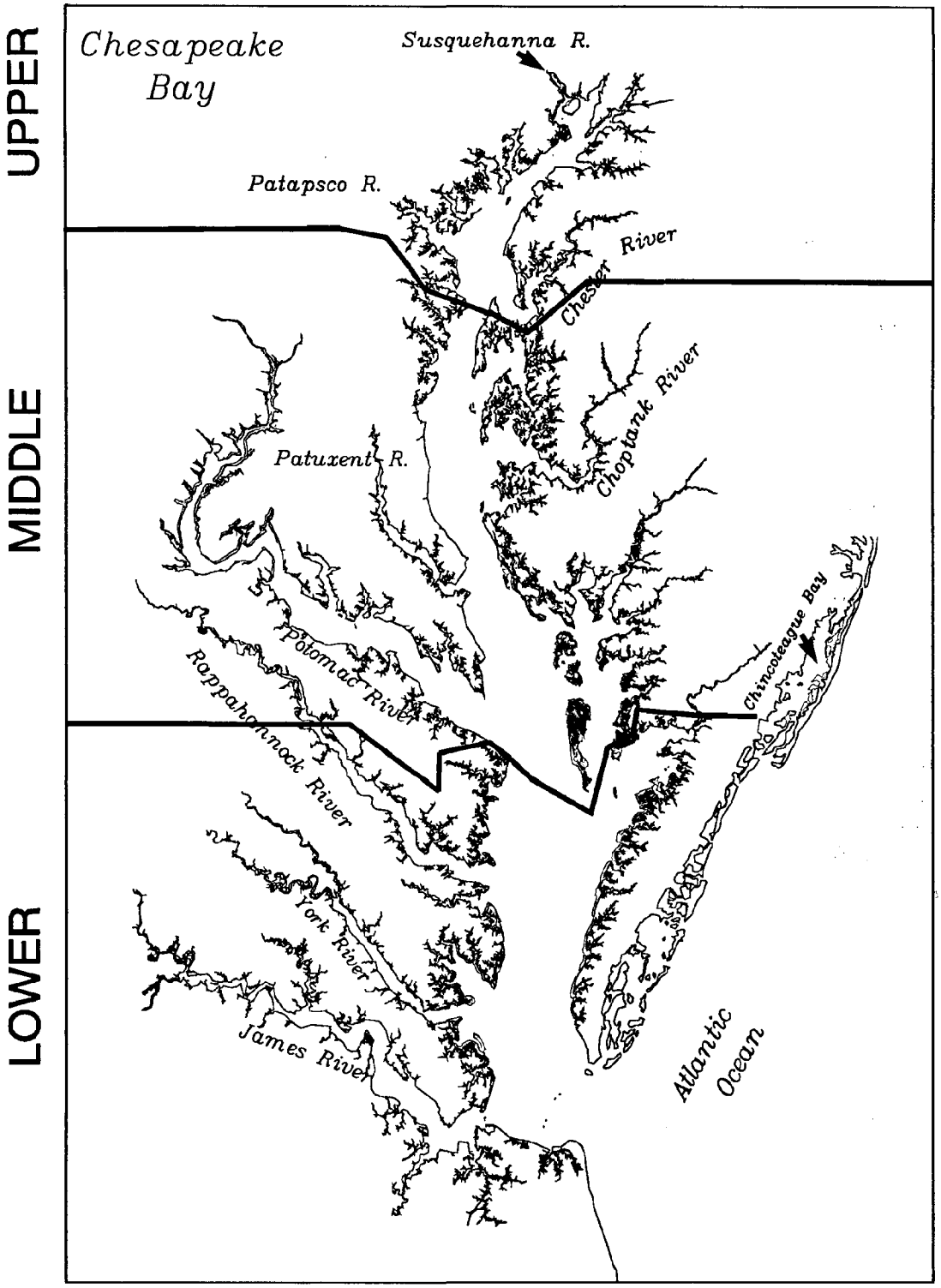

Figure 1. Map of Chesapeake Bay and tributaries with Upper, Middle, and Lower zones, and Chincoteague Bay, with locations of all SAV beds in 1991. (SAV is shown in red.)

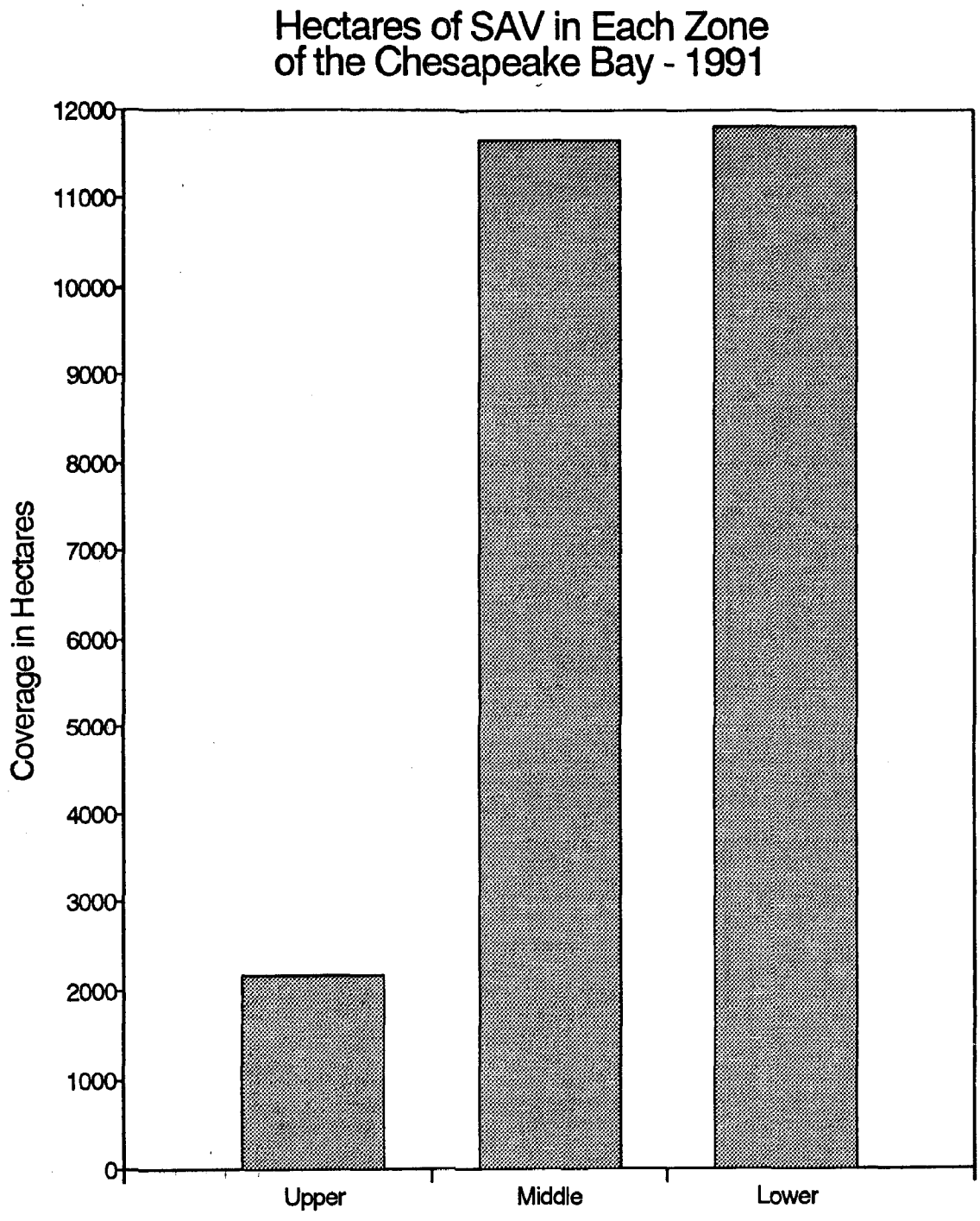

Figure 2. Total hectares SAV for the Upper, Middle, and Lower zones of the Chesapeake Bay in 1991. (Refer to Figures 1 and 7 for zone locations.)

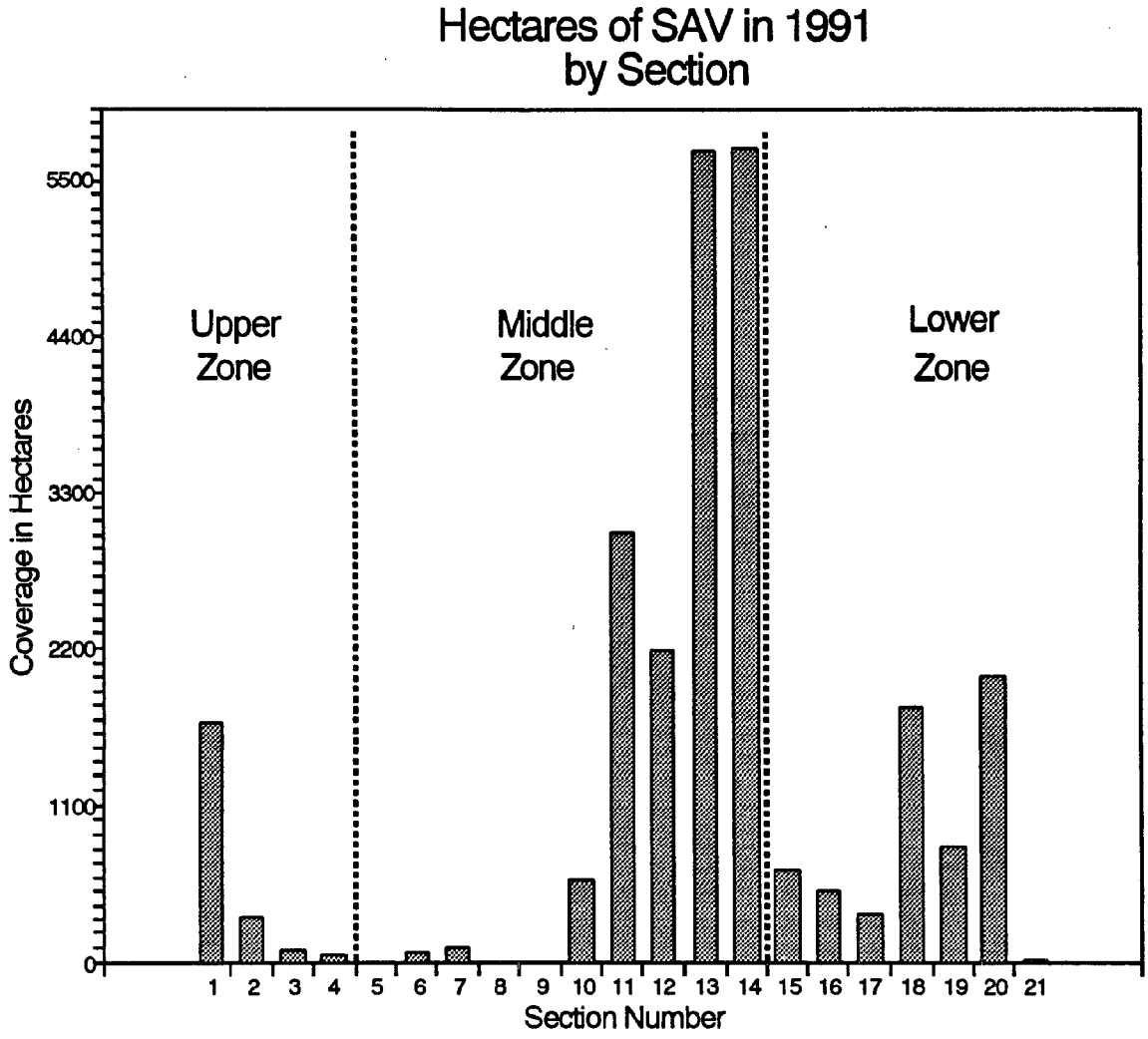

Figure 3. Total hectares SAV in 1991 by section of the Chesapeake Bay. (Refer to Figure 7, Table 3, and Appendix B for section locations and boundaries.)

or no SAV was mapped or reported from the Central Western Shore (Section 5), Patuxent River (Section 8), and Middle Western Shore (Section 9).

The Middle Bay zone also includes the entire Potomac River, where 3,597 hectares of SAV were present in 1991. SAV was concentrated in two distinct regions: 1) the Upper Potomac River (Section 11) with 3,016 hectares, where *Hydrilla verticillata* remained the numerically dominant species (nine other species were reported by the COG, VIMS, and Citizen's surveys); and 2) the upper portion of the Lower Potomac River (Section 10) with 581 hectares, including Nanjemoy Creek and Port Tobacco River, with *V. americana* and *M. spicatum* being the most frequently reported species. The total abundance of SAV in the Upper Potomac section increased from 1990 by 493 hectares. It increased in the Lower Potomac section by 49 hectares. SAV continued to decline in the Eastern Bay and Choptank River sections. SAV in the Eastern Bay (Section 6) decreased 321 hectares from 1990 to a total of 68 hectares in 1991, while in the Choptank River (Section 7) it declined 79 hectares from 1990 to a total of 114 hectares in 1991.

Distribution and abundance in 1991 in the Lower Bay zone were similar to 1990. Forty-eight percent (5,720 hectares) of SAV in this zone was found in the Lower Eastern Shore (Section 14) around the Fox Islands and the mouths of major creeks (i.e. Cherrystone Inlet and Hungars, Mattawoman, Occahannock, Craddock, Pungoteague, and Onancock creeks). Along the western shore of the Chesapeake Bay, SAV was abundant in Mobjack Bay (Section 18) (15% of SAV in the Lower Bay zone), in the lower York River (Section 19) (7% of SAV in the Lower Bay zone), and in the Lower Western Shore (Section 20), specifically Back River and Drum Island Flats area adjacent to Plum Tree Island (17% of SAV in the Lower Bay zone). There were 635 hectares of SAV mapped in the Reedville Region (Section 15) in 1991, a 4% increase over 1990. There were 339 hectares of SAV identified in 1991 in the New Point Comfort Region (Section 17) compared to 357 hectares in 1990. Both *R. maritima* and *Z. marina* were abundant throughout this zone. SAV abundance was down 7% from 1990 in both the Piankatank and Rappahannock rivers (Section 16). *Ruppia maritima* was the dominant species in those rivers, with *Zostera marina* also present as a result of previously successful transplant efforts. The James River (Section 21) had less than 3 hectares of SAV in 1991, which is the same as in 1990.

SAV in the Chincoteague Bay section increased in distribution from 1990 with 2,746 hectares mapped in 1991. SAV in Chincoteague Bay and Sinepuxent Bay consisted of *R. maritima* and *Z. marina*, and was located along the eastern side of the bay behind Assateague Island. Assawoman Bay contained only *R. maritima* while only *Z. marina* was reported from Isle of Wight Bay.

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Acknowledgement would not be complete without commendation for the groups which provided ground truthing of SAV beds which was used in conjunction with interpretation of the 1991 photography. USFWS conducted a survey and, with the Chesapeake Bay Foundation (CBF), also organized citizens to report locations and species composition of grassbeds around the bay. Bill Dennison of the University of Maryland Horn Point Environmental Laboratories (HPEL), Stan Kollar of Harford Community College (HCC), and the Essex Community College SAV Research Group of Baltimore County, Maryland provided ground truth information for certain specific regions of the Maryland portion of the Bay. The Metropolitan Washington Council of Governments (COG) provided ground truth information from the Potomac River. The National Park Service, Assateague Island, provided ground truth data for the Chincoteague Bay section. Ken Moore, Lori Morris, Mike Rosenzweig, Curtis Harper, Jill Goodman, and Cindi Horton of VIMS provided ground truth information for the lower bay.

The production of this report required the dedication of numerous scientists, technicians, artists, photographers, and others. The following people deserve a note of thanks: Silvia Terziotti (Virginia Council on the Environment) for developing computer software necessary for conversion of digital data to ARC/INFO 5.0.1 format; Rich Batiuk and Carin Bisland, USEPA-Chesapeake Bay Program Office; Linda Hurley Kelsey and Kathyrn Reshetiloff, USFWS; David Bleil, MD-DNR; and Christina Pompa, and Ed Pendleton, CBF.

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(NCIC), and the Mid-Continent Mapping Center were helpful in the procurement of high quality topo maps. Craig Breen, Professional Blueprinters, Inc., Newport News, VA, and Architectural and Engineering Supply Company, Richmond, VA, provided high quality reprographic services. Air Photographics, Inc. conducted the aerial photographic missions and was responsible for the high quality aerial photographs.

Aquatic plant illustrations were provided by the Information Office of the University of Florida, Institute of Food and Agricultural Sciences, Center for Aquatic Plants (Gainesville) and were drawn by Laura Line Reep, biological illustrator.

SAV SPECIES

The term "submerged aquatic vegetation" for the purpose of this report encompasses 19 taxa from 10 vascular macrophyte families and 3 taxa from 1 freshwater macrophytic algal family, the Characeae, but excludes all other algae, both benthic and planktonic, which occur in the Chesapeake Bay and tributaries (Appendix A). Although outside the scope of this study, the algal component does constitute a portion of the SAV biomass in the Chesapeake Bay and tributaries. For instance, benthic marine algae, including many macrophytes, sometimes co-occur in the same beds with vascular plants, even as epiphytes on vascular plants (Humm, 1979). However, except for the Characeae, this study has not attempted to identify, delineate or discuss the algal component of the vegetation nor its relative importance in the flora.

Ten species of submerged aquatic vegetation exclusive of the algae are commonly found in the Chesapeake Bay and its tributaries. *Zostera marina* (eelgrass) is dominant in the lower reaches of the bay. *Myriophyllum spicatum* (Eurasian watermilfoil), *Potamogeton pectinatus* (sago pondweed), *Potamogeton perfoliatus* (redhead grass), *Zannichellia palustris* (horned pondweed), *Vallisneria americana* (wild celery), *Elodea canadensis* (common elodea), *Ceratophyllum demersum* (coontail) and *Najas guadalupensis* (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* (widgeon grass) is tolerant of a wide range of salinities and is found from the bay mouth to the Susquehanna Flats. Approximately twelve other species are only occasionally found and, when present, occur primarily in the middle and upper reaches of the bay and the tidal rivers (Appendix A). *Hydrilla verticillata* (hydrilla), a recently introduced species, presently dominates SAV beds in the tidal freshwater reaches of the Potomac River. It has also been reported again in 1991 in the Susquehanna Flats where its growth has not been as widespread as in the Potomac River (Kollar, pers. comm.).

Zostera marina and *Ruppia maritima* are the dominant species reported from Chincoteague Bay.

METHODS

Introduction

Black and white aerial photography at a scale of 1:24,000 was the principal source of information used to assess the distribution and abundance of SAV in the Chesapeake Bay, its tributaries, and Chincoteague Bay in 1991. SAV beds mapped from photographs onto USGS 7.5 minute topographic quadrangles were then digitized, providing a digital data base for analysis of bed area and location. Ground truth information collected in 1991 was mapped onto the same topographic quadrangles.

Aerial Photography

The 1991 SAV photography was obtained by Air Photographics (Martinsburg, West Virginia) using a Wild RC-20 camera, with a 153 mm (6 inch) focal length Aviogon lens, and Agfa Pan 200 film. The camera was mounted in the bottom fuselage of the Air Photographics' Piper Aztec, a twin engine reconnaissance aircraft. Photography was acquired at approximately 12,000 feet altitude, yielding a 1:24,000 photographic scale.

Flight lines for photography, which were drawn on 1:250,000 scale USGS maps, were predetermined by Air Photographics to include all areas known to have SAV, as well as those areas which could potentially have SAV (i.e. all areas where water depths were less than 2 m at mean low water). There were 141 flight lines covering approximately 1800 miles of shoreline and yielding 1527 photographs. Flight lines also included land features that are necessary as control points for accurate mapping (Fig. 4). Sections of the upper Rappahannock, upper York, and most of the James rivers were not flown because of the continued absence of SAV in these areas.

Flight lines were prioritized by major sections. Flights were timed to occur at peak standing crop of species known to occur in the sections. In addition, specific areas with significant coverage were given priority. Prior approval by the VIMS staff was required to extend dates of flight windows if necessary. Actual dates of acquisition of photography are noted on each quadrangle map in Appendix C.

General guidelines for mission planning and execution (Table 1) address tidal stage, plant growth, sun elevation, water and atmospheric transparency, turbidity, wind, sensor operation, and plotting. Adherence to these guidelines assured acquisition of photography under nearly optimal conditions for detection of SAV, thus insuring accurate photo interpretation.

Quality assurance and calibration procedures were consistently followed. The altimeter was calibrated by the Federal Aviation Administration annually. Photographic settings were selected with an

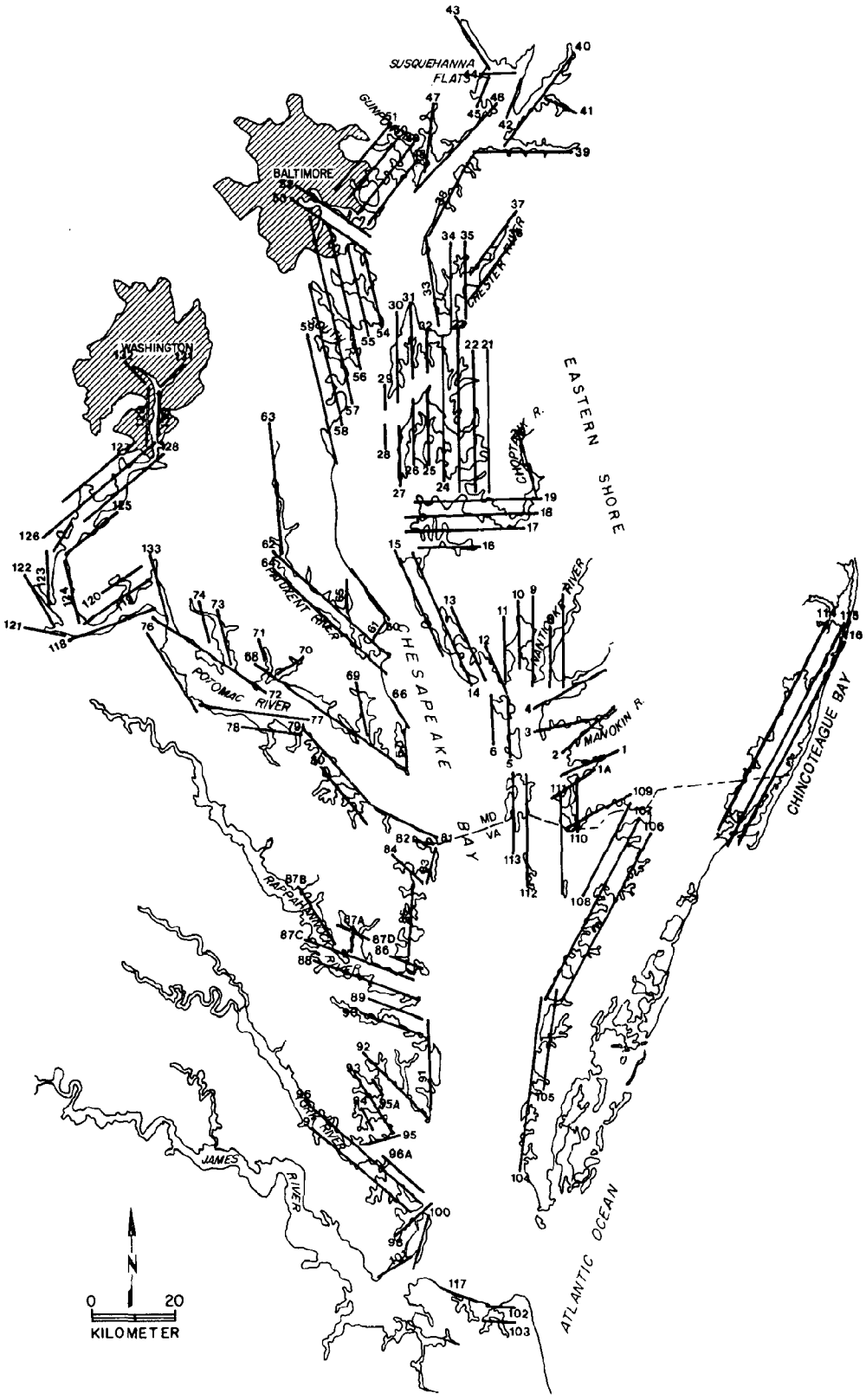

Figure 4. Map of Chesapeake Bay, its tributaries, and Chincoteague Bay with approximate locations of flight lines for 1991 SAV photography.

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. This was visually determined from the airplane to insure that SAV could be seen by the observer.

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 (at the surface).

8. Plotting - Each flight line included sufficient identifiable land area to assure accurate plotting of grass beds.

automatic exposure control. Sun angle was measured with an indicator on the plane. Flight lines were plotted on 1:250,000 scale maps to allow for overlap of photography. To minimize image degradation due to sun glint, the camera was equipped with a computer controlled intervalometer which established 60% line overlap and 20% sidelap. An automatic bubble level held the camera to within one degree tilt. The scale/altitude/film/focal length combination was coordinated so that SAV patches of one square meter could be resolved. Wind speed was monitored hourly from the flight service available in the region. Under normal operating conditions, flights were usually conducted under wind speeds less than 10 mph. (Above this, wind generated waves stir the bottom sediments which can easily obscure SAV beds in less than one hour.) Pilot experience determined what acceptable level of turbidity would ensure complete delineation of SAV beds. At low tide the pilot should have been able to distinguish bottom features such as SAV or algae. When turbid conditions prevailed photography did not commence.

Determination of cloud cover was based on pilot experience. Records of this parameter were kept in a flight notebook. Every attempt was made to acquire photographs with no cloud cover below 12,000 feet. Cloud cover did not exceed 5% of the area covered by the camera frame. A thin haze layer above 12,000 feet was generally acceptable. Experience has shown that the optimal conditions given above generally occur two to three days following passage of a cold front when winds have shifted from north-northwest to south and have moderated to less than 10 mph. Where possible, and within the guidelines given for prioritizing and executing the photography, flights were planned to coincide with these atmospheric conditions.

Exposed film was processed by Air Photographics. A contact print was produced for each exposed frame. Each photograph was labeled with date of acquisition as well as flight line number. Film and photographs were stored under appropriate environmental conditions to prevent degradation.

Mapping Process

This study utilized 176 USGS 7.5 minute topographic quadrangle maps as a basis for mapping SAV beds from aerial photography, for digitizing the SAV beds, and for compiling SAV bed area measurements. Figure 5 gives locations of topographic quadrangles in the study area which includes all regions with potential for SAV growth. Most quadrangles are sequentially numbered for efficient access to data. The name corresponding to each quadrangle in Figure 5 is listed in Table 2.

Photo-interpretation to identify and delineate SAV beds utilized all available information including knowledge of aquatic grass signatures on film, distribution of SAV in 1991 from aerial photography, 1991 ground truth information, and aerial site surveys. USGS-published 7.5 minute topographic quadrangle masters (1:24,000 scale) printed by the Mid-Continent Mapping Center of the USGS on stable transparent mylar were used as base maps. Identical copies of these base maps were made at the same scale on stable transparent mylar using a contact diazo process.

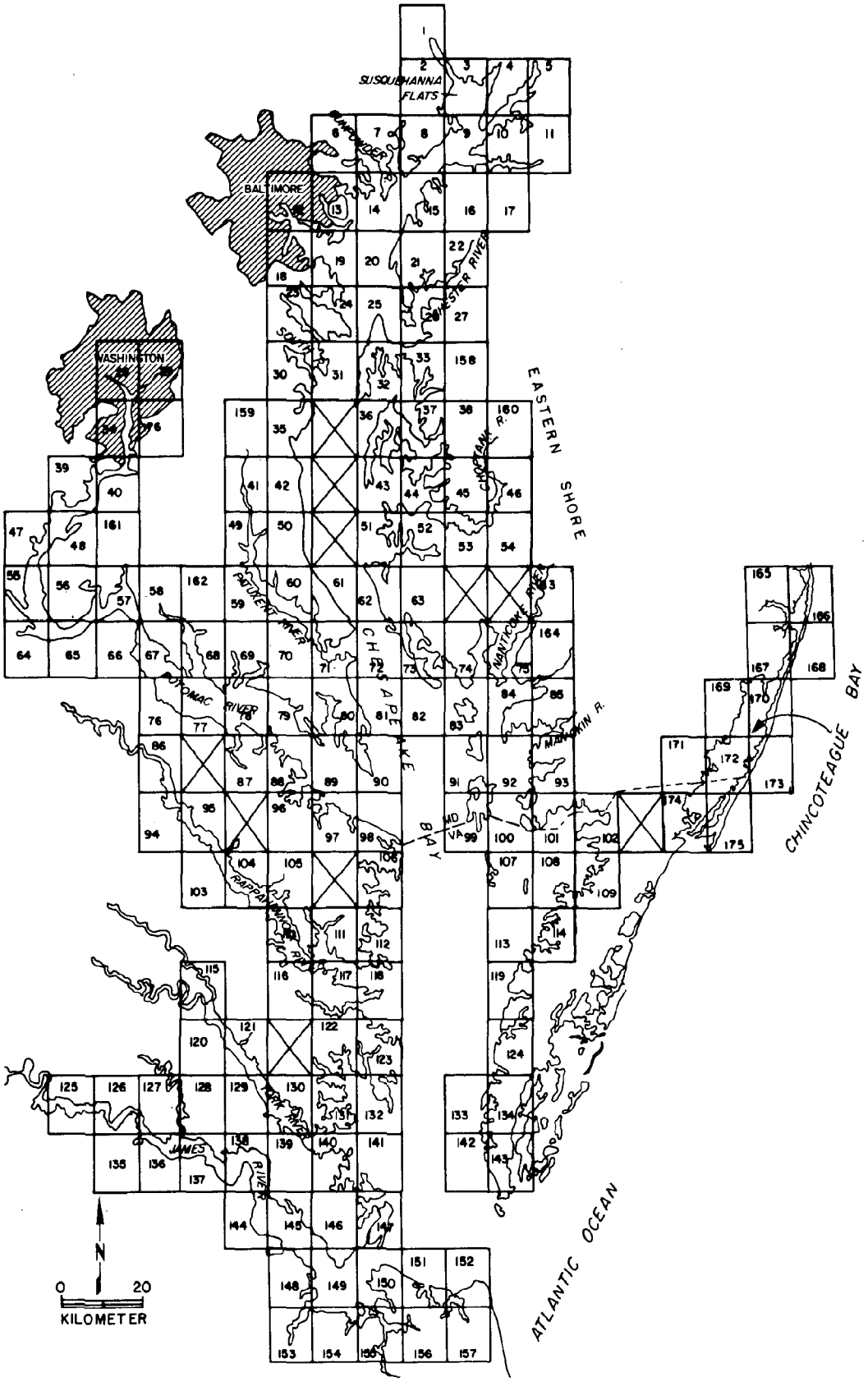

Figure 5. Location of USGS 7.5 minute topographic quadrangles in the Chesapeake Bay, its tributaries, and Chincoteague Bay with corresponding code numbers . (See Table 2 for quad names.)

Table 2

List of USGS 7.5 Minute Topographic Quadrangles for the Chesapeake Bay and Chincoteague Bay SAV Study Areas with Corresponding Code Numbers. (See Fig. 5 for Location of Quadrangles. Topographic Quadrangles with SAV Beds Can Be Found in Appendix C.)

1. Conowingo Dam, Md.-Pa.
2. Aberdeen, Md.
3. Havre de Grace, Md.
4. North East, Md.
5. Elkton, Md.-Del.
6. White Marsh, Md.
7. Edgewood, Md.
8. Perryman, Md.
9. Spesutie, Md.
10. Earleville, Md.
11. Cecilton, Md.
12. Baltimore East, Md.
13. Middle River, Md.
14. Gunpowder Neck, Md.
15. Hanesville, Md.
16. Betterton, Md.
17. Galena, Md.
18. Curtis Bay, Md.
19. Sparrows Point, Md.
20. Swan Point, Md.
21. Rock Hall, Md.
22. Chestertown, Md.
23. Round Bay, Md.
24. Gibson Island, Md.
25. Love Point, Md.
26. Langford Creek, Md.
27. Centreville, Md.
28. Washington West, Md.-D.C.-Va.
29. Washington East, D.C.-Md.
30. South River, Md.
31. Annapolis, Md.
32. Kent Island, Md.
33. Queenstown, Md.
34. Alexandria, Va.-D.C.-Md.
35. Deale, Md.
36. Claiborne, Md.
37. St. Michaels, Md.
38. Easton, Md.
39. Fort Belvoir, Va.-Md.
40. Mt. Vernon, Md.-Va.
41. Lower Marlboro, Md.
42. North Beach, Md.
43. Tilghman, Md.
44. Oxford, Md.
45. Trappe, Md.
46. Preston, Md.
47. Quantico, Va.-Md.
48. Indian Head, Va.-Md.
49. Benedict, Md.
50. Prince Frederick, Md.
51. Hudson, Md.
52. Church Creek, Md.
53. Cambridge, Md.
54. East New Market, Md.
55. Widewater, Va.-Md.
56. Nanjemoy, Md.
57. Mathias Point, Md.-Va.
58. Popes Creek, Md.
59. Mechanicsville, Md.
60. Broomes Island, Md.
61. Cove Point, Md.
62. Taylors Island, Md.
63. Golden Hill, Md.
64. Passapatanzy, Md.-Va.
65. King George, Va.-Md.
66. Dahlgren, Va.-Md.
67. Colonial Beach North, Md.-Va.
68. Rock Point, Md.
69. Leonardtown, Md.
70. Hollywood, Md.
71. Solomons Island, Md.
72. Barren Island, Md.
73. Honga, Md.
74. Wingate, Md.
75. Nanticoke, Md.
76. Colonial Beach South, Va.-Md.
77. Stratford Hall, Va.-Md.
78. St. Clements Island, Va.-Md.
79. Piney Point, Md.-Va.
80. St. Marys City, Md.
81. Point No Point, Md.
82. Richland Point, Md.
83. Bloodsworth Island, Md.
84. Deal Island, Md.
85. Monie, Md.
86. Champlain, Va.
87. Machodoc, Va.
88. Kinsale, Va.-Md.
89. St. George Island, Va.-Md.
90. Point Lookout, Md.

Table 2 (concluded)

91. Kedges Straits, Md.
92. Terrapin Sand Point, Md.
93. Marion, Md.
94. Mount Landing, Va.
95. Tappahannock, Va.
96. Lottsburg, Va.
97. Heathsville, Va.-Md.
98. Burgess, Va.-Md.
99. Ewell, Md.-Va.
100. Great Fox Island, Va.-Md.
101. Crisfield, Md.-Va.
102. Saxis, Va.-Md.
103. Dunnsville, Va.
104. Morattico, Va.
105. Lively, Va.
106. Reedville, Va.
107. Tangier Island, Va.
108. Chesconessex, Va.
109. Parksley, Va.
110. Urbanna, Va.
111. Irvington, Va.
112. Fleets Bay, Va.
113. Nandua Creek
114. Pungoteague, Va.
115. West Point, Va.
116. Saluda, Va.
117. Wilton, Va.
118. Deltaville, Va.
119. Jamesville, Va.
120. Toano, Va.
121. Gressitt, Va.
122. Ware Neck, Va.
123. Mathews, Va.
124. Franktown, Va.
125. Westover, Va.
126. Charles City, Va.
127. Brandon, Va.
128. Norge, Va.
129. Williamsburg, Va.
130. Clay Bank, Va.
131. Achilles, Va.
132. New Point Comfort, Va.
133. Cape Charles, Va.
134. Cheriton, Va.
135. Savedge, Va.
136. Claremont, Va.
137. Surry, Va.
138. Hog Island, Va.
139. Yorktown, Va.
140. Poquoson West, Va.
141. Poquoson East, Va.
142. Elliotts Creek, Va.
143. Townsend, Va.
144. Bacons Castle, Va.
145. Mulberry Island, Va.
146. Newport News North, Va.
147. Hampton, Va.
148. Benns Church, Va.
149. Newport News South, Va.
150. Norfolk North, Va.
151. Little Creek, Va.
152. Cape Henry, Va.
153. Chuckatuck, Va.
154. Bowers Hill, Va.
155. Norfolk South, Va.
156. Kempsville, Va.
157. Princess Anne, Va.
158. Wye Mills, Md.
159. Bristol, Md.
160. Fowling Creek, Md.
161. Port Tobacco, Md.
162. Charlotte Hall, Md.
163. Mardela Springs, Md.
164. Wetipquin, Md.
165. Selbyville, Md.
166. Assawoman Bay, Md.
167. Berlin, Md
168. Ocean City, Md.
169. Public Landing, Md.
170. Tingles Island, Md.
171. Girdle Tree, Md.-Va.
172. Boxiron, Md.-Va.
173. Whittington Point, Md.-Va.
174. Chincoteague West, Va.
175. Chincoteague East, Va.
176. Anacostia, D.C.-Md.

SAV beds from the 1991 aerial photographs were mapped onto these diazo copies of USGS topographic quadrangles. Delineation of each SAV bed onto the topographic quadrangle maps was facilitated by superimposing the photographic print with the appropriate mylar quadrangle on a light table. SAV boundaries were then traced directly onto the mylar quadrangle with a pencil. Where minor scale differences were evident between a photograph and a quadrangle, or where significant shoreline erosion or accretion had occurred since USGS publication of a map, either a best fit was obtained or shoreline changes were noted on the quadrangle.

In addition to delineating SAV bed boundaries, 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. 6). Bed density was classified into one of four categories based on a subjective comparison with the density scale. These were: 1, very sparse (<10% coverage); 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 the above density categories. Additionally, each distinct SAV unit (bed or bed subsection) was assigned an identifying two letter designation unique to its map. Subsections of beds were further identified as being part of a contiguous bed by the addition of two letters unique to each contiguous bed. These contiguous bed descriptions aid the tracking of a single bed between quad sheets as well as the analysis of those beds that had to be separated due to variation in SAV density.

SAV Perimeter Digitization

The perimeters of all SAV beds mapped from the aerial photography were digitized in a clockwise direction using a Numonics Model 2400/2200 DigiTablet Graphics Analysis System having a resolution of .001 inches (.00254 cm) and an accuracy of .005 inches (.0127 cm). Coordinates were transmitted to a PRIME 9955 computer for data manipulation via software developed at VIMS. The perimeter of each SAV bed was defined by a polygon with a linear data point density of 127 per chart inch (50 per cm, 5 meter ground resolution). The total number of points defining any SAV bed is dependent on overall bed size. The SAV bed perimeter was stored as X and Y coordinates in centimeters from the quadrangle origin (lower left corner).

Tests of Precision and Accuracy

Prior to each digitization session, the Numonics instrument was checked manually against a digitizing standard. After a map had been secured to the digitizing tablet, the standard was secured to the map and digitized four times. The information from digitizing the standard was transmitted to the beginning of the SAV bed perimeter file on the PRIME computer. This same procedure was followed at the end of each digitizing session. When this file was processed by the computer, the digitized area

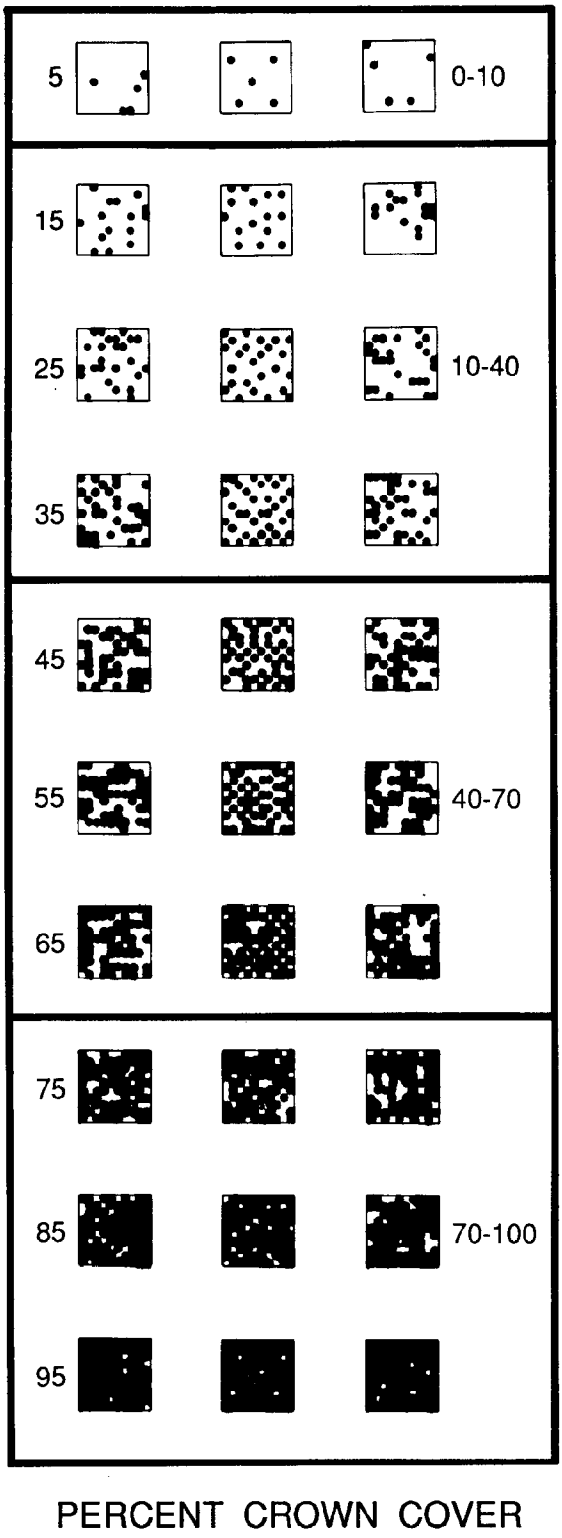

Figure 6. Crown density scale used for determining density of SAV beds: (1) very sparse, 0-10%; (2) sparse, 10-40%; (3) moderate, 40-70%; (4) dense, 70-100%.

of each standard was compared to the known area of the standard. If a variation between the known and the mean of the observed areas exceeded 1.0%, a warning was printed advising the operator to check the digitizing system. In addition, checks were made with respect to the absolute location of the digitizing standard as secured to the map. A comparison was made between the location of the standard before and after the digitizing session. If the absolute location differed by more then 0.10 cm another warning to check the system was printed. Any movement in absolute location can be indicative of digitizer instrument drift or chart movement during the digitization session. These checks assure that the final calculated bed locations are as accurate as possible.

Maximum accuracy was maintained by exclusively using mylar topographic quadrangles rather than paper ones which can change scale as a function of changes in air temperature and humidity in the digitizer room.

A complete outline of the digitization procedure can be found in Orth et al., 1988.

Standard Operating Procedures for Quality Assurance/Quality Control

Standard operating procedures (SOPs) were developed to facilitate orderly and efficient processing of the 1991 SAV maps and the SAV bed perimeter computer files produced from them, and to comply with the need for consistency, quality assurance, and quality control. SOPs developed include: a detailed procedure outlining 46 steps for digitization of SAV maps; a 47 step checklist for editing SAV perimeter computer files to insure completeness and accuracy; a digitizer log in which all operations were recorded and dated, and which was used to guide and record editing operations; and a flow chart used to track progress of all operations including all changes in file names. Examples of these SOPs are in Orth et al., 1988.

Choice of Representative SAV Bed

Every SAV bed mean area was the result of at least four independent digitizations of the outline of each SAV bed as part of a quality assurance/quality control program designed to isolate and remove anomolous data and produce accurate and representative SAV bed polygons. The computer calculated area for each replication, and the three bed outlines or perimeters most similar in terms of area were then used for the calculation of a mean area. The areas used in the mean area calculation had to be, by contract, within 5% or less from that of the mean area. All beds whose areal difference were in excess of 5% of the mean bed area were flagged by the VIMS quality assurance quality control computer program for additional error assesment. The VIMS error rate was normally less than 1%. The replicate bed whose area was most similar to the mean area was identified as the "best bed". The best bed area and

perimeter coordinate points were then saved by the computer program and transferred to the ARC/INFO GIS system for area calculations.

Conversion of SAV Perimeter Points from X,Y Centimeters to Universal Transverse Mercator (UTM) Coordinates in ARC/INFO 5.0.1 Format

The EPA Chesapeake Bay Program Computer Center manages its geographic data base using Environmental Systems Research Institute (ESRI) ARC/INFO Geographic Information System (GIS) (ESRI, 1989). During 1992, the VIMS SAV program also began converting its operation from the Prime to ARC/INFO based on a SUN Sparc 2 Unix workstation. With the assistance of the Virginia Council on the Environment EcoMAPS program, procedures were developed in 1991 to convert/transform the best bed perimeter points from X,Y centimeters to UTM based coordinates in ARC/INFO 5.0.1 format. This involved construction of data transfer files in an ARC/INFO standard format ("generate"). This was done on the VIMS PRIME for each topographic quadrangle with SAV beds present. Four files per quadrangle were produced:

1. Polygon file containing SAV bed coordinates in digitizer-based centimeters.
2. Attribute file containing SAV bed labels, density, species composition, and dates.
3. Tic file containing map corner locations in digitizer-based coordinates (cm).
4. Geo file containing corresponding latitude and longitude positions for map corners.

The generate files were then transferred to the workstation and imported into the ARC/INFO system.

A set of automated ARC/INFO routines were used to input quadrangle-based SAV "generate" data into ARC/INFO 5.0.1 format, and to assist in interactive editing of SAV polygons. ARC-based SAV polygons were displayed and edited by VIMS staff. SAV polygons appearing on the computer display screen were compared to their counterparts on the mylar quad maps. Discrepancies and artifacts were edited using a suite of ARC/INFO editing "tools". ARC/INFO-based data sets were considered satisfactory for submission to the EPA when the shape, location, and label of all SAV beds corresponded to those on the base mylar quad input map. ARC/INFO-based SAV data were transformed to UTM coordinates, Zone 18, and submitted to EPA for final review, analysis, and deposition to archives.

Calculation of 1991 SAV Areas

The SAV coverages in UTM ARC/INFO Zone 18 format were used to calculate area in square meters for all SAV beds. These areas are reported as quadrangle totals in Table 4, and section and zone totals in Tables 5 and 6. Section and zone totals were calculated by using an overlay operation of

the polygons on the SAV beds in ARC/INFO. The definition of the sections used in this analysis are provided in Table 3.

Organizational Procedures for Analysis and Discussion

Discussion of the distribution of SAV in the Chesapeake Bay and tributaries has been organized into three zones as established by Orth and Moore (1982) and modified by Orth et al., (1989) (Fig. 7). 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 approximately 3 nautical miles south of Tangier Island then extending to the eastern side of the bay to an area just south of the mouth of the Little Annemessex River is referred to as the Lower Bay zone.

The area between the south shore of the Little 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°/oo), Lower zone; mesohaline (5-18°/oo), Middle zone; oligohaline (0.5-5 °/oo), Upper zone. Although the major rivers and smaller tributaries of the bay have their own salinity regimes, the distribution of SAV in each river is discussed within the zone where it connects to the bay proper.

In addition, 21 major sections of the bay are identified for more detailed discussion of SAV distribution (Fig. 7, Table 3). These sections, which were first delineated for the 1984 survey (Orth et al., 1985) and slightly modified for the 1987 survey (Orth et al., 1989), denote relatively distinct parts of the bay and its tributaries that are readily identifiable from a map. The section boundaries used for analysis and discussion of the 1991 SAV distribution and abundance data are those used for the 1987, 1989, and 1990 reports (Orth et al., 1989; Orth and Nowak, 1990, Orth et al., 1991). Sections 1 through 4 are located in the Upper Bay zone. Sections 5 through 13 are located in the Middle Bay zone, and sections 14 through 21 are located in the Lower Bay zone. Appendix B gives the latitude and longitude of the boundary points of each Chesapeake Bay section and Chincoteague Bay in decimal degrees. SAV distribution in Chincoteague Bay is presented and discussed separately from the Chesapeake Bay.

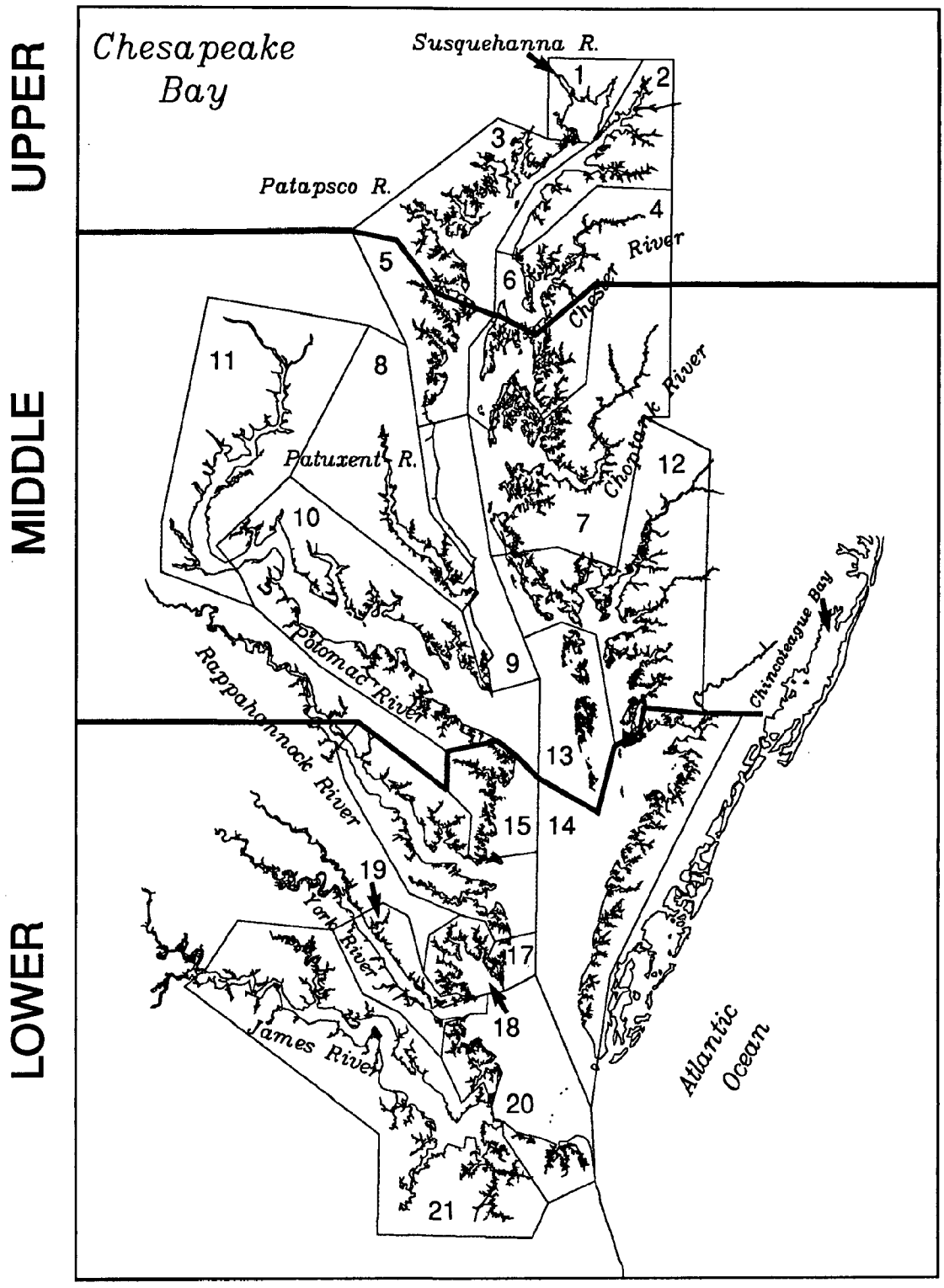

Figure 7. Location of Chincoteague Bay and Chesapeake Bay with Upper, Middle, and Lower zones and 21 sections used for delineation of SAV distribution patterns. (See Table 3 and Appendix B for exact boundary positions.)

Table 3

Area Descriptions for Each of the 21 Major Sections of the Chesapeake Bay SAV Study Area.

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, and to include SAV on the Swan Point 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 Choptank 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 a line extending from Maryland Point on the north shore, just above Nanjemoy Creek, to Somersett Beach on the south shore.
Section 11.	Upper Potomac River - all areas from upriver limit of the Lower Potomac River Section to Chain Bridge at Washington D.C.

Table 3 (concluded)

Section 12.**	Middle Eastern Shore - all areas south of Taylor Island and north of a line bisecting Cedar Island to include the Big and Little Annemessex Rivers, Fishing Bay, and the Honga, Nanticoke, Wicomico, and Manokin Rivers.
Section 13.**	Mid-bay Island Complex - all areas in and adjacent to Bloodsworth, South Marsh, Smith, and Tangier Islands.
Section 14.**	Lower Eastern Shore - all areas south of a line bisecting Cedar Island and located just above the Maryland-Virginia line to Fisherman's Island.
Section 15.	Reedville Region - 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 north of a line bisecting the large shoal area around the Guinea Marsh area.
Section 19.**	York River - all areas along the north shore from Clay Bank to the Guinea Marsh area and south of a line bisecting the large shoal area around the Guinea Marsh area, and along the south shore to include the north shore of 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.

**- Sections 12, 13, 14, 18, 19, and 20 were given new boundaries for the 1987 report (Orth et al., 1989) which also changed the delineation of the three major zones. These new boundaries were retained for the 1989 and 1990 reports (Orth and Nowak, 1990; Orth et al., 1991) and for this report. (Refer to Figure 7 and Appendix B for boundary locations.)

Ground Truth and Other Data Bases

Ground truthing was accomplished by cooperative efforts of a number of agencies and individuals. Although not all areas of the bay were groundtruthed this program does provide valuable supplemental information. This program confirmed the existence of some SAV beds mapped from 1991 aerial photography, located a few 1991 SAV beds not visible from the photography, and provided species data for many of these beds. Ground truth survey information supplied to VIMS researchers was included on the SAV distribution and abundance maps reproduced in Appendix C to show positions of the survey stations in relation to the 1991 beds of SAV mapped from the aerial photographs. Each survey was designated by a unique symbol to identify the different methods of sampling. In most cases, the symbols on the SAV maps (Appendix C) have been enlarged and offset from the actual sampling point to avoid confusion with the mapped SAV bed. Where species information was available, it was included on the map. Because of space limitations on the maps reproduced in Appendix C, in some cases certain survey points were omitted, or data from one or more survey points were combined where the information was duplicated. Additionally, all ground truth data supplied to VIMS referenced on copies of 1990 SAV maps were tabulated in Appendix E and cross-referenced at VIMS by 1991 bed locations.

For those areas in Virginia waters where aerial photographic evidence of SAV beds was inconclusive, photo-verification was accomplished by ground truthing. Observations were principally made from small boats and by divers snorkeling over areas indicated from the photographs. In several river systems included in this survey (York, Piankatank and Rappahannock) where VIMS researchers transplanted SAV (principally eelgrass), transplant sites were also examined carefully by divers for any extant SAV. VIMS scientists also surveyed a number of sites in the bay as part of an intensive quantitative SAV study (VIMS, unpublished data). Citizen Field Observation data for Virginia waters (compiled by the USFWS) were also added to the 1991 Virginia SAV maps reproduced in Appendix C. In addition, a great deal of ground truth information could be extrapolated from earlier studies (Orth et al., 1979; Orth and Moore, 1982) since SAV beds in the lower bay contain primarily one or two species and have not undergone drastic fluctuations in distribution and abundance since the first bay-wide survey in 1978.

In Maryland, ground truth data were obtained in 1991 by the Metropolitan Washington Council of Governments (COG) Potomac River survey, three SAV research projects, the USFWS, the Maryland DNR, and the Citizens' volunteer survey (this data set was compiled by the USFWS along with their own survey data). USFWS personnel surveyed selected locations in the upper bay, including the Potomac River, by boat using rakes to collect samples to determine presence or absence of SAV. All plant samples collected by USFWS were identified to species. Citizen groundtruthing identified plants to species when possible. SAV sightings

were referenced on USGS 7.5 minute topographic maps. USFWS staff transferred data from these surveys to full-scale copies of 1990 SAV distribution maps (USGS 7.5 minute topographic quads with 1990 SAV beds). These USFWS-prepared survey maps were supplied to VIMS SAV researchers and survey data were transferred by VIMS staff to the 1991 SAV distribution maps reproduced in Appendix C. USFWS survey data were tabulated, locating each SAV siting by listing its associated 1990 bed. This table was supplied to VIMS where additional survey data were added and it became the basis for the much expanded table published in Appendix E. In this latter VIMS version of the USFWS table, all ground truth data were added from the additional surveys, as noted in this report, and all were cross-referenced by 1991 bed locations as well as by 1990 bed locations.

The field study in the Potomac River by the COG, which covered the shoreline areas from the District of Columbia (D.C.) to Aquia Creek used shoreline surveys to document the distribution of SAV in the tidal freshwater and transition zones of the Potomac River and tributaries (Maps 28, 34, 39, 40, 47, 48, 55, and 64) in September. This survey was done by boat, using rakes to collect samples to determine presence or absence of SAV. Plants were identified by species and the proportion of each was estimated for vegetated areas. Each vegetated area with species proportions was referenced on USGS 7.5 minute topographic maps by the surveyors. The USFWS and Citizens' Survey also collected ground truth data from tributaries of the Potomac. The USFWS surveyed the Port Tobacco River, while the Citizens' Survey covered Nanjemoy and Piscataway creeks. Survey maps were supplied to VIMS SAV researchers. Patuxent River ground truth data were obtained by the Citizens' Survey. Data from these surveys were transferred by VIMS staff to the 1991 SAV distribution maps (reproduced in Appendix C) and were tabulated in Appendix E.

One 1991 SAV project being conducted on the Susquehanna Flats by Stan Kollar of Harford Community College provided data in the form of species presence by percentage, primarily by visual estimates. A SAV research group headed by William Dennison at the University of Maryland Horn Point Environmental Laboratories (HPEL) also provided 1991 ground truth data in collaboration with the VIMS research team. This was part of the intensive quantitative study mentioned earlier (VIMS, unpublished data). The Essex Community College SAV Research Group of Baltimore County, Maryland, contributed ground truth data for quads 13 and 14. The National Park Service, Assateague Island, as well as citizens, provided ground truthing for Chincoteague Bay. Maps of these study sites with species data were provided to VIMS researchers. Species locations from these data were added to the 1991 SAV maps reproduced in Appendix C and were tabulated in Appendix E by VIMS staff.

In addition to the scientific surveys, private citizens participated in identifying 1991 SAV beds by checking for presence of SAV at previous years' SAV bed locations in certain areas in the bay, and by identifying new SAV beds in 1991. Private citizens volunteered to assist in the 1991

SAV ground survey under guidance of the USFWS and the Chesapeake Bay Foundation (CBF). This program entailed identifying and recording the location of SAV in the bay in 1991. Volunteers, who were recruited through press releases, newsletters, and personal letters, were provided with a SAV identification guide, reduced 1990 SAV maps to aid in location of SAV beds, and data sheets for reporting visits to numerous sites around the bay. Each volunteer was asked to identify the location where SAV was sighted, and to identify the species. All information from the Citizens' Survey was submitted to Kathryn Reshetiloff (USFWS) for processing. SAV sitings reported by the Citizens' Survey were mapped on 1990 SAV maps. As previously explained, USFWS personnel also tabulated data from most of the 1991 Citizens' Survey along with their own survey's data, listing each SAV siting by 1990 bed location. VIMS staff mapped these data on 1991 maps reproduced in Appendix C, and data were tabulated in Appendix E.

RESULTS

Data Presentation

SAV distribution data are presented by topographic quadrangle (Table 4), by section and zone (Table 5), and by quadrangles within a section (Table 6). Topographic quadrangle maps annotated with all SAV beds are presented in Appendix C, while individual bed areas for each quadrangle are given in Appendix D. Appendix E tabulates all ground truth data for 1991. The 1991 SAV distribution data and species occurrences are first discussed relative to the Upper, Middle, and Lower Bay zones, respectively. The 21 sections of the Chesapeake Bay, and Chincoteague Bay, are then discussed individually and the data compared to results from the 1990 survey of SAV distribution and abundance (Orth, et al., 1991). SAV is plotted for each section and for Chincoteague Bay in Figures 8 through 29. SAV is plotted in red, a bold black line represents a section boundary, and USGS 7.5 minute topographic quadrangles are represented by a grid of numbered rectangles. (Refer to Table 2 for quadrangle names listed by map number.)

1991 SUMMARY

In 1991, the Chesapeake Bay had 25,623 hectares of SAV, compared to 24,296 hectares in 1990, with 2,158 hectares (8.4%), 11,664 hectares (45.5%), and 11,802 hectares (46.1%) occurring in the Upper, Middle, and Lower Bay zones, respectively (Figs. 1, 2, and 3).

Upper Bay Zone

In 1991 seventy-eight percent (1,684 hectares) of the SAV within the Upper Bay zone was located in the Susquehanna Flats (Section 1). Eight species of SAV were documented by ground truth surveys in this section, with *Myriophyllum spicatum* being dominant. A recently introduced exotic species, *Hydrilla verticillata*, was found in the Flats but occurred in small isolated beds. Overall abundance of SAV declined from the 1990 (1,773 hectares) level, but the density of beds increased slightly from 1990. Eighty-nine percent of all SAV beds in the Flats were classified as very sparse (0-10% coverage), and 7% of beds were classified as dense (70-100% coverage). This is a slight improvement over 1990 coverage when 92% were very sparse and 5% of beds were classified as dense. In the Upper Eastern Shore (Section 2) there were 326 hectares of SAV (95 hectares less than in 1990) located principally in the Elk and lower Sassafras rivers, and Swan, Stillpond, and Churn creeks, with many of the same species as reported in the Susquehanna Flats section. The Upper Western Shore (Section 3) had 91 hectares of SAV, primarily *M. spicatum* and *Vallisneria americana*, concentrated in Saltpeter and Dundee creeks. This is similar to 1990 when there were 90.47 hectares. In the Chester River (Section 4) SAV abundance (57 hectares) was down 10 hectares from 1990. SAV was most abundant adjacent to Eastern Neck, Eastern Neck Island, and in the lower Chester River. In this region *Ruppia maritima* was the most abundant of seven species reported.

Table 4

Total Area of SAV in Hectares by USGS 7.5 Minute Topographic Quadrangles for 1990 and 1991.

QUADRANGLE	1990	1991
001. Conowingo Dam, Md.-Pa.	-	0
002. Aberdeen, Md.	2.12	8.79
003. Havre de Grace, Md.	1,768.85	1,652.84
004. North East, Md.	146.75	75.36
005. Elkton, Md.-Del.	39.65	24.97
006. White Marsh, Md.	-	#
007. Edgewood, Md.	0	0
008. Perryman, Md.	0	0
009. Spesutie, Md.	50.84	87.15
010. Earleville, Md.	166.22	155.01
011. Cecilton, Md.	-	0
012. Baltimore East, Md.	-	0
013. Middle River, Md.	.69	4.40
014. Gunpowder Neck, Md.	89.78	84.24
015. Hanesville, Md.	6.32	4.02
016. Betterton, Md.	4.23	.60
017. Galena, Md.	7.90	3.89
018. Curtis Bay, Md.	#	#
019. Sparrows Point, Md.	#	#
020. Swan Point, Md.	6.46	3.81
021. Rock Hall, Md.	11.99	9.74
022. Chestertown, Md.	0	0
023. Round Bay, Md.	#	#
024. Gibson Island, Md.	#	#
025. Love Point, Md.	0	0
026. Langford Creek, Md.	47.75	42.04
027. Centreville, Md.	0	0
028. Washington West, Md.-D.C.	0	3.96
029. Washington East, D.C.-Md.	#	#
030. South River, Md.	#	#
031. Annapolis, Md.	#	#
032. Kent Island, Md.	133.08	1.58
033. Queenstown, Md.	55.76	4.24
034. Alexandria, Va.-D.C.-Md.	400.23	453.72
035. Deale, Md.	#	#

Table 4 (continued)

QUADRANGLE	1990	1991
036. Claiborne, Md.	139.11	59.47
037. St. Michaels, Md.	62.76	3.68
038. Easton, Md.	#	#
039. Fort Belvoir, Va.-Md.	105.16	160.27
040. Mt. Vernon, Va.-Md.	358.03	526.17
041. Lower Marlboro, Md.	#	#
042. North Beach, Md.	0	-
043. Tilghman, Md.	11.83	12.54
044. Oxford, Md.	19.28	6.28
045. Trappe, Md.	0	0
046. Preston, Md.	0	0
047. Quantico, Va.-Md.	694.15	805.93
048. Indian Head, Md.- Va.	303.92	355.27
049. Benedict, Md.	#	#
050. Prince Frederick, Md.	0	-
051. Hudson, Md.	96.63	62.85
052. Church Creek, Md.	6.45	2.24
053. Cambridge, Md.	0	0
054. East New Market, Md.	0	0
055. Widewater, Va.-Md.	614.49	648.13
056. Nanjemoy, Md.	126.91	140.79
057. Mathias Point, Md.-Va.	284.96	290.27
058. Popes Creek, Md.	4.86	20.13
059. Mechanicsville, Md.	0	0
060. Broomes Island, Md.	0	#
061. Cove Point, Md.	#	#
062. Taylors Island, Md.	58.41	30.01
063. Golden Hill, Md.	4.05	8.92
064. Passapatanzy, Md.-Va.	0	#
065. King George, Va.-Md.	52.97	64.17
066. Dahlgren, Va.-Md.	51.59	58.33
067. Colonial Beach North, Va.	45.86	46.62
068. Rock Point, Md.	#	#
069. Leonardtown, Md.	#	0
070. Hollywood, Md.	#	#
071. Solomons Island, Md.	#	#
072. Barren Island, Md.	299.56	121.72
073. Honga, Md.	1,005.06	861.83

Table 4 (continued)

QUADRANGLE	1990	1991
074. Wingate, Md.	399.64	460.31
075. Nanticoke, Md.	0	0
076. Colonial Beach South, Va.	0	0
077. Stratford Hall, Va.-Md.	0	0
078. St. Clements Island, Va.-Md.	0	#
079. Piney Point, Md.-Va.	#	0
080. St. Mary's City, Md.	0	0
081. Point No Point, Md.	0	-
082. Richland Point, Md.	30.79	20.91
083. Bloodsworth Island, Md.	699.45	801.70
084. Deal Island, Md.	39.05	24.35
085. Monie, Md.	18.33	7.28
086. Champlain, Va.	-	0
087. Machodoc, Va.	0	0
088. Kinsale, Va.-Md.	0	0
089. St. George Island, Md.-VA	0	1.74
090. Point Lookout, Md.	0	0
091. Kedges Straits, Md.	875.24	884.83
092. Terrapin Sand Point, Md.	256.95	261.07
093. Marion, Md.	191.96	305.93
094. Mount Landing, Va.	-	-
095. Tappahannock, Va.	-	-
096. Lottsburg, Va.	0	0
097. Heathsville, Va.-Md.	0	0
098. Burgess, Va.-Md.	0	0
099. Ewell, Md.-Va.	2,442.48	2,605.93
100. Great Fox Island, Md.-Va.	1,372.34	1,421.02
101. Crisfield, Md.-Va.	226.44	318.73
102. Saxis, Va.-Md.	.78	1.26
103. Dunnsville, Va.	-	-
104. Morattico, Va.	0	0
105. Lively, Va.	0	0
106. Reedville, Va.	226.76	242.79
107. Tangier Island, Va.	749.74	782.21
108. Chesconessex, Va.	952.46	1,052.51
109. Parksley, Va.	339.38	483.10
110. Urbanna, Va.	15.89	5.39
111. Irvington, Va.	221.48	165.03

Table 4 (continued)

QUADRANGLE	1990	1991
112. Fleets Bay, Va.	381.44	391.85
113. Nandua Creek, Va.	364.46	441.55
114. Pungoteague, Va.	823.09	976.18
115. West Point, Va.	0	-
116. Saluda, Va.	1.97	0
117. Wilton, Va.	48.63	16.00
118. Deltaville, Va.	90.50	107.54
119. Jamesville, Va.	509.45	621.64
120. Toano, Va.	-	-
121. Gressitt, Va.	-	-
122. Ware Neck, Va.	302.98	321.73
123. Mathews, Va.	196.06	260.64
124. Franktown, Va.	484.56	627.61
125. Westover, Va.	#	#
126. Charles City, Va.	-	-
127. Brandon, Va.	-	#
128. Norge, Va.	-	-
129. Williamsburg, Va.	-	-
130. Clay Bank, Va.	1.48	0
131. Achilles, Va.	996.40	1,010.88
132. New Point Comfort, Va.	1,398.44	1,448.69
133. Cape Charles, Va.	318.81	362.17
134. Cheriton, Va.	70.93	82.73
135. Savedge, Va.	-	-
136. Claremont, Va.	-	-
137. Surry, Va.	-	#
138. Hog Island, Va.	-	-
139. Yorktown, Va.	1.68	.71
140. Poquoson West, Va.	540.40	554.65
141. Poquoson East, Va.	1,007.92	1,151.41
142. Elliotts Creek, Va.	28.20	68.17
143. Townsend, Va.	1.51	.72
144. Bacons Castle, Va.	-	-
145. Mulberry Island, Va.	-	-
146. Newport News North, Va.	-	-
147. Hampton, Va.	342.10	381.24
148. Benns Church, Va.	-	-

Table 4 (concluded)

QUADRANGLE	1990	1991
149. Newport News South, Va.	0	-
150. Norfolk North, Va.	0	-
151. Little Creek, Va.	0	0
152. Cape Henry, Va.	28.31	23.66
153. Chuckatuck, Va.	-	-
154. Bowers Hill, Va.	-	-
155. Norfolk South, Va.	-	-
156. Kempsville, Va.	-	-
157. Princess Anne, Va.	.73	0
158. Wye Mills, Md.	0	0
159. Bristol, Md.	#	0
160. Fowling Creek, Md.	0	0
161. Port Tobacco, Md.	11.89	12.65
162. Charlotte Hall, Md.	0	8.97
163. Mardela Springs, Md.	0	0
164. Wetipquin, Md.	0	0
165. Selbyville, Md.	0	0
166. Assawoman Bay, Md.	0	1.23
167. Berlin, Md.	6.34	11.13
168. Ocean City, Md.	19.76	17.67
169. Public Landing, Md.	0	0
170. Tingles Island, Md.	993.17	1,066.44
171. Girdle Tree, Md.-Va.	0	0
172. Boxiron, Md.-Va.	635.15	672.52
173. Whittington Point, Md.-VA	239.86	363.68
174. Chincoteague West, Va.	0	.63
175. Chincoteague East, Va.	598.66	612.86
176. Anacostia, D.C.-Md.	0	0
TOTAL SAV - Chesapeake Bay	24,295.79	25,623.47
TOTAL SAV - Chincoteague Bay	2492.95	2,746.17

NOTES:

- \- Indicates quadrangle not photographed and assumed to have no SAV.
- 0 Indicates quadrangle photographed and no SAV noted.
- # SAV detected by ground truthing only.

Table 5

Number of Hectares of SAV in 1990 and 1991 for the 21 Major Sections and Three Zones of the Chesapeake Bay and for Chincoteague Bay.

ZONE	SECTION	AREA (HECTARES) 1990	1991
Upper	1. Susquehanna Flats	1,772.74	1,684.06
	2. Upper Eastern Shore	420.57	326.19
	3. Upper Western Shore	90.47	91.00
	4. Chester River	67.32	56.68
	Zone Total	2,351.10	2,157.93
Middle	5. Central Western Shore	0.00	0.00
	6. Eastern Bay	389.18	67.89
	7. Choptank River	192.60	113.92
	8. Patuxent River	0.00	0.00
	9. Middle Western Shore	0.00	0.00
	10. Lower Potomac River	531.85	581.10
	11. Upper Potomac River	2,523.18	3,016.04
	12. Middle Eastern Shore	2,284.60	2,177.51
	13. Mid-Bay Island Complex	5,396.71	5,707.36
	Zone Total	11,318.12	11,663.82
Lower	14. Lower Eastern Shore	4,823.39	5,719.50
	15. Reedville	608.20	634.64
	16. Rappahannock River Complex	544.14	508.93
	17. New Point Comfort Region	356.91	338.87
	18. Mobjack Bay Complex	1,703.48	1,787.76
	19. York River	790.87	803.53
	20. Lower Western Shore	1,796.84	2,005.75
	21. James River	2.73	2.74
	Zone Total	10,626.56	11,801.72
Total SAV for Chesapeake Bay		24,295.79	25,623.47
Total SAV for Chincoteague Bay		2,492.95	2,746.17

Table 6

Number of Square Meters of SAV in 1991 for Each Quadrangle of the 21 Sections in the Chesapeake Bay and of Chincoteague Bay. (Map Code Numbers from Table 2 in Parentheses.)

SECTION	QUADRANGLE	AREA
Susquehanna Flats - 1	Conowingo Dam (1)	0.00
	Aberdeen (2)	87,854.22
	Havre de Grace (3)	16,528,372.04
	North East (4)	0.00
	Elkton (5)	0.00
	Perryman (8)	0.00
	Spesutie (9)	224,397.45
	Earleville (10)	0.00
		16,840,623.71 sq.m
		1,684.06 hectares
		4,161.32 acres
Upper Eastern Shore - 2	North East (4)	753,561.57
	Elkton (5)	249,674.66
	Perryman (8)	0.00
	Spesutie (9)	623,425.10
	Earleville (10)	1,550,110.67
	Cecilton (11)	0.00
	Gunpowder Neck (14)	0.00
	Hanesville (15)	40,200.46
	Betterton (16)	6000.27
	Galena (17)	38,897.80
	Swan Point (20)	0.00
	Rock Hall (21)	0.00
	Chestertown (22)	0.00
		3,261,870.53 sq.m
		326.19 hectares
		806.01 acres
Upper Western Shore - 3	White Marsh (6)	0.00
	Edgewood (7)	0.00
	Perryman (8)	0.00
	Spesutie (9)	23,662.02
	Baltimore East (12)	0.00
	Middle River (13)	44,006.71
	Gunpowder Neck (14)	842,359.28

Table 6 (continued)

SECTION	QUADRANGLE	AREA
Upper Western Shore - 3 (continued)		
	Hanesville (15)	0.00
	Curtis Bay (18)	0.00
	Sparrows Point (19)	0.00
	Swan Point (20)	0.00
	Round Bay (23)	0.00
	Gibson Island (24)	0.00
	Love Point (25)	0.00
		910,028.01 sq.m
		91.00 hectares
		224.87 acres
Chester River - 4	Betterton (16)	0.00
	Galena (17)	0.00
	Swan Point (20)	38,128.53
	Rock Hall (21)	97,388.73
	Chestertown (22)	0.00
	Love Point (25)	0.00
	Langford Creek (26)	420,387.02
	Centreville (27)	0.00
	Kent Island (32)	0.00
	Queenstown (33)	10,855.25
		566,759.53 sq.m
		56.68 hectares
		140.05 acres
Central Western Shore - 5	Curtis Bay (18)	0.00
	Round Bay (23)	0.00
	Gibson Island (24)	0.00
	South River (30)	0.00
	Annapolis (31)	0.00
	Deale (35)	0.00
	North Beach (42)	0.00
		0.00 sq.m
		0.00 hectares
		0.00 acres
Eastern Bay - 6	Centreville (27)	0.00
	Annapolis (31)	0.00

Table 6 (continued)

SECTION	QUADRANGLE	AREA
Eastern Bay - 6 (continued)		
	Kent Island (32)	15,831.92
	Queenstown (33)	31,494.79
	Claiborne (36)	594,702.21
	St. Michaels (37)	36,845.75
	Easton (38)	0.00
	Tilghman (43)	0.00
	Oxford (44)	0.00
	Wye Mills (158)	0.00
		678,874.67 sq.m
		67.89 hectares
		167.75 acres
Choptank River - 7	Centreville (27)	0.00
	Claiborne (36)	0.00
	St. Michaels (37)	0.00
	Easton (38)	0.00
	Tilghman (43)	125,408.08
	Oxford (44)	62,772.74
	Trappe (45)	0.00
	Preston (46)	0.00
	Hudson (51)	628,458.07
	Church Creek (52)	22,390.68
	Cambridge (53)	0.00
	East New Market (54)	0.00
	Taylors Island (62)	300,132.97
	Golden Hill (63)	0.00
	Nanticoke (75)	0.00
	Wye Mills (158)	0.00
	Fowling Creek (160)	0.00
		1,139,162.54 sq.m
		113.92 hectares
		281.49 acres
Patuxent River - 8	Deale (35)	0.00
	Lower Marlboro (41)	0.00
	North Beach (42)	0.00
	Benedict (49)	0.00
	Prince Frederick (50)	0.00
	Mechanicsville (59)	0.00

Table 6 (continued)

SECTION	QUADRANGLE	AREA
Patuxent River - 8 (continued)		
	Broomes Island (60)	0.00
	Cove Point (61)	0.00
	Hollywood (70)	0.00
	Solomons Island (71)	0.00
	Bristol (159)	0.00
	Charlotte Hall (162)	0.00
		0.00 sq.m
		0.00 hectares
		0.00 acres
Middle Western Shore - 9	North Beach (42)	0.00
	Prince Frederick (50)	0.00
	Hudson (51)	0.00
	Broomes Island (60)	0.00
	Cove Point (61)	0.00
	Taylors Island (62)	0.00
	Solomons Island (71)	0.00
	Barren Island (72)	0.00
	St. Marys City (80)	0.00
	Point No Point (81)	0.00
	Richland Point (82)	0.00
	Point Lookout (90)	0.00
		0.00 sq.m
		0.00 hectares
		0.00 acres
Lower Potomac River - 10	Nanjemoy (56)	1,407,941.03
	Mathias Point (57)	2,902,732.51
	Popes Creek (58)	201,296.25
	Mechanicsville (59)	0.00
	King George (65)	140,416.50
	Dahlgren (66)	583,297.24
	Colonial Beach North (67)	466,224.38
	Rock Point (68)	0.00
	Leonardtown (69)	0.00
	Hollywood (70)	0.00
	Solomons Island (71)	0.00
	Colonial Beach South (76)	0.00
	Stratford Hall (77)	0.00

Table 6 (continued)

SECTION	QUADRANGLE	AREA
Lower Potomac River - 10 (continued)		
	St. Clements Island (78)	0.00
	Piney Point (79)	0.00
	St. Marys City (80)	0.00
	Champlain (86)	0.00
	Machodoc (87)	0.00
	Kinsale (88)	0.00
	St. George Island (89)	17,394.50
	Point Lookout (90)	0.00
	Lottsburg (96)	0.00
	Heathsville (97)	0.00
	Burgess (98)	0.00
	Port Tobacco (161)	1,936.12
	Charlotte Hall (162)	89,746.53
		5,810,985.06 sq.m
		581.10 hectares
		1,435.90 acres
Upper Potomac River - 11	Washington West (28)	39,603.63
	Washington East (29)	0.00
	Alexandria (34)	4,537,155.33
	Fort Belvoir (39)	1,602,669.61
	Mt. Vernon (40)	5,261,718.59
	Quantico (47)	8,059,338.98
	Indian Head (48)	3,552,675.31
	Widewater (55)	6,481,334.74
	Nanjemoy (56)	0.00
	Mathias Point (57)	0.00
	Passapatanzy (64)	0.00
	King George (65)	501,326.80
	Dahlgren (66)	0.00
	Port Tobacco (161)	124,586.30
	Anacostia (176)	0.00
		30,160,409.29 sq.m
		3,016.04 hectares
		7,452.65 acres
Middle Eastern Shore - 12	Taylors Island (62)	0.00
	Golden Hill (63)	89,204.58
	Barren Island (72)	1,217,150.55

Table 6 (continued)

SECTION	QUADRANGLE	AREA
Middle Eastern Shore - 12 (continued)		
	Honga (73)	8,618,267.55
	Wingate (74)	4,603,087.15
	Nanticoke (75)	0.00
	Point No Point (81)	0.00
	Richland Point (82)	209,149.62
	Bloodsworth Island (83)	1,072,434.03
	Deal Island (84)	243,518.42
	Monie (85)	72,752.33
	Terrapin Sand Point (92)	193,695.86
	Marion (93)	3,059,298.19
	Great Fox Island (100)	1,302,055.06
	Crisfield (101)	1,094,474.54
	Mardela Springs (163)	0.00
	Wetipquin (164)	0.00
		21,775,087.88 sq.m
		2,177.51 hectares
		5,380.63 acres
Mid-Bay Island Complex - 13	Richland Point (82)	0.00
	Bloodsworth Island (83)	6,944,572.70
	Deal Island (84)	0.00
	Kedges Straits (91)	8,848,294.97
	Terrapin Sand Point (92)	2,416,997.70
	Ewell (99)	26,059,291.19
	Great Fox Is. (100)	5,582,617.55
	Tangier Island (107)	7,221,859.69
		57,073,633.80 sq.m
		5,707.36 hectares
		14,102.91 acres
Lower Eastern Shore - 14	Marion (93)	0.00
	Great Fox Island (100)	7,325,551.74
	Crisfield (101)	2,092,802.67
	Saxis (102)	12,604.37
	Tangier Island (107)	600,259.70
	Chesconessex (108)	10,525,052.96
	Parksley (109)	4,831,002.93
	Nandua Creek (113)	4,415,540.04
	Pungoteague (114)	9,761,805.83

Table 6 (continued)

SECTION	QUADRANGLE	AREA
Lower Eastern Shore - 14 (continued)		
	Jamesville (119)	6,216,401.30
	Franktown (124)	6,276,144.04
	Cape Charles (133)	3,621,726.88
	Cheriton (134)	827,269.68
	Elliotts Creek (142)	681,657.12
	Townsend (143)	7,217.51
		57,195,036.77 sq. m
		5,719.50 hectares
		14,132.91 acres
Reedville Region - 15	Heathsville (97)	0.00
	Burgess (98)	0.00
	Reedville (106)	2,427,887.01
	Irvington (111)	0.00
	Fleets Bay (112)	3,918,542.87
		6,346,429.88 sq. m
		634.64 hectares
		1,568.20 acres
Rappahannock River Complex - 16	Tappahannock (95)	0.00
	Lottsburg (96)	0.00
	Dunnsville (103)	0.00
	Morattico (104)	0.00
	Lively (105)	0.00
	Urbanna (110)	53,866.07
	Irvington (111)	1,650,345.65
	Fleets Bay (112)	0.00
	Saluda (116)	0.00
	Wilton (117)	159,977.81
	Deltaville (118)	1,075,439.81
	Ware Neck (122)	0.00
	Mathews (123)	2,149,646.62
		5,089,275.96 sq.m
		508.93 hectares
		1,257.56 acres

Table 6 (continued)

SECTION	QUADRANGLE	AREA
New Point Comfort Region - 17	Mathews (123)	0.00
	New Point Comfort (132)	3,388,663.14
		3,388,663.14 sq. m
		338.87 hectares
		837.34 acres
Mobjack Bay Complex - 18	Ware Neck (122)	3,217,268.38
	Mathews (123)	456,732.50
	Clay Bank (130)	0.00
	Achilles (131)	6,920,407.22
	New Point Comfort (132)	7,283,189.59
		17,877,597.69 sq.m
		1,787.76 hectares
		4,417.56 acres
York River - 19	Toano (120)	0.00
	Gressitt (121)	0.00
	Williamsburg (129)	0.00
	Clay Bank (130)	0.00
	Achilles (131)	3,188,378.21
	New Point Comfort (132)	3,815,095.07
	Hog Island (138)	0.00
	Yorktown (139)	7,078.38
	Poquoson West (140)	1,024,715.31
	Poquoson East (141)	0.00
		8,035,266.97 sq. m
		803.53 hectares
		1,985.52 acres
Lower Western Shore - 20	New Point Comfort (132)	0.00
	Poquoson West (140)	4,521,745.16
	Poquoson East (141)	11,514,108.41
	Elliotts Creek (142)	0.00
	Newport News North (146)	0.00
	Hampton (147)	3,785,021.89
	Norfolk North (150)	0.00
	Little Creek (151)	0.00
	Cape Henry (152)	236,623.52

Table 6 (continued)

SECTION	QUADRANGLE	AREA
Lower Western Shore - 20 (continued)		
	Kempsville (156)	0.00
	Princess Anne (157)	0.00
		20,057,498.98 sq.m
		2,005.75 hectares
		4,956.21 acres
James River - 21	Toano (120)	0.00
	Westover (125)	0.00
	Charles City (126)	0.00
	Brandon (127)	0.00
	Norge (128)	0.00
	Williamsburg (129)	0.00
	Savedge (135)	0.00
	Claremont (136)	0.00
	Surry (137)	0.00
	Hog Island (138)	0.00
	Yorktown (139)	0.00
	Bacons Castle (144)	0.00
	Mulberry Island (145)	0.00
	Newport News North (146)	0.00
	Hampton (147)	27,356.48
	Benns Church (148)	0.00
	Newport News South (149)	0.00
	Norfolk North (150)	0.00
	Little Creek (151)	0.00
	Chuckatuck (153)	0.00
	Bowers Hill (154)	0.00
	Norfolk South (155)	0.00
	Kempsville (156)	0.00
		27,356.48 sq. m
		2.74 hectares
		6.76 acres
Chincoteague Bay	Selbyville (165)	0.00
	Assawoman Bay (166)	12,336.71
	Berlin (167)	111,297.89
	Ocean City (168)	176,746.94
	Public Landing (169)	0.00

Table 6 (concluded)

SECTION	QUADRANGLE	AREA
Chincoteague Bay - (continued)		
	Tingles Island (170)	10,664,391.90
	Girdle Tree (171)	0.00
	Boxiron (172)	6,725,236.53
	Whittington Point (173)	3,636,812.61
	Chincoteague West (174)	6,316.30
	Chinoteague East (175)	6,128,605.33
	Anacostia (176)	0.00
		27,261,744.21 sq.m
		2,746.17 hectares
		6,785.80 acres

Middle Bay Zone

In 1991 forty-nine percent (5,707 hectares) of the SAV in the Middle Bay zone was found in the Mid-Bay Island Complex (Section 13) which includes the broad shoal area between Smith and Tangier Islands. This is an increase of 310 hectares over 1990. The two dominant species were *R. maritima* and *Zostera marina*. Nineteen percent (2,178 hectares) of the SAV in this zone was present in the Middle Eastern Shore (Section 12), primarily in the Barren Island-Honga River area, the Big and Little Annemessex rivers, and the lower section of the Manokin River, with *R. maritima* being the dominant species reported. Little or no SAV was mapped or reported from the Central Western Shore (Section 5), Patuxent River (Section 8), and Middle Western Shore (Section 9).

The Middle Bay zone also includes the entire Potomac River, where 3,597 hectares of SAV were present in 1991. SAV was concentrated in two distinct regions: 1) the Upper Potomac River (Section 11) with 3,016 hectares, where *Hydrilla verticillata* remained the numerically dominant species (nine other species were reported by the COG, VIMS, and Citizens' Survey); and 2) the upper portion of the Lower Potomac River (Section 10) with 581 hectares, including Nanjemoy Creek and Port Tobacco River, with *V. americana* and *M. spicatum* being the most frequently reported species. The total abundance of SAV in the Upper Potomac section increased from 1990 by 493 hectares; it increased in the Lower Potomac section by 49 hectares. SAV continued to decline in the Eastern Bay and Choptank River sections. SAV in the Eastern Bay (Section 6) decreased 321 hectares from 1990 to a total of 68 hectares in 1991, while in the Choptank River (Section 7) it declined 79 hectares from 1990 to a total of 114 hectares in 1991.

Lower Bay Zone

Distribution and abundance in 1991 in the Lower Bay zone were similar to 1990. Forty-eight percent (5,720 hectares) of SAV in this zone was found in the Lower Eastern Shore (Section 14) around the Fox Islands and the mouths of major creeks (i.e. Cherrystone Inlet and Hungars, Mattawoman, Occahannock, Craddock, Pungoteague, and Onancock creeks). Along the western shore of the Chesapeake Bay, SAV was abundant in Mobjack Bay (Section 18) (15% of SAV in the Lower Bay zone), in the lower York River (Section 19) (7% of SAV in the Lower Bay zone), and in the Lower Western Shore (Section 20), specifically Back River and Drum Island Flats area adjacent to Plum Tree Island (17% of SAV in the Lower Bay zone). There were 635 hectares of SAV mapped in the Reedville Region (Section 15) in 1991, a 4% increase over 1990. There were 339 hectares of SAV identified in 1991 in the New Point Comfort Region (Section 17) compared to 357 hectares in 1990. Both *R. maritima* and *Z. marina* were abundant throughout this zone. SAV abundance was down 7% from 1990 in both the Piankatank and Rappahannock rivers (Section 16). *Ruppia maritima* was the dominant species in those rivers, with *Zostera marina* also present as a result of previously successful transplant efforts from 1984 to 1990 using both seeds and whole plants. The James River (Section 21) had less than 3 hectares of SAV in 1991, which is the same as in 1990.

Chincoteague Bay

SAV in the Chincoteague Bay section increased slightly in distribution from 1990 with 2,746 hectares mapped in 1991. SAV in Chincoteague Bay and Sinepuxent Bay consisted of *R. maritima* and *Z. marina*, and was located along the eastern side of the bay behind Assateague Island. Assawoman Bay contained only *R. maritima* while only *Z. marina* was reported from Isle of Wight Bay.

DISCUSSION OF SECTIONS ARRANGED WITHIN ZONES

Upper Bay Zone

1. SUSQUEHANNA FLATS

There were 1,684 hectares of SAV in the Susquehanna Flats section in 1991 (Tables 4-6; Fig. 8; Appendix C, Maps 2, 3, and 9) compared to 1,773 hectares mapped in 1990. Seven percent of the total coverage of SAV in this section was dense (density class 4), 1% was moderate (density class 3), 3% was sparse (density class 2), and 89% was very sparse (density class 1). SAV beds were located principally in two main areas: 1) sparse to dense fringing beds in the Susquehanna River consisting primarily of *M. spicatum*, with *P. pectinatus*, *C. demersum*, *V. americana*, *H. dubia*, *N. guadalupensis*, *N. minor*, *H. verticillata*, and *Najas* spp. in lesser amounts from Spencer Island to the river mouth at Havre de Grace on the west side, and to Stump Point at the mouth of Mill Creek on the north side; and 2) a large area of very sparse SAV located in the broad shoal area at the river mouth. This broad shoal consisted primarily of small patches of *M. spicatum*. In addition, SAV beds were mapped in Spesutie Narrows for the first time this year. Most of the beds were small, fringing beds, most likely *M. spicatum*.

A total of ten species (*M. spicatum*, *H. dubia*, *V. americana*, *H. verticillata*, *C. demersum*, *P. pectinatus*, *N. quadilupensis*, *N. minor*, *N. gracillima*, *P. perfoliatus*, and *Najas* spp.) have been reported either by Stan Kollar of Harford Community College, or the Citizens' Survey.

2. UPPER EASTERN SHORE

There were 326 hectares of SAV mapped for the Upper Eastern Shore section in 1991 (Tables 4-6; Fig. 9; Appendix C, Maps 4, 5, 9, 10, 15, 16, and 17) compared to 421 hectares mapped for 1990. One percent of the total coverage of SAV in this section was moderate (density class 3), 32% was sparse (density class 2), and 66% was very sparse (density class 1). Principal locations of beds were in the Elk River, mouth of Bohemia River, Swan Creek, lower Sassafras River, Still Pond and the mouth of Churn Creek. Very little SAV was mapped in the Bohemia River and along the mainstem of the bay from Still Pond to Swan Point.

Myriophyllum spicatum and *V. americana* were the two most commonly reported species, with four other species (*H. verticillata*, *Najas* spp., *Z. palustris, and P. pectinatus*) reported in lesser amounts as determined by Stan Kollar of Harford Community College and the Citizens' Survey (maps 4, 5, 9, 10, 15, and 16).

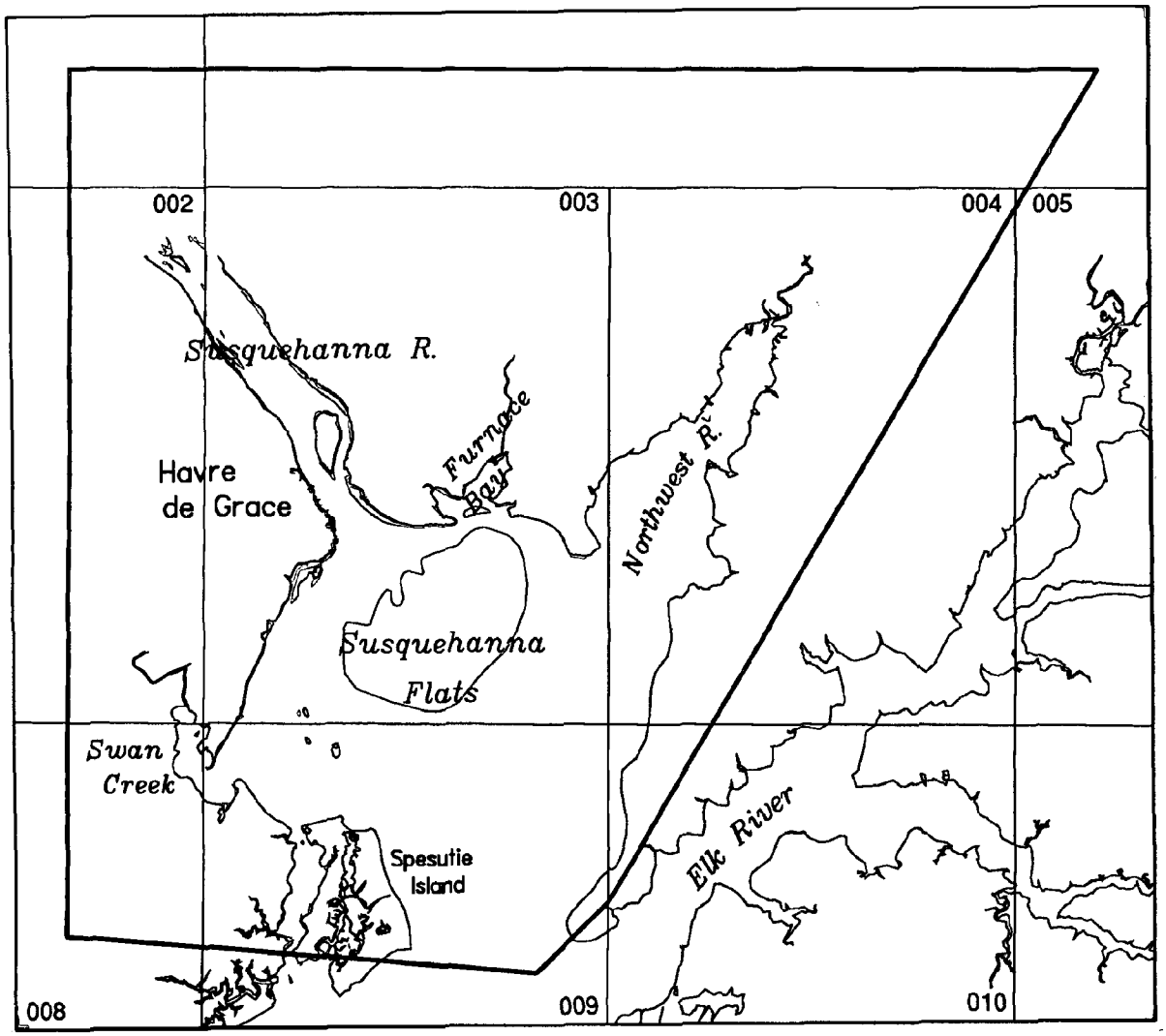

Figure 8. Distribution of SAV in the Susquehanna Flats (Section 1).

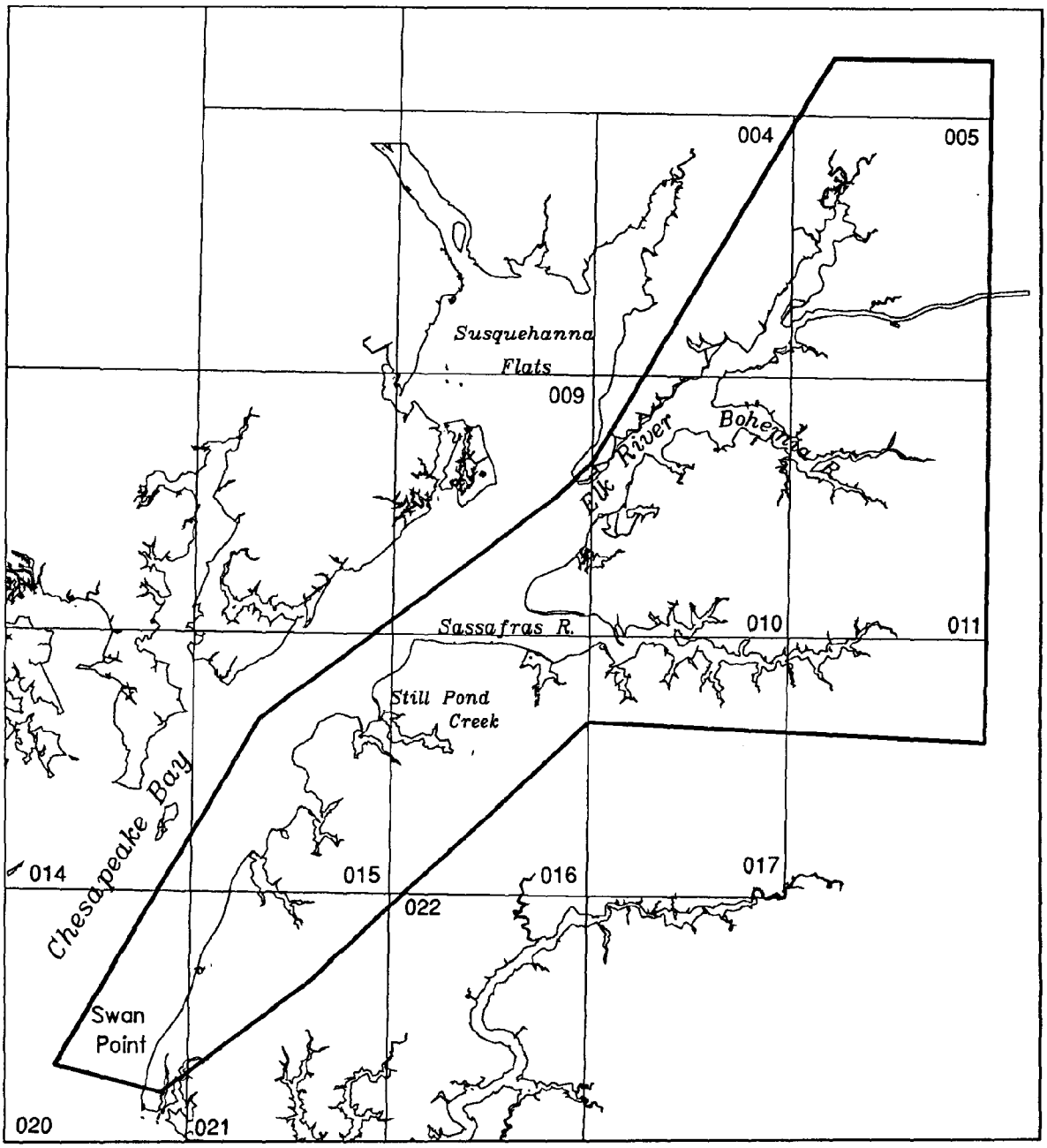

Figure 9. Distribution of SAV in the Upper Eastern Shore (Section 2).

3. UPPER WESTERN SHORE

There were 91 hectares of SAV mapped from the aerial photographs in 1991 for the Upper Western Shore section (Tables 4-6; Fig. 10; Appendix C, Maps 9, 13 and 14) compared to 90 hectares in 1990. Ninety percent of the total coverage of SAV in this section was moderate (density class 3), and 10% was sparse (density class 2). SAV beds were concentrated in Saltpeter and Dundee creeks. SAV was mapped in the lower Spesutie Narrows in 1991, the first time SAV was mapped in this part of section 3. Very little or no SAV was reported in the Back, Patapsco, Bush, Gunpowder, Middle, and Magothy rivers. *M. spicatum, E. canadensis, C. demersum, Z. palustris, R. maritima, N. quadalupensis,* and *V. americana* were reported by the Citizens' Survey, Stan Kollar of Harford Community College, and Essex Community College (Maps 13, 14, 19, 23, and 24).

4. CHESTER RIVER

There were 57 hectares of SAV in the Chester River section in 1991 (Tables 4-6; Fig. 11; Appendix C, Maps 20, 21, 26, and 33) compared to 67 hectares in 1990. Ten percent of the total coverage of SAV in this section was dense (density class 4), 56% was moderate (density class 3), and 34% was sparse (density class 2). SAV has continually declined in this section since 1987 when 515 hectares of SAV were mapped and large, dense beds of *R. maritima* dominated this section. SAV was located adjacent to Eastern Neck and Eastern Neck Island, especially near Eastern Neck Narrows, and in Robin Cove in the Chester River. Additional beds are found in Rock Hall Harbor, The Haven, Swan, and Huntingfield creeks, located above Eastern Neck on the Chesapeake Bay.

Six species of SAV were reported from this section in 1991 by the Citizens', University of Maryland's HPEL, and USFWS surveys *(R. maritima, P. perfoliatus, P. pectinatus, M. spicatum, E. canadensis,* and *Z. palustris*). Robin Pond was reported to have all six species from the Citizens' Survey which would make this one of the most diverse beds in this section.

Middle Bay Zone

5. CENTRAL WESTERN SHORE

There was no SAV observed from the aerial photography in the Central Western Shore section in 1991 (Tables 4-6; Fig. 12) which was similar to 1990. Although not evident in the aerial photography, the Citizens' Survey reported SAV from a few sites in this section, primarily the Severn and South rivers, Lake Ogleton, and South Creek of the West River (Maps 18, 23, 24, 30, 31, and 35). Species reported from this section include *Z. palustris, C. demersum, M. spicatum,* and *R. maritima.*

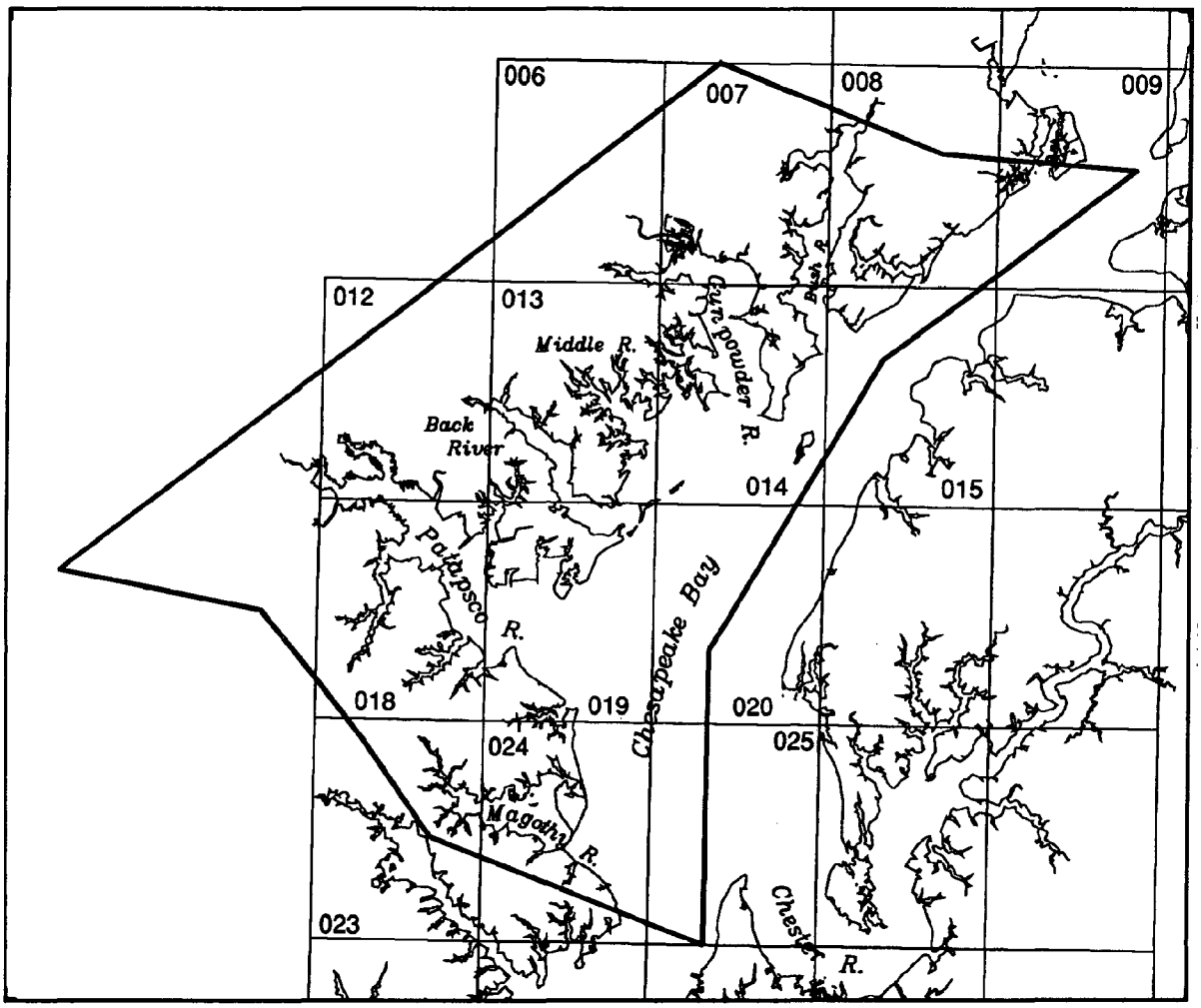

Figure 10. Distribution of SAV in the Upper Western Shore (Section 3).

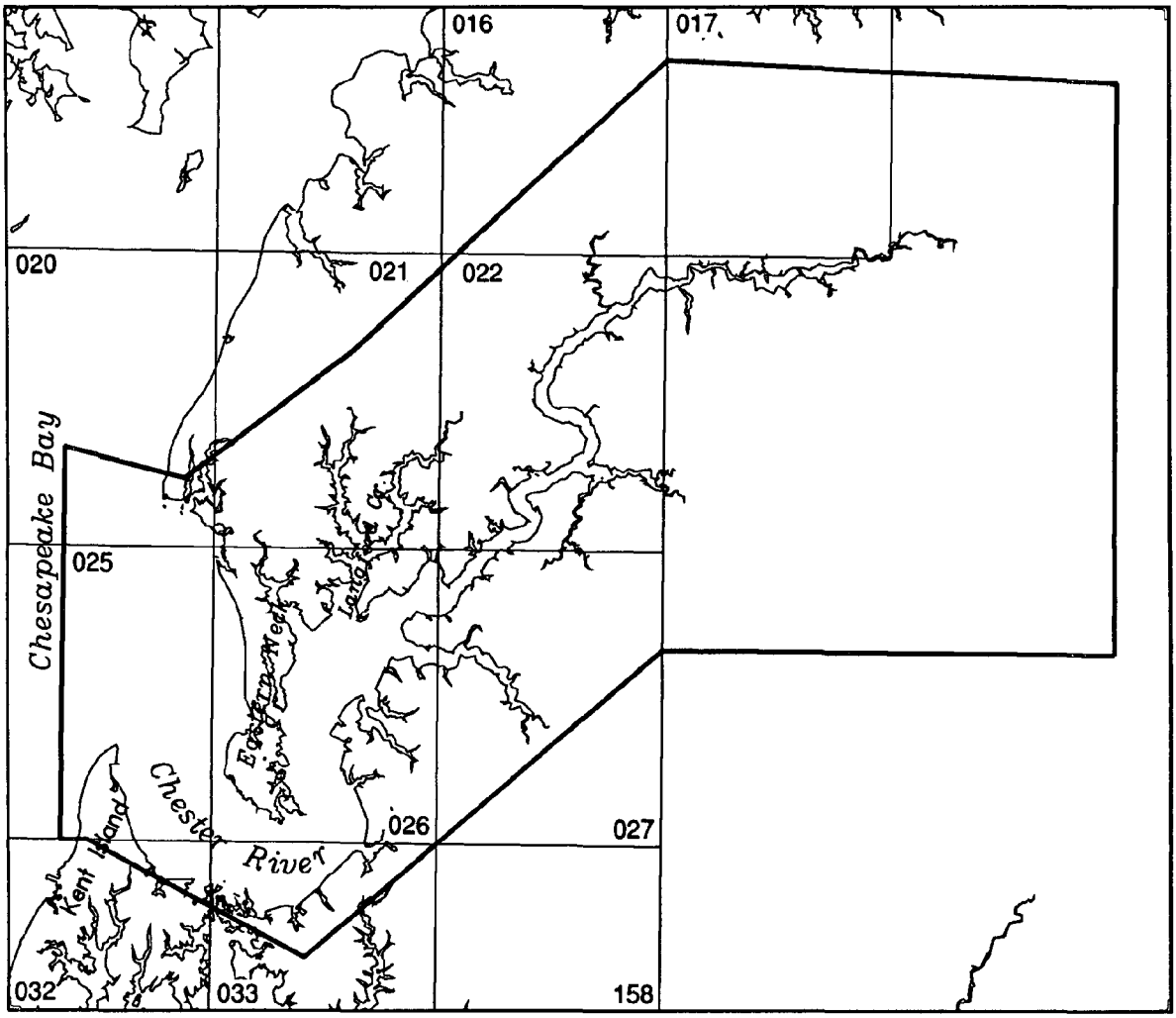

Figure 11. Distribution of SAV in the Chester River (Section 4).

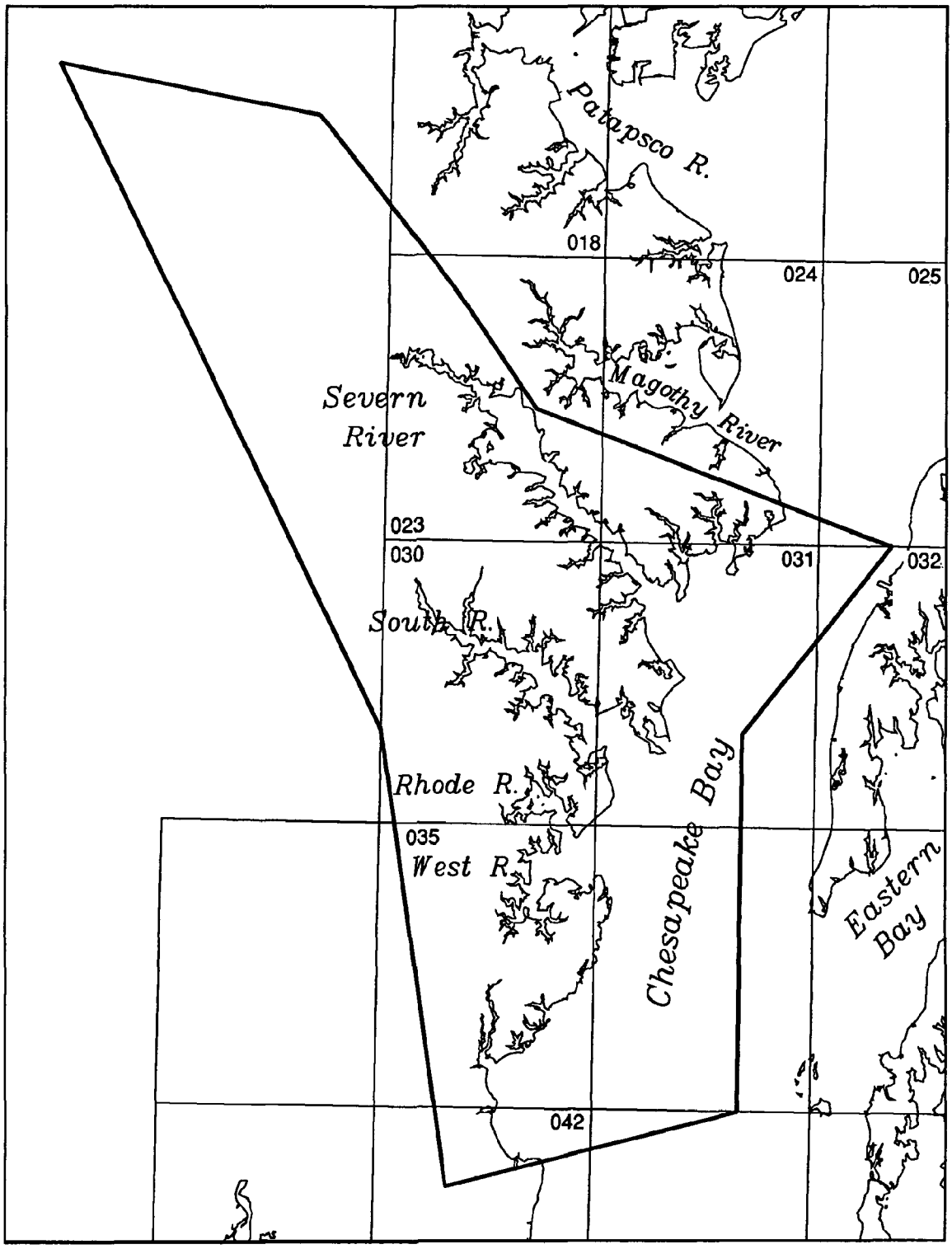

Figure 12. Distribution of SAV in the Central Western Shore (Section 5).

6. EASTERN BAY

There were 68 hectares of SAV identified from the Eastern Bay section in 1991 (Tables 4-6; Fig. 13; Appendix C, Maps 32, 33, 36, and 37) compared to 389 hectares reported in 1990. This is a dramatic reduction from 1989 when 831 hectares were found. Eight percent of the total coverage of SAV in this section was dense (density class 4), 4% was moderate (density class 3), 57% was sparse (density class 2), and 30% was very sparse (density class 1). In 1991 most of the SAV was found in lower Cox Creek, the eastern shore of lower Kent Island, Parson Island, Harbor Cove and between Wades Point and Claiborne. *R. maritima* and *Z. palustris* were the only species reported by the University of Maryland HPEL and the Citizens' surveys (Maps 32, 33, 36, 37 and 38).

7. CHOPTANK RIVER

There were 114 hectares of SAV observed in the Choptank River section in 1991 (Tables 4-6; Fig. 14; Appendix C, Maps 43, 44, 51, 52, and 62) compared to 193 hectares in 1990. Thirty-one percent of the total coverage of SAV in this section was moderate (density class 3), 68% was sparse (density class 2), and 1% was very sparse (density class 1). SAV was found in mainly small beds in Blackwalnut Cove at the southern tip of Tilghman Island, Broad Creek at the mouth of Bulls Creek, Brannock Bay, the mouth of Chapel Creek, Tred Avon River, Irish Creek, Cook Point Cove, Covey Creek, Cators Cove, and James Island.

Ground truthing by Citizens' Survey and scientists from the University of Maryland's HPEL located two species of SAV in this section (Maps 36, 43, 44, 51, and 52) with *R. maritima* being the most prevalent. *Zannichellia palustris* was observed in scattered locations.

8. PATUXENT RIVER

There was no SAV observed from the aerial photography in the Patuxent River section in 1991 (Tables 4-6; Fig. 15) which was similar to 1990. There were sporadic sightings of four SAV species in the Patuxent River by the the Citizens' Survey (Maps 41, 49, 61, 70, 71, and 159). Those species reported from the lower sections of the river were *Z. palustris* and *R. maritima*. Species found from the upper sections of the river were *V. americana, C. demersum, Najas guadalupensis, Najas minor, Z. palustris, E. canadensis* and *P. crispus*.

9. MIDDLE WESTERN SHORE

There were no SAV beds identified in the Middle Western Shore section in 1991 (Tables 4-6; Fig. 16) which was similar to 1990. There were no observations from ground surveys in 1991.

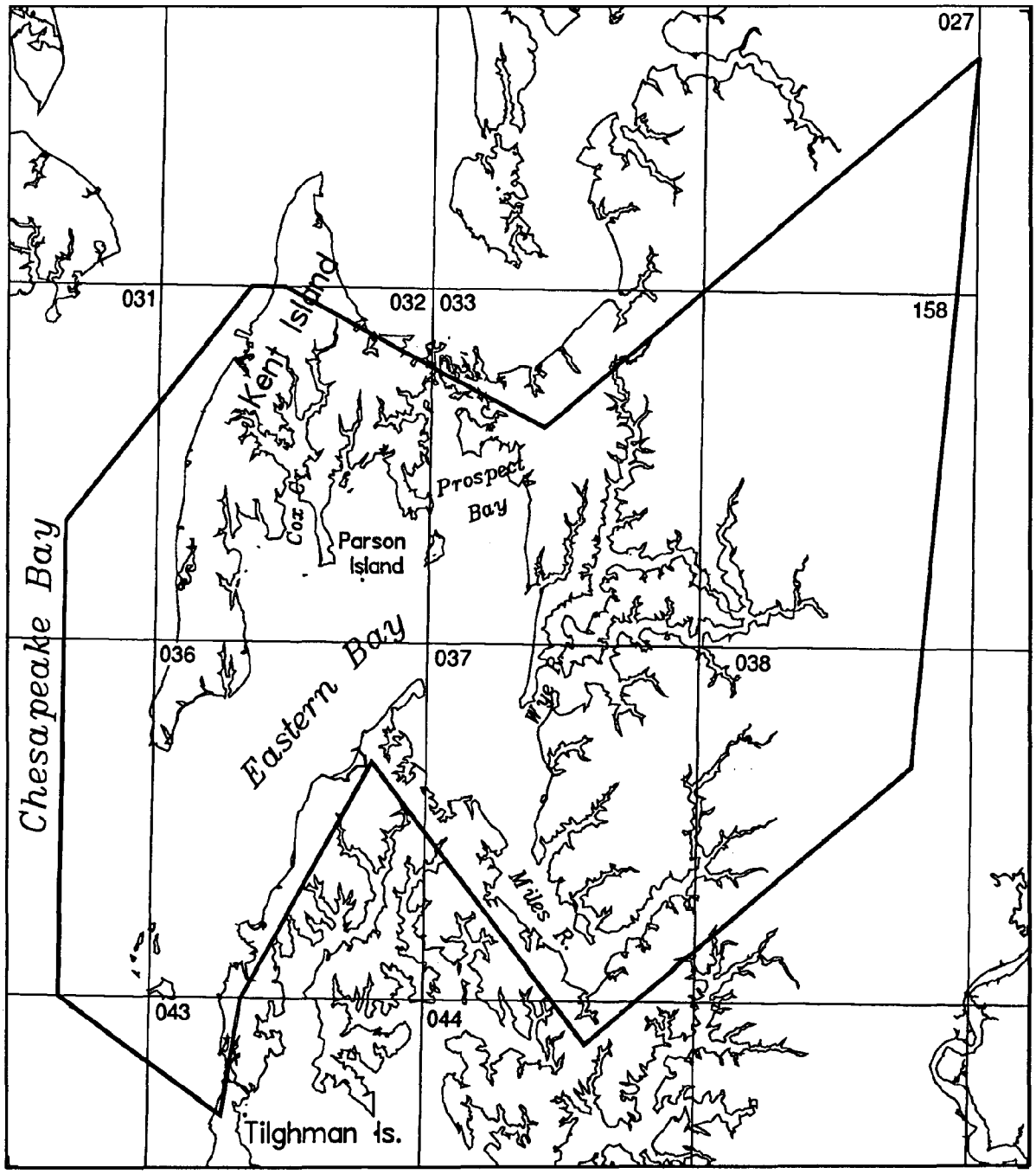

Figure 13. Distribution of SAV in the Eastern Bay (Section 6).

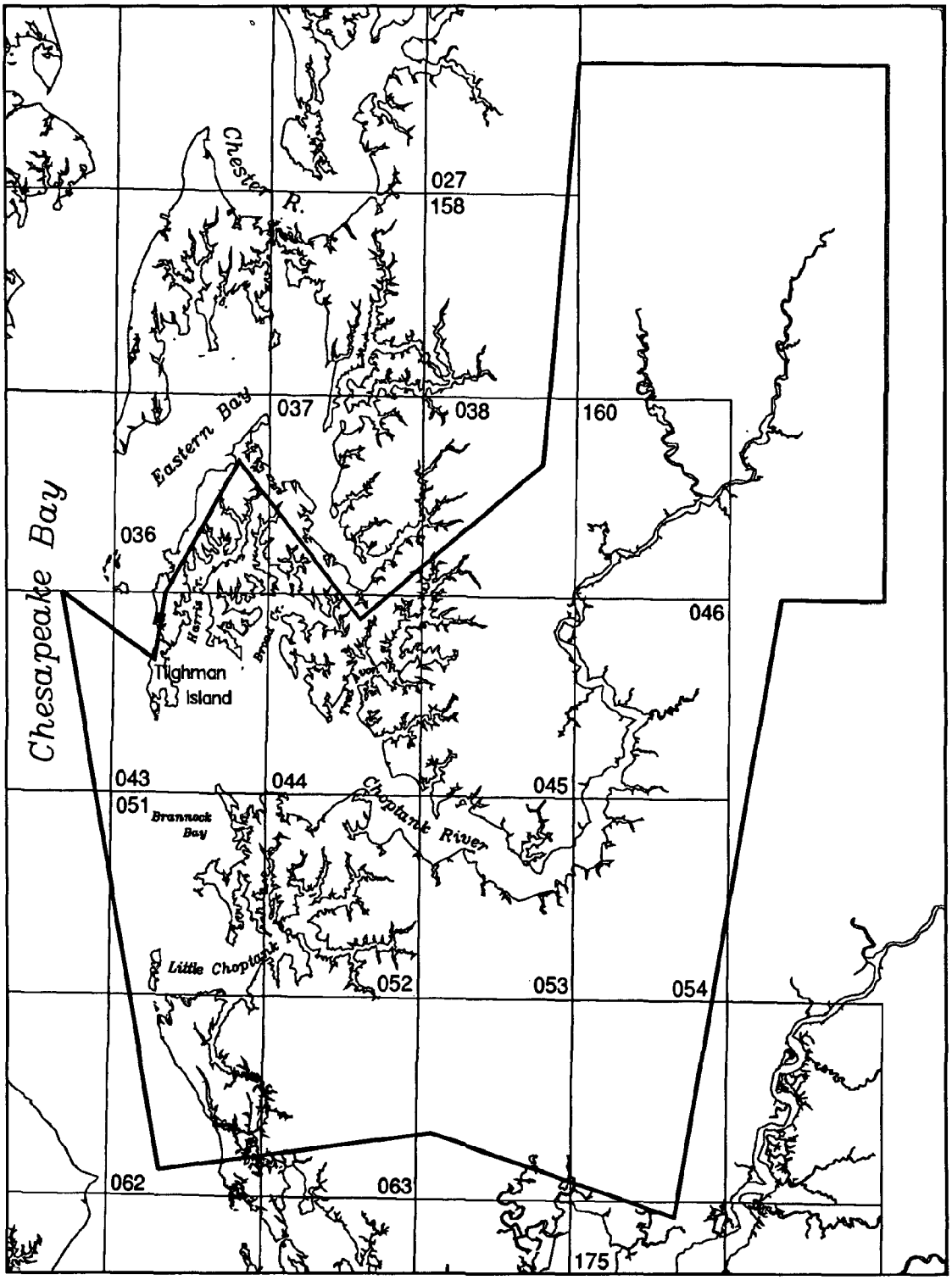

Figure 14. Distribution of SAV in the Choptank River (Section7).

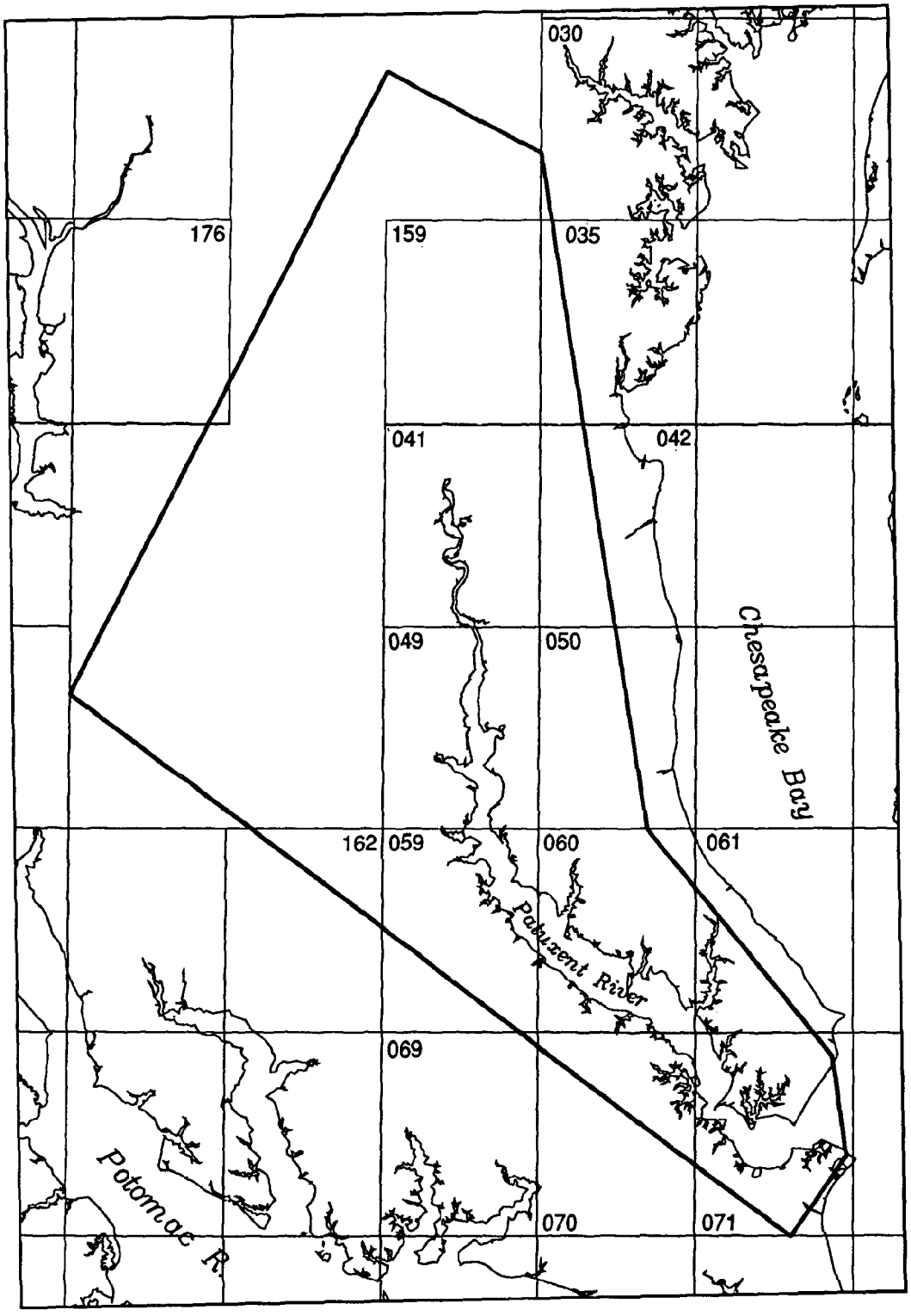

Figure 15. Distribution of SAV in the Patuxent River (Section 8).

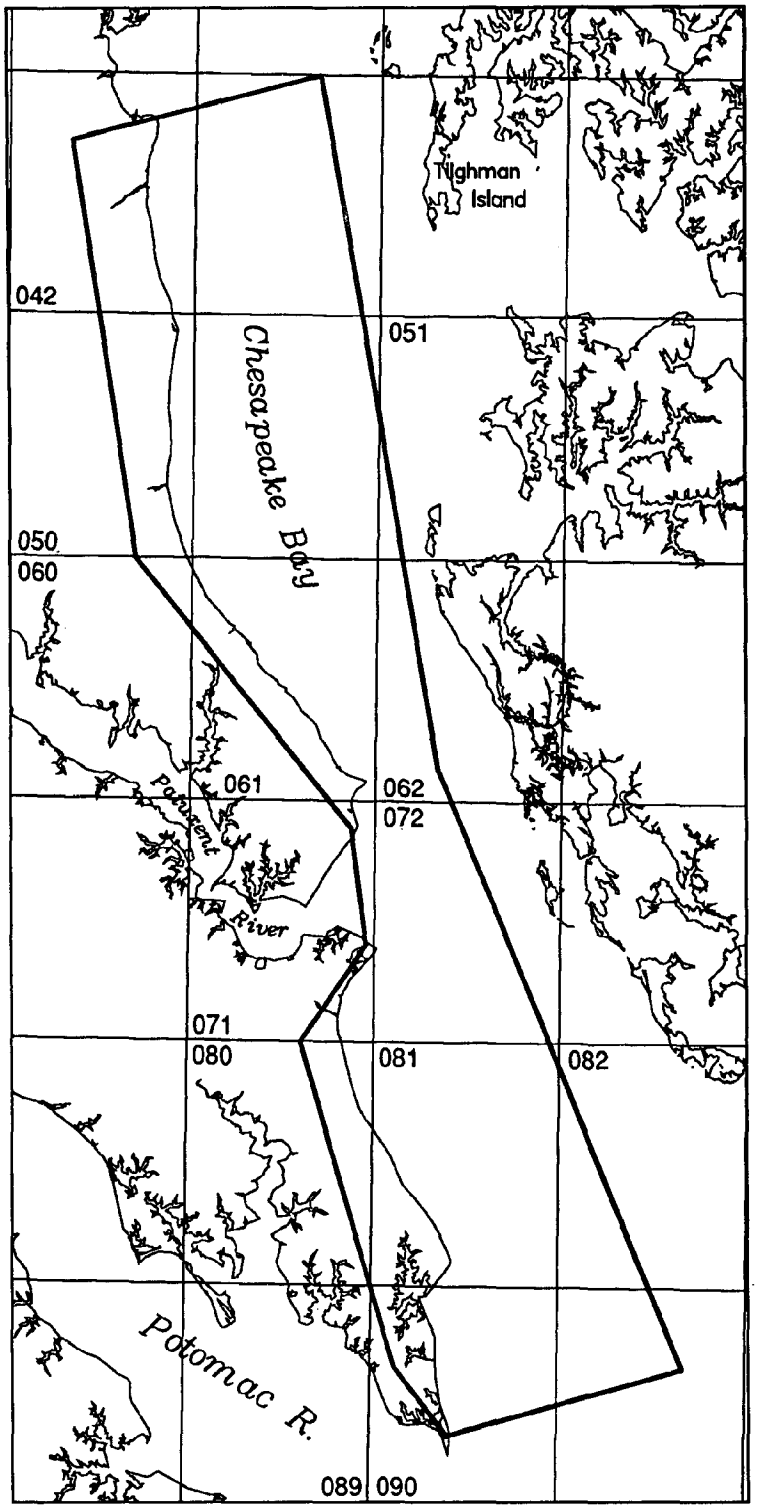

Figure 16. Distribution of SAV in the Middle Western Shore (Section 9).

10. LOWER POTOMAC RIVER

There were 581 hectares of SAV identified in the Lower Potomac River section from the 1991 aerial photography (Tables 4-6; Fig. 17; Appendix C, Maps 56, 57, 58, 65, 66, 67, 89, 161, and 162) compared to 532 hectares reported in 1990. Sixty-one percent of the total coverage of SAV in this section was dense (density class 4), 26.5% was moderate (density class 3), 8% was sparse (density class 2), and 4.5% was very sparse (density class 1). Most of the SAV occurred in the region near the Route 301 bridge, in Nanjemoy Creek and Port Tobacco River, and in the shoreline adjacent to these two creeks. SAV beds were fringing along the eastern side of Mathias Point Neck to just below the Route 301 bridge. Several small beds were observed in Machodoc, Rosier, and Cuckhold creeks, and the Wicomico River. VIMS surveys reported *R. maritima, E. canadensis,* and *P. perfoliatus* in Cuckhold Creek and *R. maritima, V. americana* , and *P. perfoliatus* between the mouth of Cuckhold Creek and the 301 bridge (map 67). VIMS surveys also reported *R. maritima, M. spicatum,* on the upper Wicomico River (maps 58 and 162), and the Citizens' Survey reported *Z. palustris* at the mouth of the Wicomico River (map 68).

VIMS surveys reported *V. americana,* and *R. maritima,* at Windmill Point on the Port Tobacco River, *V. americana* at Upper Cedar Point and Mathias Point, and *V.americana* and *M. spicatum* in Nanjemoy Creek and Goose Creek (Map 57). The Citizens' Survey reported *V. americana* and *C. demersum* in Nanjemoy Creek (map 56), and *Z. palustris* and *R. maritima* in lower Machodoc Creek (map 78). The USFWS reported *V. americana, P. perfoliatus, P. pectinatus, E. canadensis, and R. maritima* in the Port Tobacco River.

11. UPPER POTOMAC RIVER

There were 3,016 hectares of SAV mapped in the Upper Potomac River section (Tables 4-6; Fig. 18; Appendix C, Maps 28, 34, 39, 40, 47, 48, 55, 65, and 161) in 1991 compared to 2,523 hectares reported in 1990. A total of 81% of the SAV beds were densely vegetated (density class 4), 4.7% was moderate (density class 3), 8.5% was sparse (density class 2), and 5.8% was very sparse (density class 1). SAV beds from the Woodrow Wilson Bridge (except those in the middle of the river - Map 34, beds MA4, EA4, and FA4) to just below Piscataway Creek still remain reduced in coverage from 1989. However, SAV distribution in the Alexandria and Mount Vernon quadrangles increased 13% and 47% respectively from 1990. SAV is still absent from Occoquan Bay and Belmont Bay.

Extensive groundtruth surveys were conducted by the Council of Governments (Maps 28, 34, 39, 40, 47, 48, 55 and 64) while the Citizens' Survey reported SAV from Maps 29 and 40. There were ten species identified from this section in 1991. *Hydrilla verticillata* was reported from Quantico, Mattawoman, Chicamuxen, Dogue, Pomonkey, Piscataway, Swan, and Broad creeks, Gunston Cove, and both sides of the mainstem Potomac River from Washington D.C. to Aquia Creek. Other species reported from this section included *M. spicatum, C. demersum, H. dubia, N. minor, V. americana, P. pectinatus, P. crispus, N. gracillima,* and *Najas* spp.

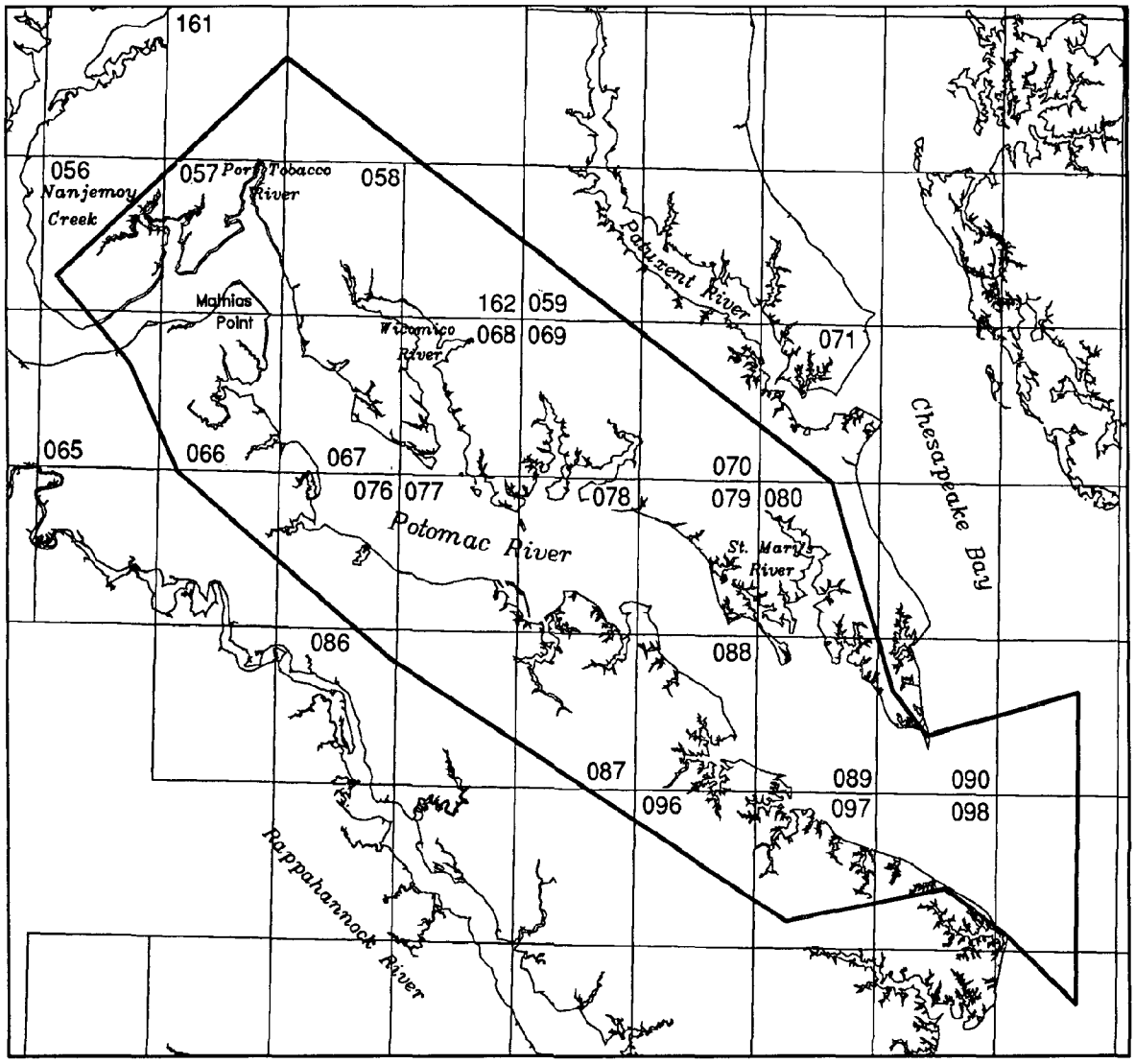

Figure 17. Distribution of SAV in the Lower Potomac River (Section 10).

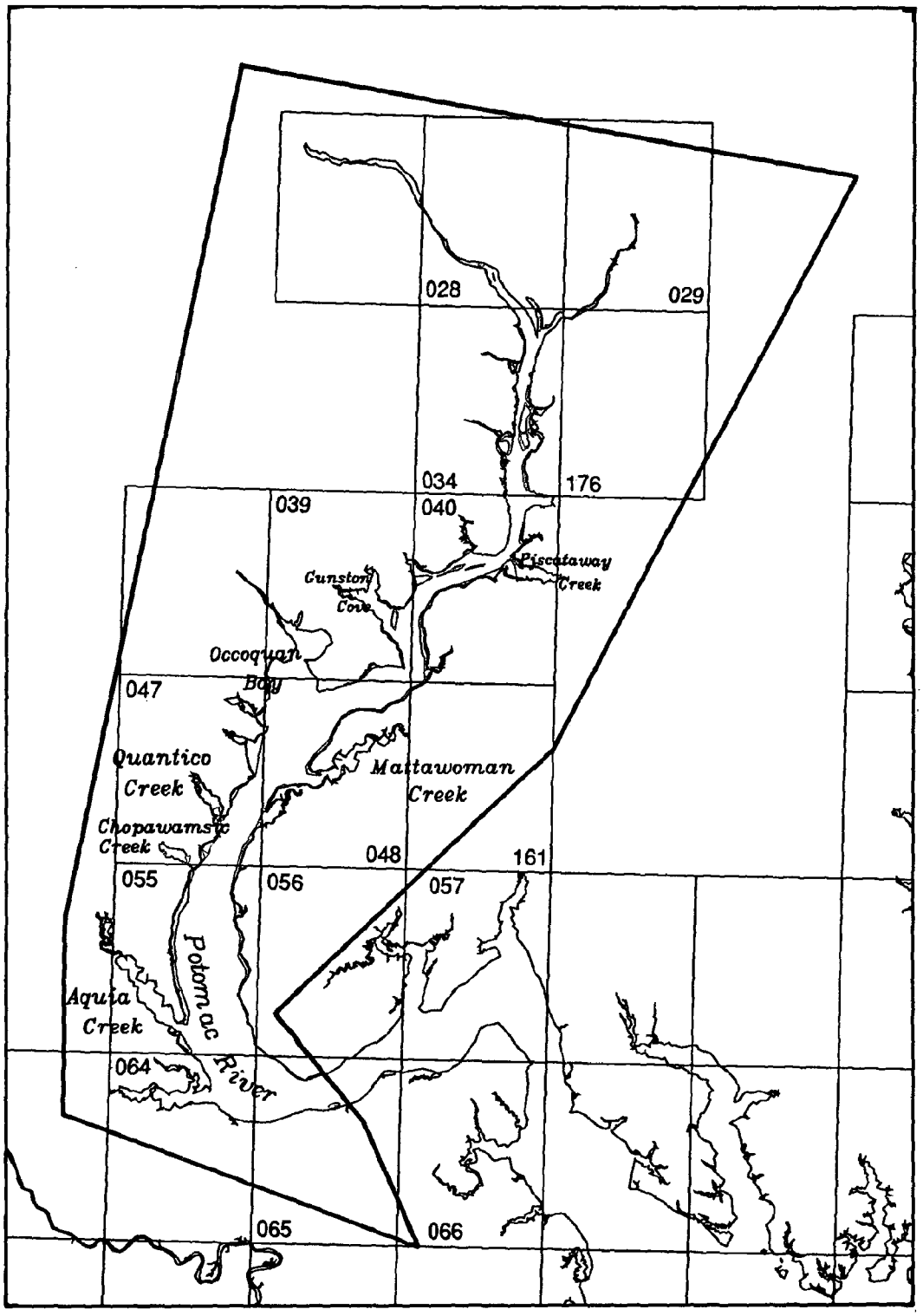

Figure 18. Distribution of SAV in the Upper Potomac River (Section 11).

12. MIDDLE EASTERN SHORE

There were 2,178 hectares of SAV identified in the Middle Eastern Shore section (Tables 4-6; Fig. 19; Appendix C, Maps 63, 72, 73, 74, 82, 83, 84, 85, 92, 93, 100, and 101) in 1991 compared to 2,285 hectares reported in 1990. SAV beds, of which 41% were dense (class 4), 29% moderate (class 3), 22% sparse (class 2), and 8% very sparse (class 1) were very abundant in: 1) the Honga River, 2) between Barren Island and Meekins Neck-Upper Hooper Island, and 3) the lower Manokin and the Big and Little Annemessex rivers. Few SAV beds were observed in Fishing Bay and in the Nanticoke and Wicomico rivers.

Ruppia maritima was the predominant species found by the HPEL and Citizens' surveys (Maps 63, 72, 73, 74, 82, 83, 84, 85, 92, 93, 100, and 101). *Zostera marina* was reported from several locations on the Marion (Map 93), Great Fox Island (Map 100), and Crisfield (Map 101) quadrangles. *Zannichellia palustris* was reported from Crisfield quad (Map 101) and Marion quad (Map 93).

13. MID-BAY ISLAND COMPLEX

There were 5,707 hectares of SAV mapped in the Mid-Bay Island Complex in 1991 (Tables 4-6; Fig. 20; Appendix C, Maps 83, 91, 92, 99, 100, and 107) compared to 5,397 hectares reported in 1990. This section contains 22.3% of the SAV in the entire Chesapeake Bay, an increase of only 0.1% over 1990. However, the density of SAV has increased since 1990. Fifty-nine percent of the SAV within this section was in density class 4 compared to 45% in 1990. Twenty-three percent of SAV within this section in 1991 was moderate in density (class 3), 16% was sparse (class 2), and 2% was very sparse (class 1).

Ground truth surveys were conducted by VIMS, HPEL, and the Citizens' Survey. The broad, expansive shoal area between Tangier Island and Smith Island continued to be densely vegetated by both *R. maritima* and *Z. marina*, and was by far the largest bed in the Chesapeake Bay. *R. maritima* was the species most often reported by the surveys around these islands.

Lower Bay Zone

14. LOWER EASTERN SHORE

There were 5,720 hectares of SAV observed in the Lower Eastern Shore section in 1991 (Tables 4-6; Fig. 21; Appendix C, Maps 100, 101, 102, 107, 108, 109, 113, 114, 119, 124, 133, 134, 142, and 143) compared to 4,823 hectares reported in 1990. Forty-seven percent of the total SAV was in density class 4; 15% was in class 3; 28% was in class 2; and 10% was in class 1. Species reported were primarily *Z. marina* and *R. maritima* with *Z. palustris* reported at a few sites. There were ground truth observations from VIMS and Citizens' surveys (Maps 100, 101, 108, 113, 114, and 124). Large, dense beds continue to persist at the mouth of Cherrystone Inlet near Cape Charles, at the mouths of Hungars, Mattawoman, Occohannock, Craddock, Pungoteague, Onancock, and Chesconessex creeks, at the Big Marsh area near Chesconessex Creek, at Webb Island off the mouth of Deep Creek, and on the large

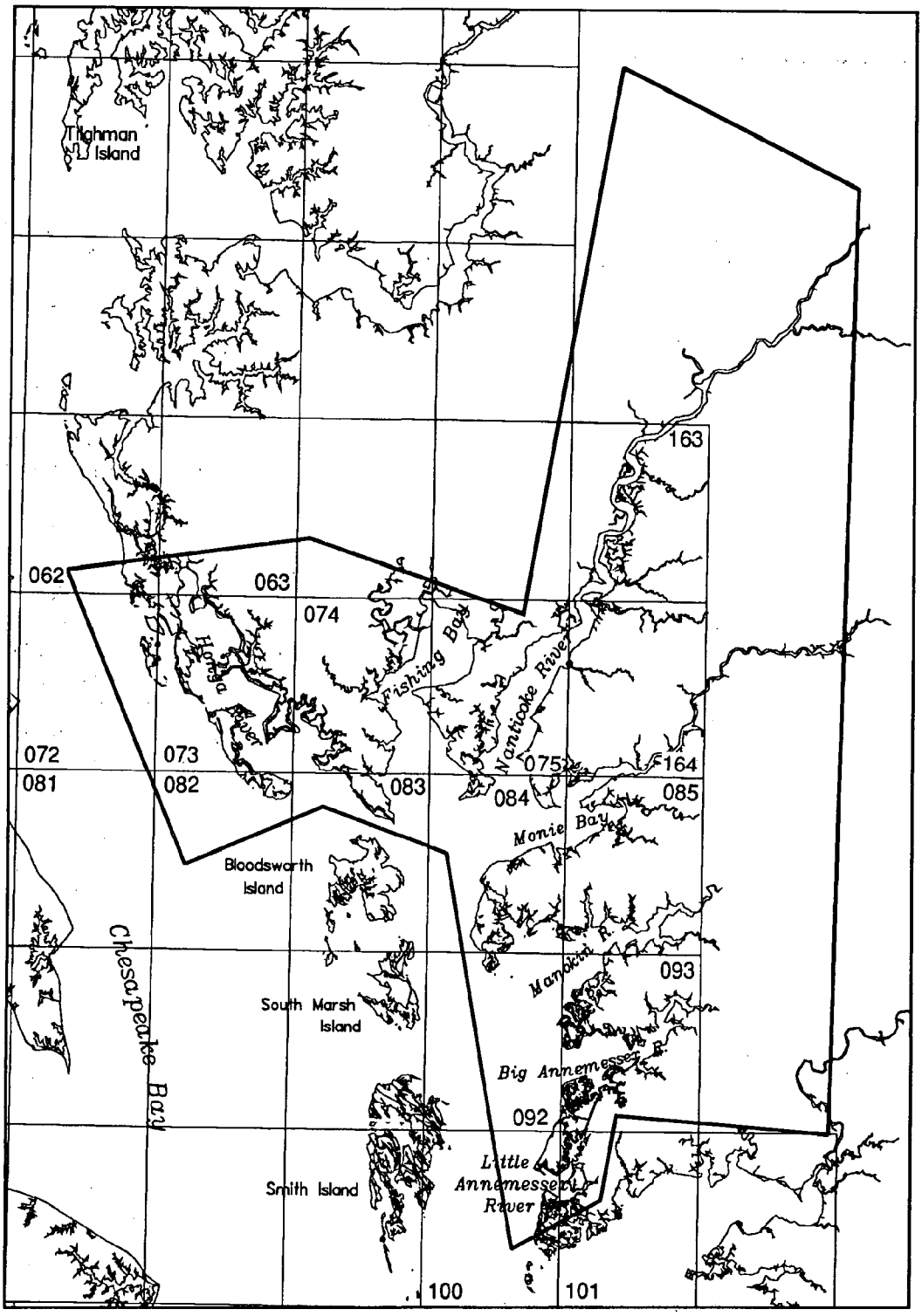

Figure 19. Distribution of SAV in the Middle Eastern Shore (Section 12).

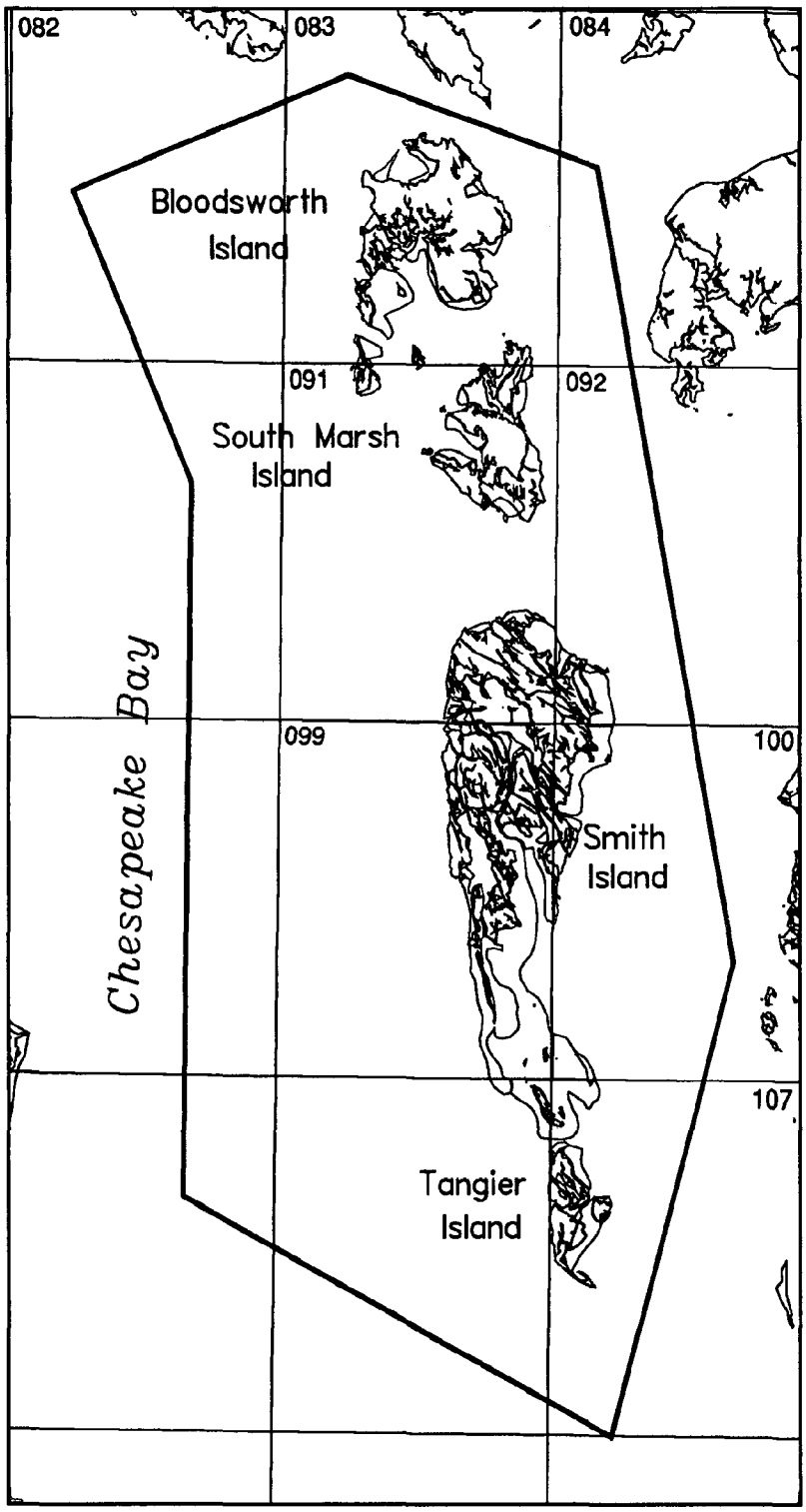

Figure 20. Distribution of SAV in the Mid-Bay Island Complex (Section 13).

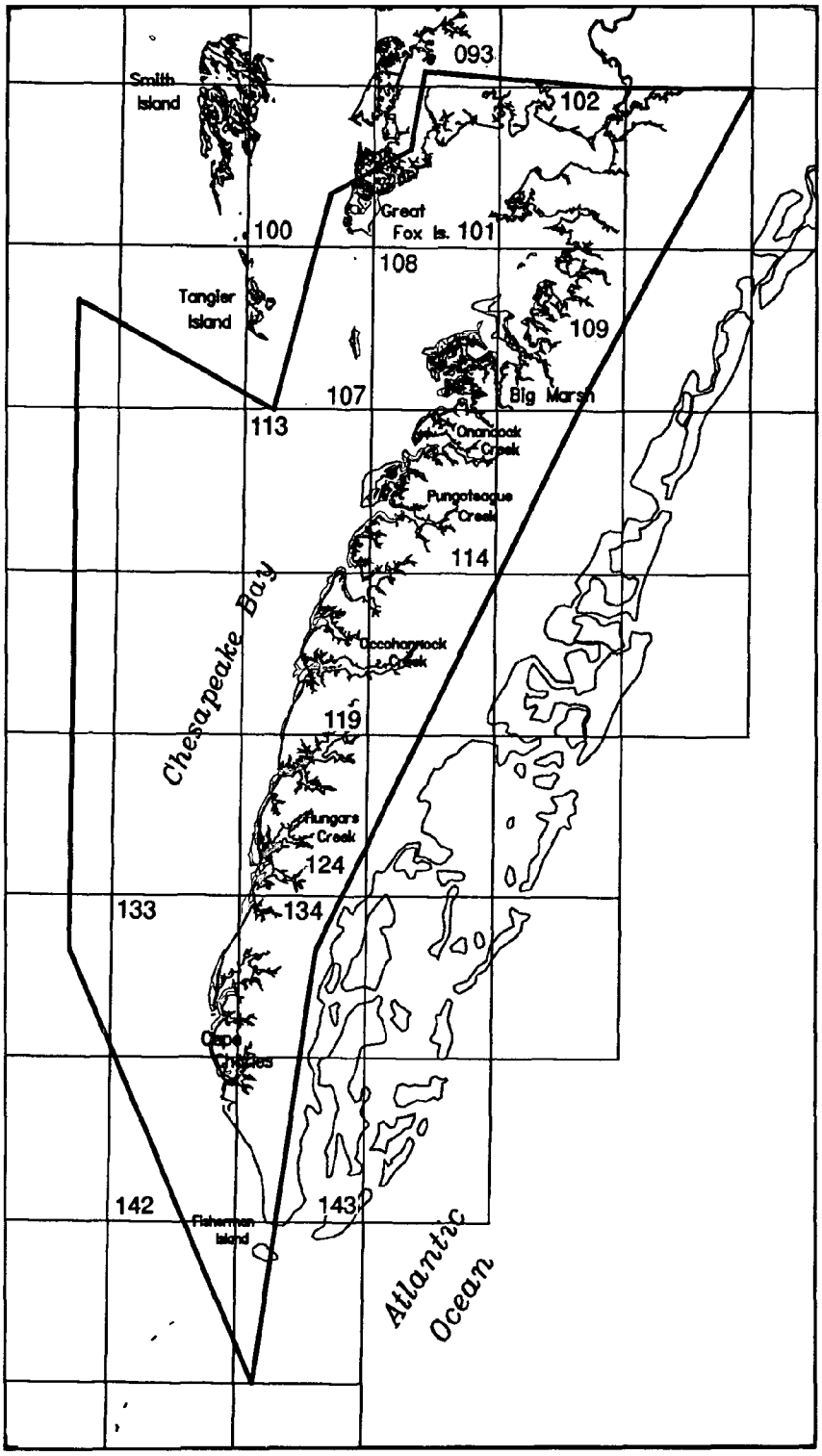

Figure 21. Distribution of SAV in the Lower Eastern Shore (Section 14).

shoal area on the eastern side of the Fox and Cedar Islands. The only SAV in the Pocomoke Sound area was on the eastern side of Watts Island. There was no SAV south of Old Plantation Creek just below Cape Charles.

15. REEDVILLE REGION

There were 635 hectares of SAV identified in the Reedville Region in 1991 (Tables 4-6; Fig. 22; Appendix C, Maps 106 and 112) compared to 608 hectares reported in 1990. Twenty-three percent of the total coverage of SAV in this section was dense (density class 4), 34% was moderate (density class 3), 36% was sparse (density class 2), and 7% was very sparse (density class 1). *R. maritima* and *Z. marina* were the two species identified by VIMS and Citizens' Survey in 1991 (Maps 106 and 112). Most beds were found in Little Bay, Fleets Bay, Dymer Creek, Indian Creek, Dividing Creek, Ball Creek, Cloverdale Creek, Dameron Marsh, Ingram Bay, and Fleeton Point. There was one large bed in Fleets Bay, principally *Z. marina*, that was located in a water depth of two meters (MLW). This bed may be one of the deepest occurring *Z. marina* beds in the bay, and although undoubtedly present during previous surveys, had not been mapped.

16. RAPPAHANNOCK RIVER COMPLEX

There were 509 hectares of SAV observed in the Rappahannock River Complex in 1991 (Tables 4-6; Fig. 23; Appendix C, Maps 110, 111, 117, 118, and 123) compared to 544 hectares reported in 1990. SAV coverage has been declining in this section over the last three years when it reached a peak abundance of 669 hectares in 1989. This decline has occurred in the Rappahannock River where some of the large beds of *R. maritima* present in recent surveys have either disappeared or been reduced in coverage. However, the abundance is still greater than in 1986 when only 18 hectares were mapped, with none in the Rappahannock River. Thirty-eight percent of the total coverage of SAV in this section was dense (density class 4), 17% was moderate (density class 3), 44% was sparse (density class 2), and 1% was very sparse (density class 1).

Ruppia maritima continues to be the dominant species in both the Rappahannock and Piankatank rivers. In particular, dense beds of *R. maritima* were present in the Corrotoman River and along the north shore of the Rappahannock River between Carters Creek and the Corrotoman River (includes obervations from the Citizens' and VIMS surveys; Maps 110, 111, 117, 118, and 123). *Z. marina* is present in small patches in both rivers. This is a result of successful transplant efforts using both seeds and whole plants in a number of different areas since 1984 (VIMS, unpublished data) and as a result of natural propagation from nearby beds. In the Rappahannock River transplanted *Z. marina* is still doing well off Sanders Cove just above the bridge, while the large bed off Windmill Pt. at the mouth continues to expand to an area of 13.3 hectares, up from 8.8 hectares in 1990. In the Piankatank River *Z. marina* is present off Burton Point (transplanted), along the northeast side of Gwynn Island (both transplanted and natural) and off Stingray Pt. (natural). In Milford Haven *Z. marina* is present off Hills Creek (transplanted), on the west side of Gwynn Island off The Hole in the Wall and off the northeast tip of the island, and in the Willis Wharf area.

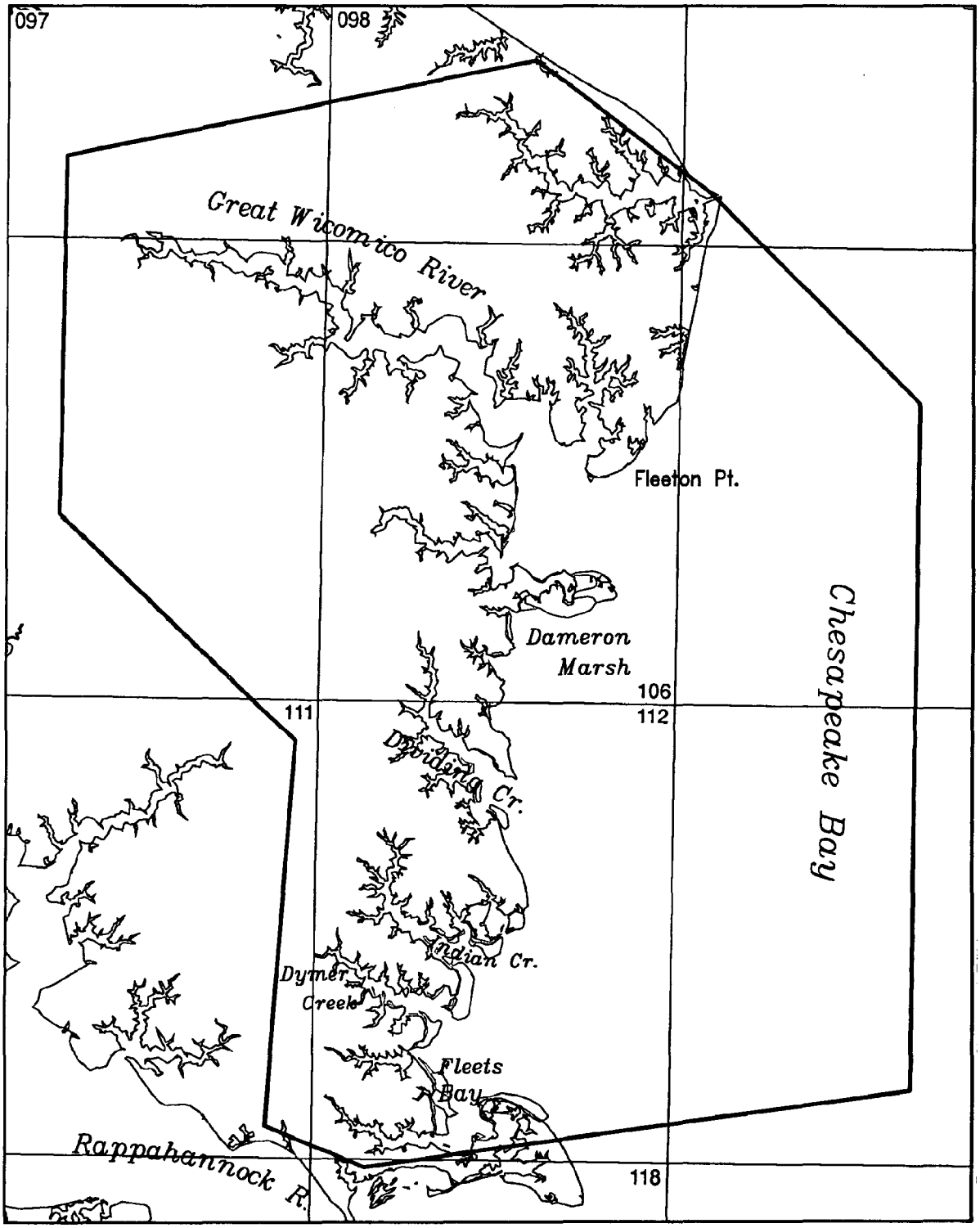

Figure 22. Distribution of SAV in the Reedville Region (Section 15).

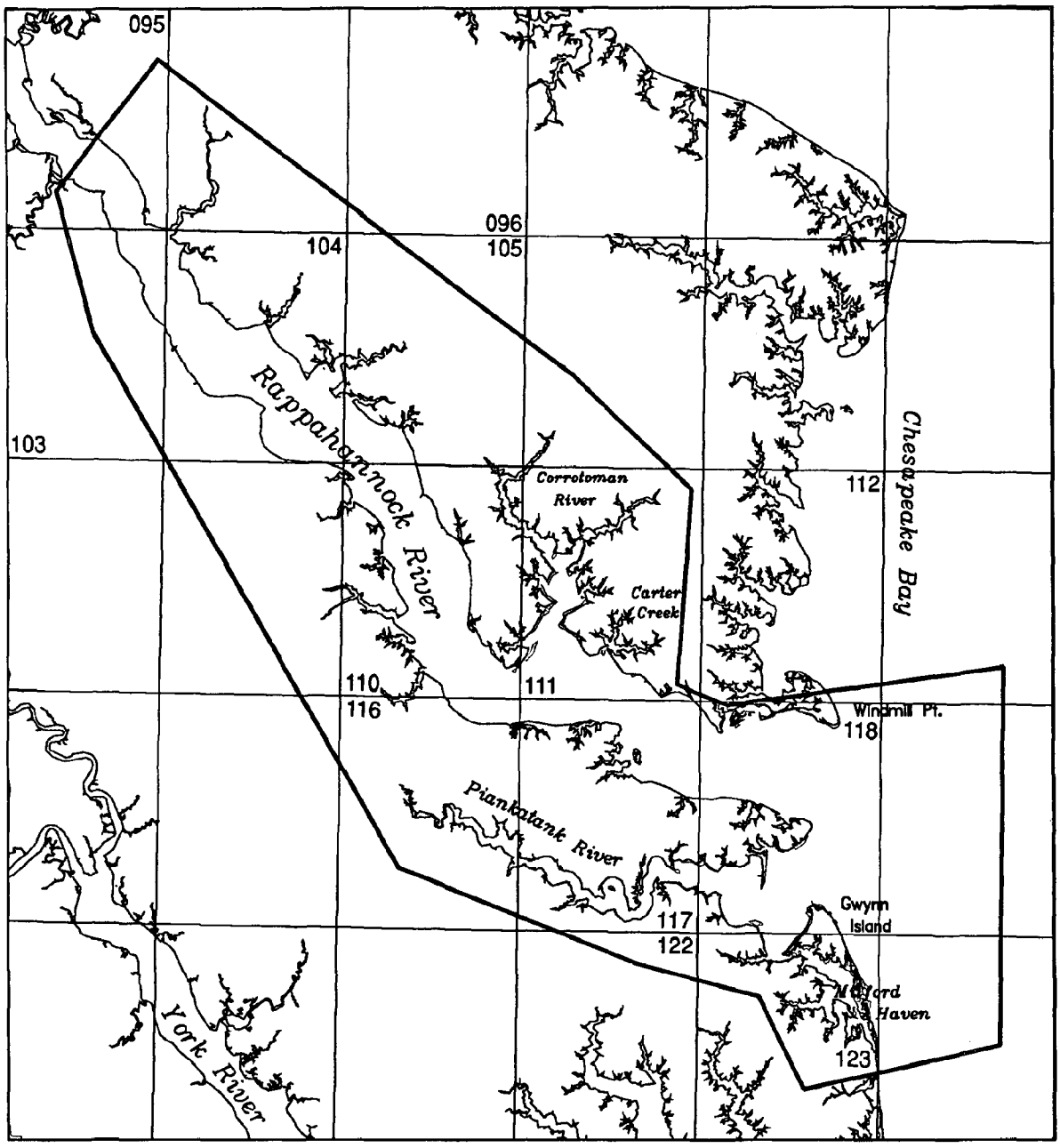

Figure 23. Distribution of SAV in the Rappahannock River Complex (Section 16).

17. NEW POINT COMFORT REGION

There were 339 hectares of SAV identified in the New Point Comfort Region in 1991 (Tables 4-6; Fig. 24; Appendix C, Map 132) compared to 357 hectares reported in 1990. Fifty-nine percent of the total coverage of SAV in this section was dense (density class 4), 20% was moderate (density class 3), and 21% was sparse (density class 2). The Citizens' Survey reported only *Z. marina,* although *R. maritima* has been found in earlier surveys.

18. MOBJACK BAY COMPLEX

The Mobjack Bay Complex contained 1,788 hectares of SAV in 1991 (Tables 4-6; Fig. 25; Appendix C, Maps 122, 123, 131, and 132) compared to 1,703 hectares reported in 1990. SAV beds consisting of both *Z. marina* and *R. maritima* (from ground truth observations made by citizens and VIMS personnel in maps 122, 123, 131, and 132) were abundant along the entire shoreline of Mobjack Bay, as well as in the four tributaries: Severn, Ware, North, and East rivers. The Mobjack Bay area continued to harbor some of the more extensive SAV beds on the western shore of the lower Chesapeake Bay. Fifty-six percent of the total coverage of SAV in this section was dense (density class 4), 27% was moderate (density class 3), and 13% was sparse (density class 2).

19. YORK RIVER

There were 804 hectares of SAV observed in the York River section in 1991 (Tables 4-6; Fig. 26; Appendix C, Maps 131, 132, 139, and 140) compared to 791 hectares reported in 1990. Seventy-eight percent of the total coverage in this section is classified as dense (class 4), while 2% was moderately dense (density class 3), 19.8% was sparse (density class 2), and less than 1% was very sparse (density class 1). Ground truth observations were made by VIMS surveys (Maps 131, 132, 139, and 140). Dense SAV beds, consisting of both *Z. marina* and *R. maritima,* were located principally along the north shore from Gloucester Point to the mouth of the river. SAV beds were absent upstream of Gloucester Point on the north shore except for one small bed of *Z. marina* near Gloucester Point, a result of VIMS transplanting efforts using seeds in 1990. *Z. marina* was transplanted to Mumfort Island, Catlett Island, and Clay Bank in the fall of 1990 by VIMS staff and was present through the spring and early summer, but did not survive the summer. Except for one large bed located on the north side of the Goodwin Islands and a smaller bed adjacent to the Coast Guard Station, the south shore was unvegetated.

20. LOWER WESTERN SHORE

There were 2,006 hectares of SAV mapped in the lower Western Shore section in 1991 (Tables 4-6; Fig. 27; Appendix C, Maps 140, 141, 147, and 152) compared to 1,797 hectares reported in 1990. Ground truth surveys by citizens and VIMS (Maps 140, 141 and 152) reported both *Z. marina* and *R. maritima.* Forty-one percent of the total coverage in this section was mapped as dense (density class 4), 28% as moderate

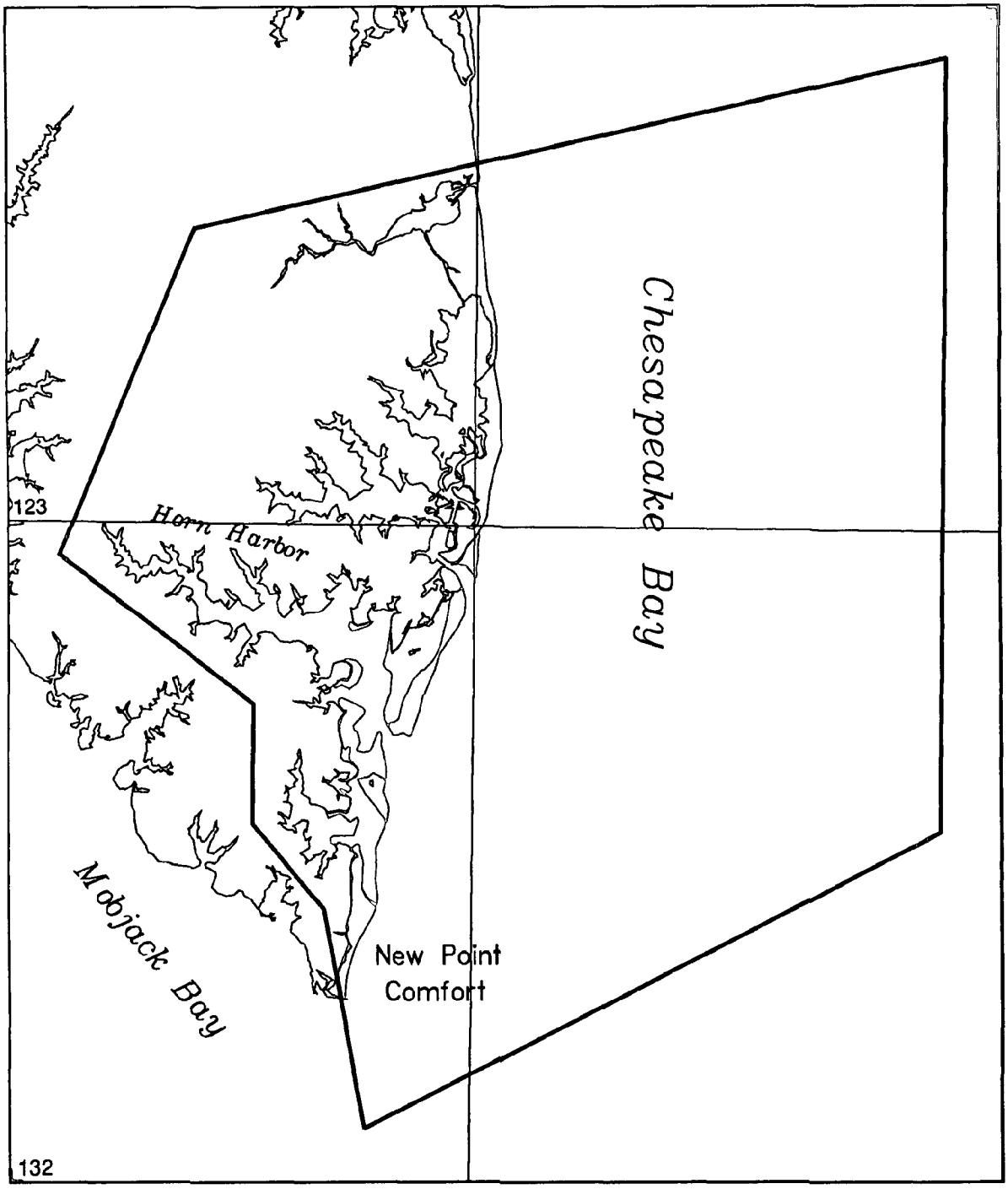

Figure 24. Distribution of SAV in the New Point Comfort Region (Section 17).

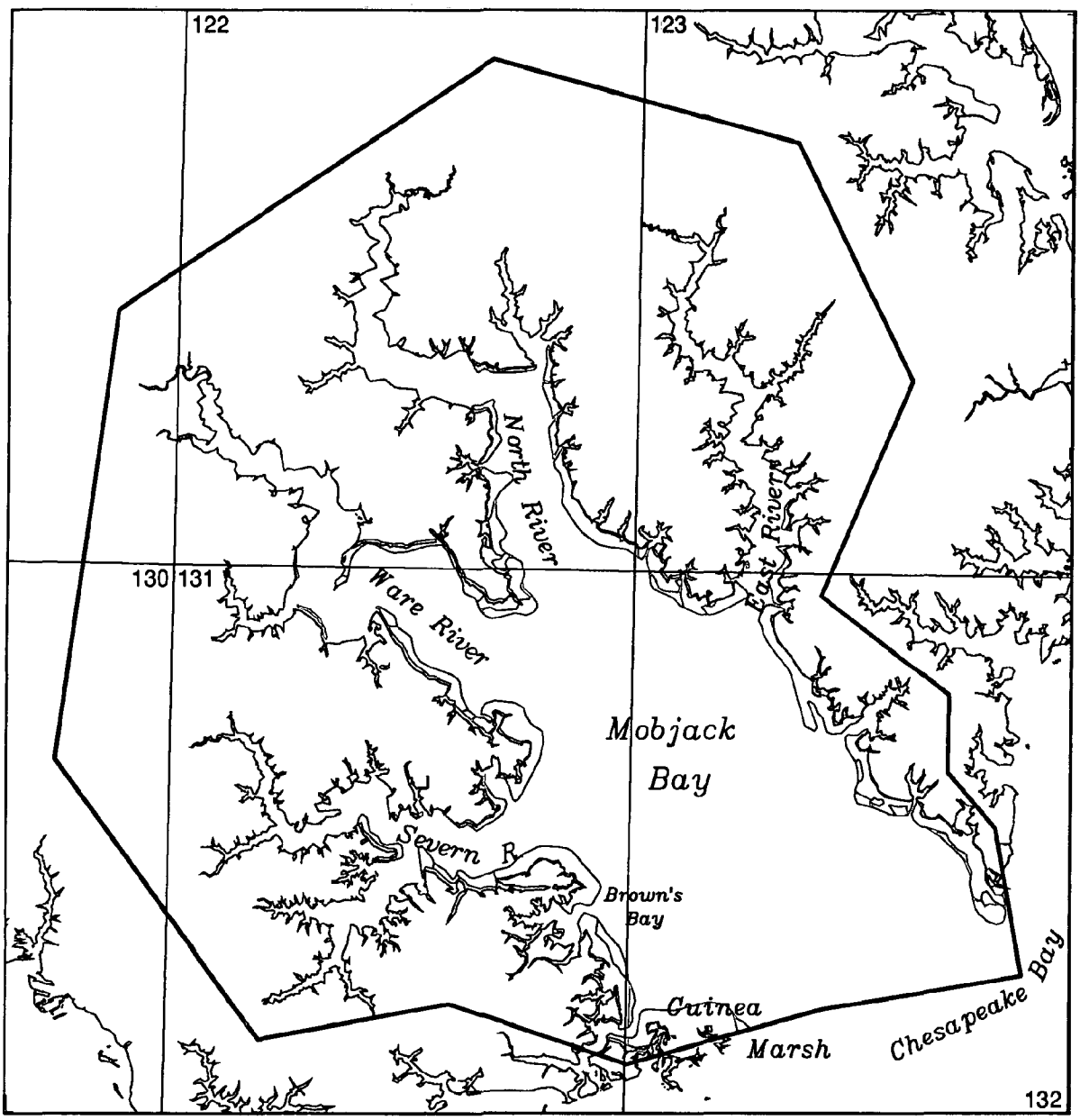

Figure 25. Distribution of SAV in the Mobjack Bay Complex (Section 18).

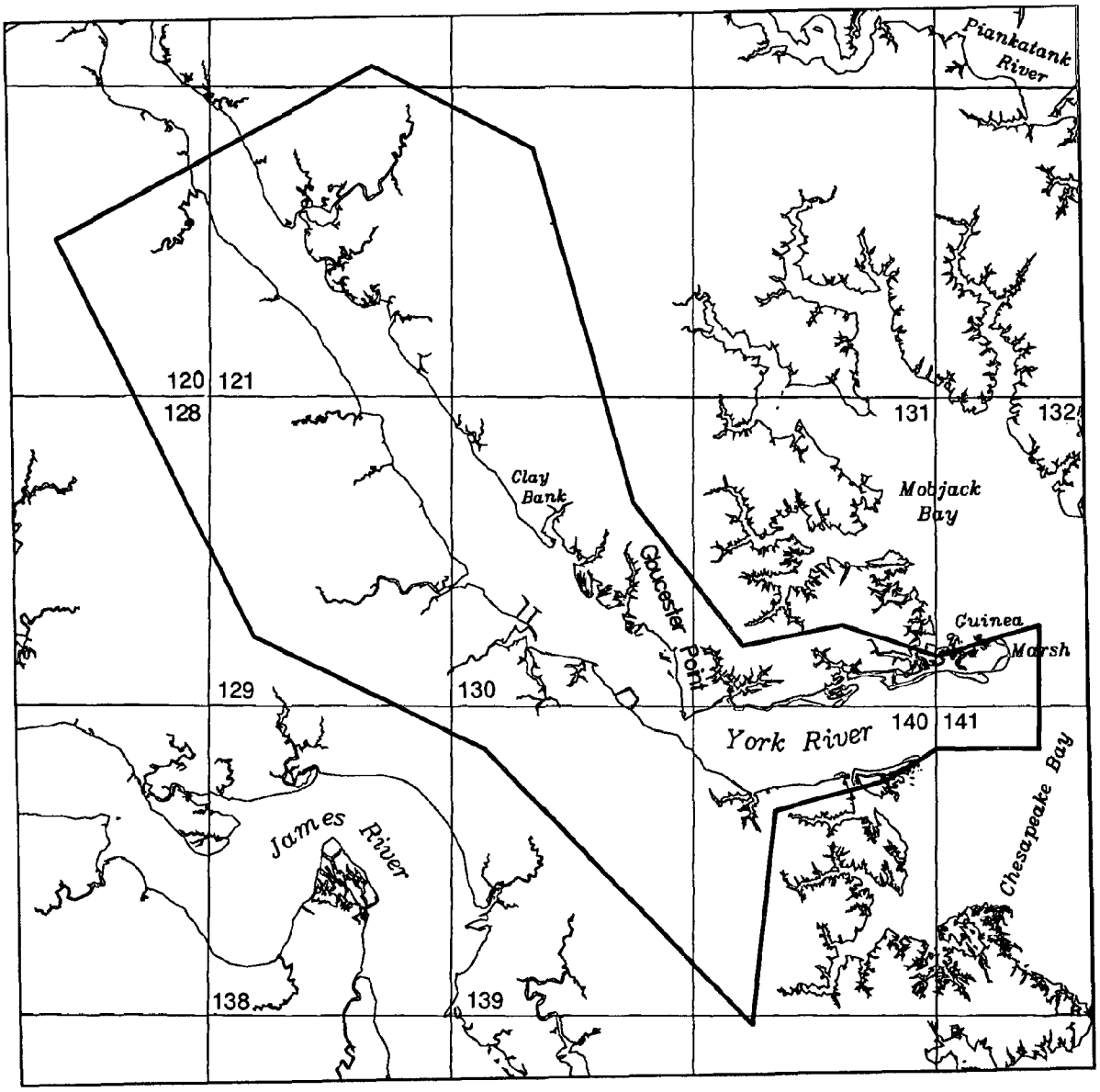

Figure 26. Distribution of SAV in the York River (Section 19).

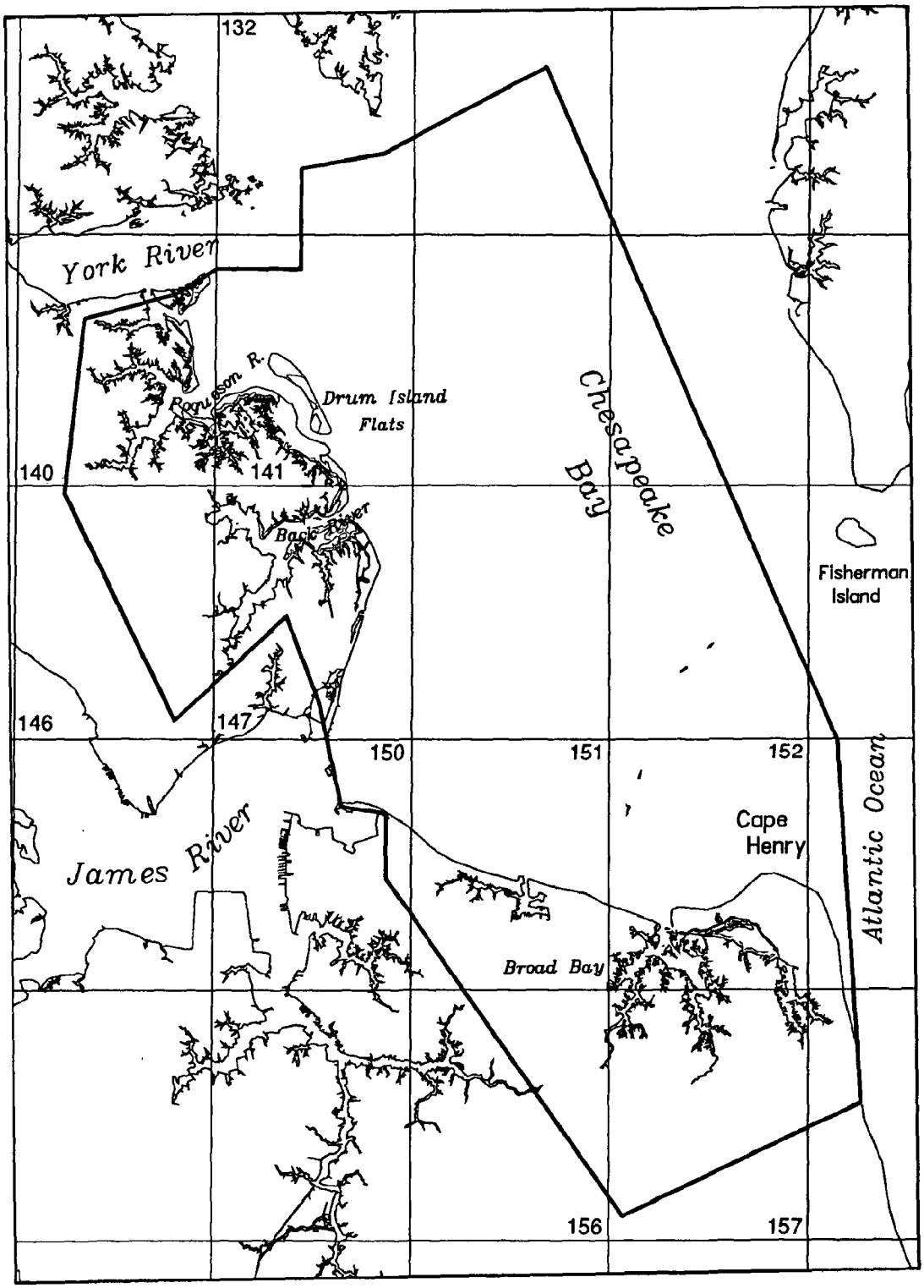

Figure 27. Distribution of SAV in the Lower Western Shore (Section 20).

(density class 3), 17% as sparse (density class 2), and 14% as very sparse (density class 1). SAV was mapped in Broad Bay, Back River, the mouth of the Poquoson River off Pasture and Hunts Neck, Drum Island Flats, Poquoson Flats, adjacent to Crab Neck just south of Goodwin Island, and on the south side of Goodwin Island. No SAV was present in the southwest and northwest branches of Back River, or in the Poquoson River, Chisman Creek, and Back Creek.

21. JAMES RIVER

There were 2.74 hectares of SAV (density class 3) in the mainstem James River in 1991 (Tables 4-6; Fig. 28; Appendix C, Map 147), compared to 2.73 hectares in 1990. This moderately dense bed located at the mouth of Hampton Creek adjacent to the Veteran's Hospital had no ground truthing in 1991 but has been reported to consist predominantly of *Z. marina* in previous ground surveys. The Citizens' Survey reported *C. demersum* and *Z. palustris* in Herring Creek (Map 125) and Morris Creek (Map 127), and *C. demersum* in Gray's Creek but no SAV was mapped from aerial photography for these quadrangles.

CHINCOTEAGUE BAY

There were 2,746 hectares of SAV identified in Chincoteague Bay in 1991 (Tables 4-6; Fig. 29; Appendix C, Maps 167, 168, 170, 172, 173, and 175) compared to 2,493 hectares reported in 1990. Sixty-nine percent of the total coverage in this section was mapped as dense (density class 4), 24% as moderate (density class 3), 2% as sparse (density class 2), and 5% as very sparse (density class 1). The VIMS, Citizens', MD-DNR, and National Park Service surveys found both *Z. marina* and *R. maritima* throughout Chincoteague Bay (Maps 170, 172, 173, and 175). The Citizens' and MD-DNR surveys both reported only *Z. marina* from Sinepuxent Bay (maps 167, 168, and 170), however, the National Park Service reported *Z. marina* and *R. maritima* for Sinepuxent Bay (map 167, and 170). Only *R. maritima* was reported from Assawoman Bay (Map 166) while the Citizens' Surveys reported *Z. marina* in Isle of Wight Bay (map 168). All of the SAV in Chincoteague Bay continues to be present on the eastern side of the bay adjacent to Assateague Island. The vegetation was concentrated in four relatively distinct areas identical to that reported in the earlier surveys from 1986 through 1990. They were located west of the northern end of Chincoteague Island, and west of West Bay, Green Run Bay, and the Tingles Island area.

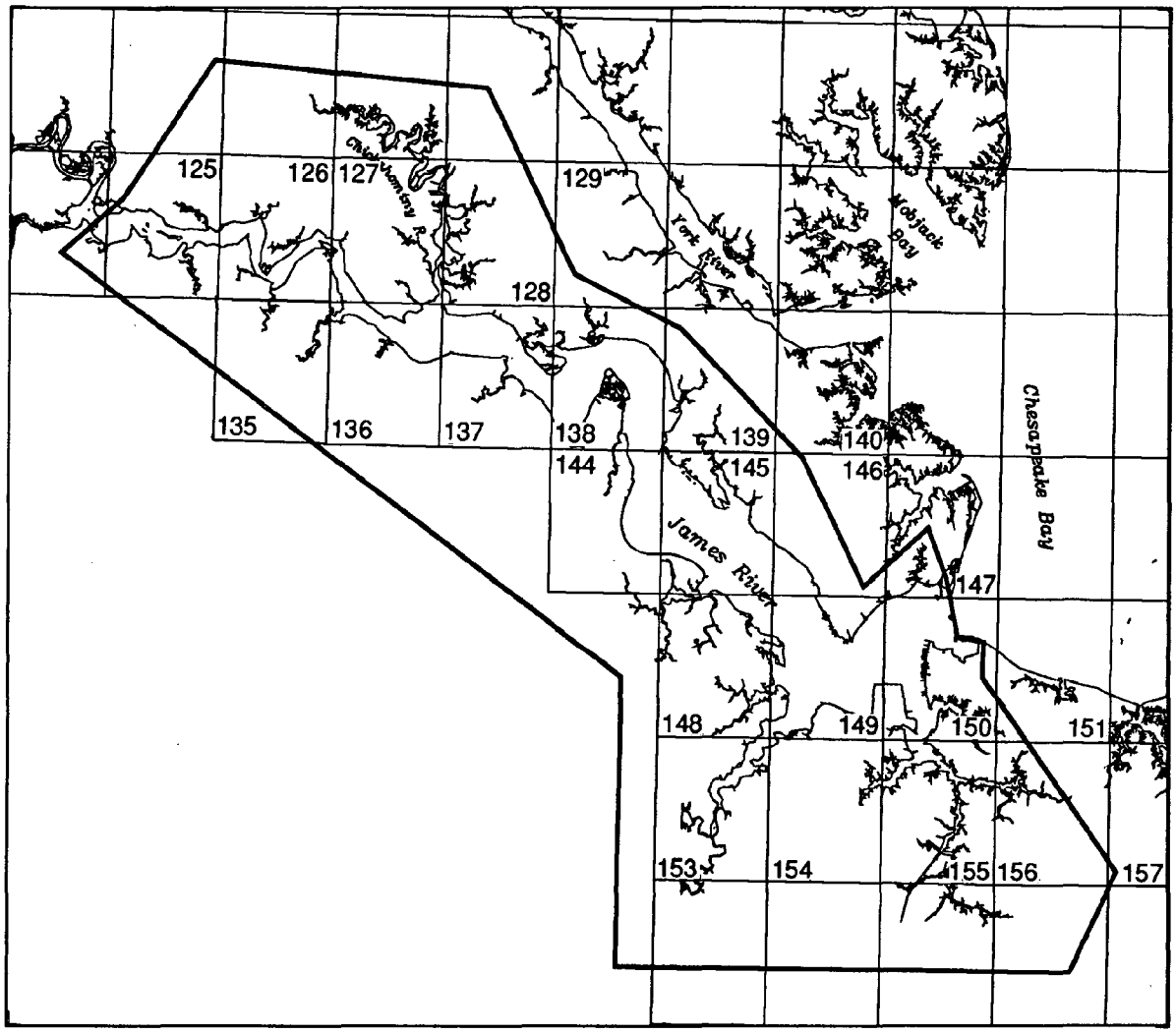

Figure 28. Distribution of SAV in the James River (Section 21).

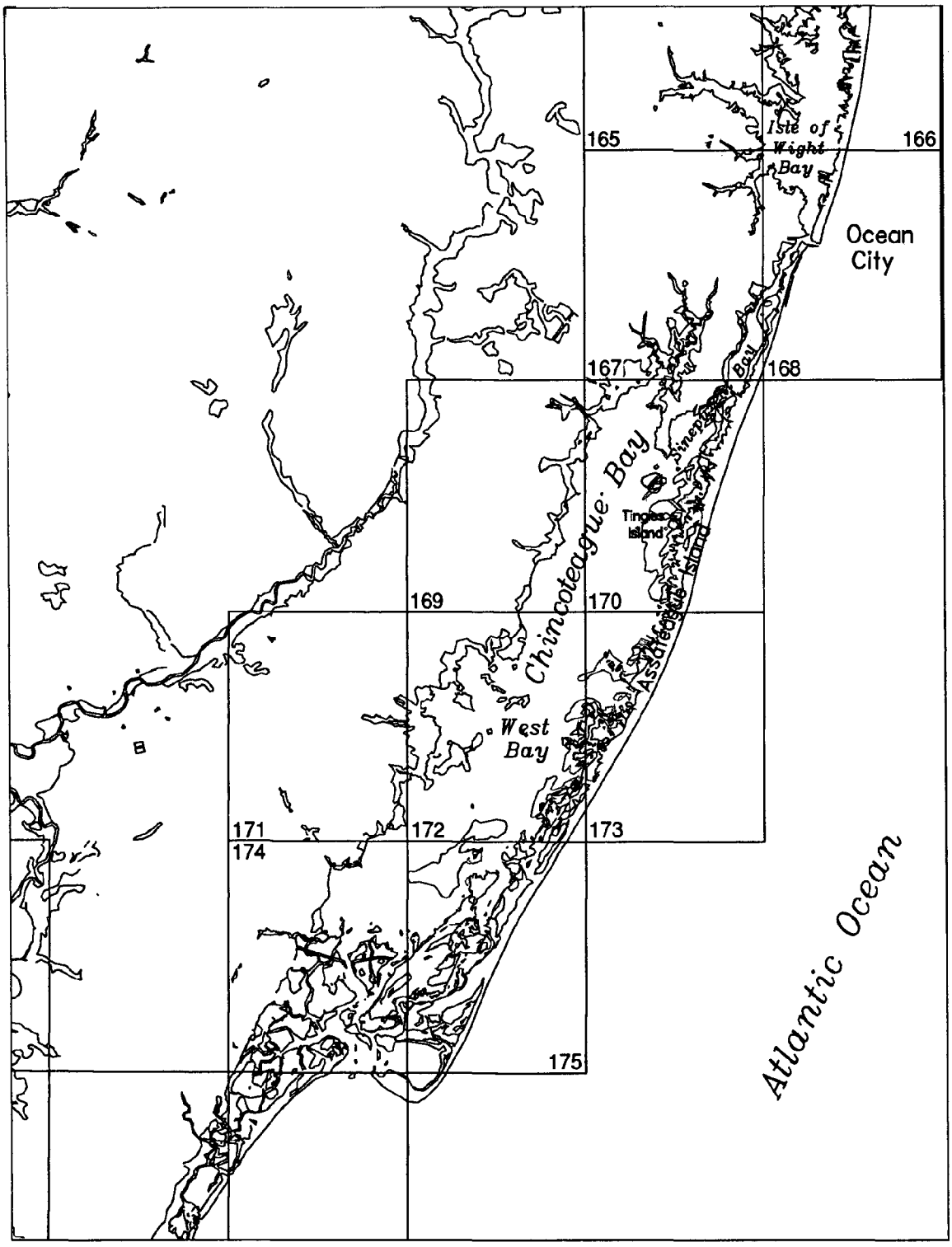

Figure 29. Distribution of SAV in the Chincoteague Bay.

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APPENDICES

APPENDIX A

Species of Submerged Aquatic Plants Found in the Chesapeake Bay and Tributaries Exclusive of the Marine Algae (Classification and Nomenclature Derived from: Godfrey and Wooten, 1979, 1981; Harvill et al., 1977, 1981; Kartesz and Kartesz, 1980; Radford et al., 1968; Wood and Imahori, 1965, 1965)

Family	Species	Common name
Characeae (muskgrass)	*Chara braunii* Gm.	Muskgrass
	Chara zeylanica Klein. ex Willd., em.	
	Nitella flexilis (L). Ag., em.	Stonewort
Potamogetonaceae (pondweed)	*Potamogeton perfoliatus* L. var. *bupleuroides* (Fernald) Farwell	Redhead grass
	Potamogeton epihydrus	Leafy pondweed
	Potamogeton pectinatus L.	Sago pondweed
	Potamogeton crispus L.	Curly pondweed
	Potamogeton pusillus L.	Slender pondweed
Ruppiaceae	*Ruppia maritima* L.	Widgeon grass
Zannichelliaceae	*Zannichellia palustris* L.	Horned pondweed
Najadaceae	*Najas guadalupensis* (Sprengel) Magnus	Southern naiad
	Najas gracillima (A. Braun) Magnus	Naiad
	Najas minor Allioni	
Hydrocharitaceae (frogbit)	*Vallisneria americana* Michaux	Wild celery, tapegrass
	Elodea canadensis (Michaux)	Common elodea
	Egeria densa Planchon	Water-weed
	Hydrilla verticillata (L.f.) Boyle	Hydrilla
Pontedariaceae (pickerelweed)	*Heteranthera dubia* (Jacquin) MacMillian	Water stargrass
Ceratophyllaceae (coontail)	*Ceratophyllum demersum* L.	Coontail
Trapaceae	*Trapa natans* L.	Water chestnut
Haloragaceae (watermilfoil)	*Myriophyllum spicatum* L.	Eurasian watermilfoil
Zosteraceae	*Zostera marina* (L.)	Eelgrass

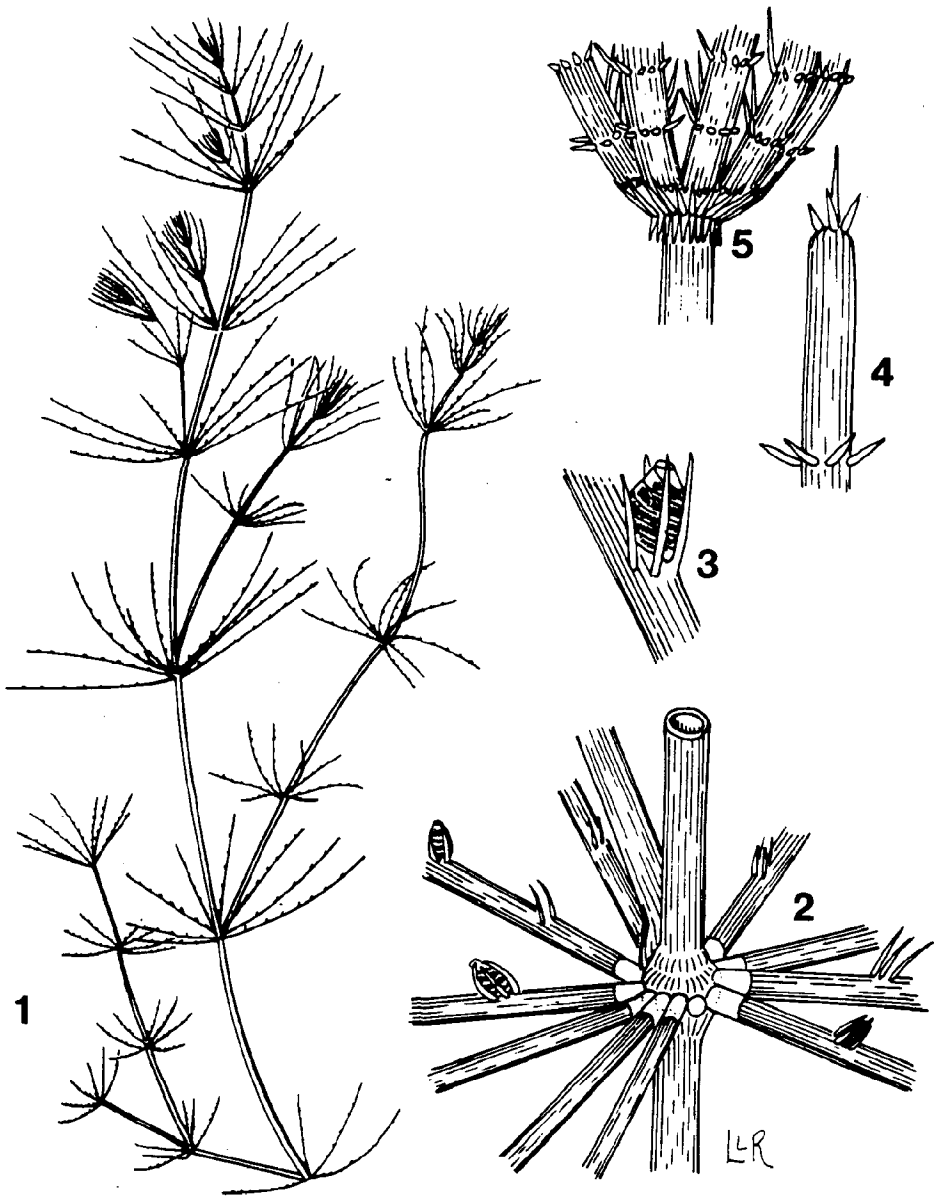


Figure 30. Illustration of *Chara* spp. (Muskgrass): 1. habit, upper portion of plant with branchlet whorls; 2. axial node and fertile branchlets with oogonia; 3. oogonium; 4. branchlet end segment; 5. axial node with 2 tier stipulodes.

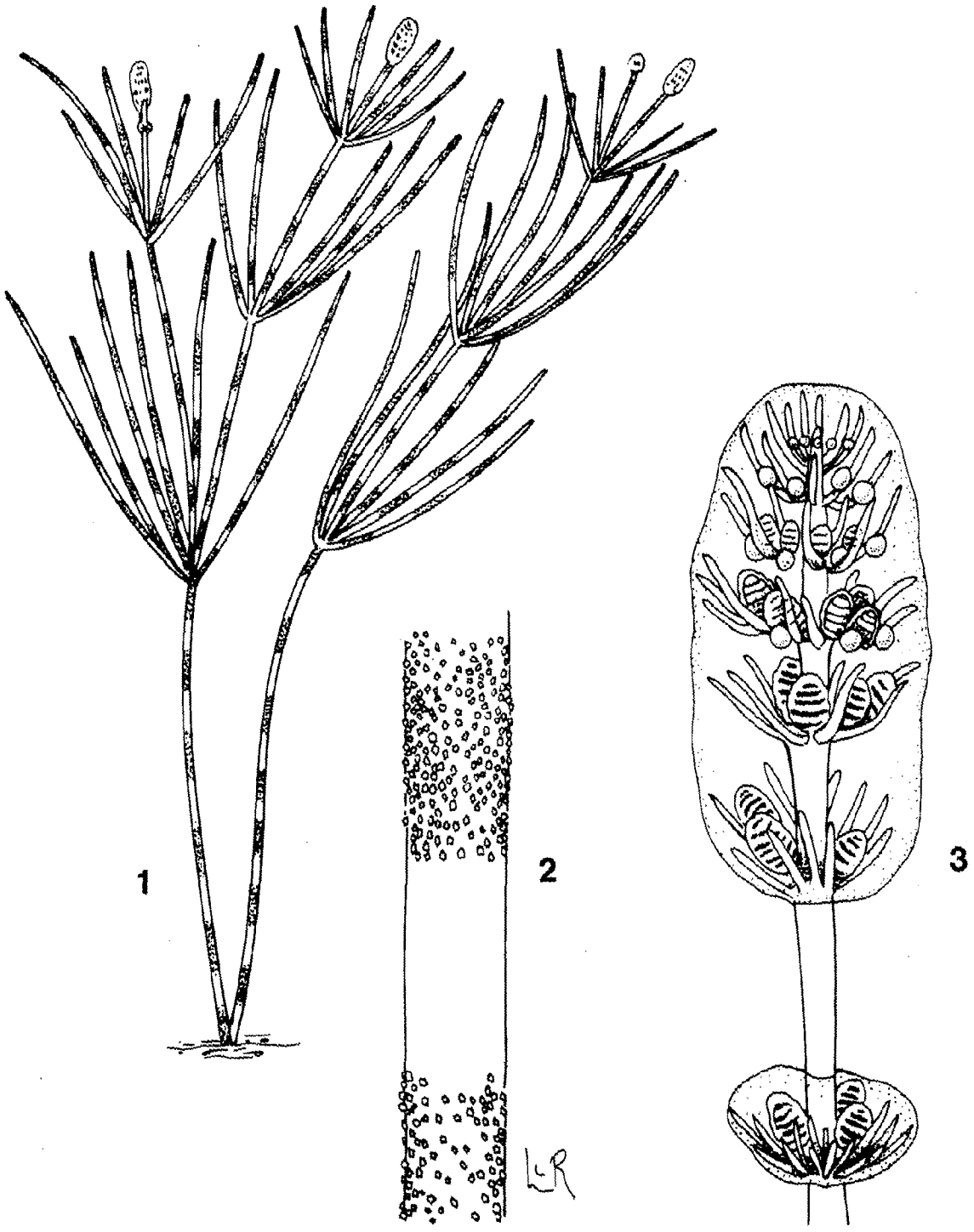


Figure 31. Illustration of *Nitella* spp. (Stonewort): 1. habit, entire plant; 2. portion of ecorticate branchlet; 3. mucus cloud surrounding compacted upper whorls with gametangia.

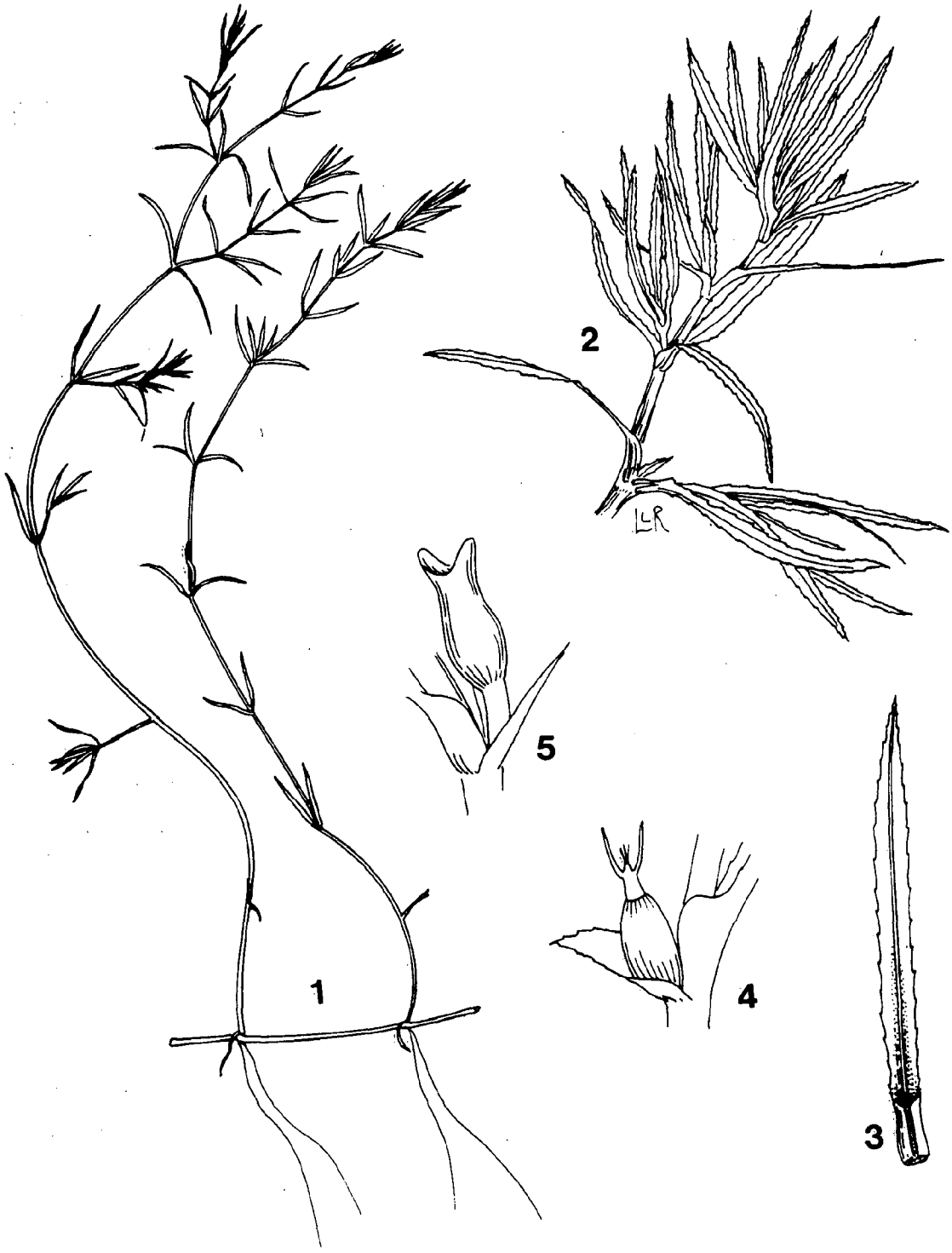


Figure 32. Illustration of *Najas guadalupensis* (Southern naiad): 1. habit, portion of plant; 2. branches; 3. leaf; 4. female flower; 5. male flower.

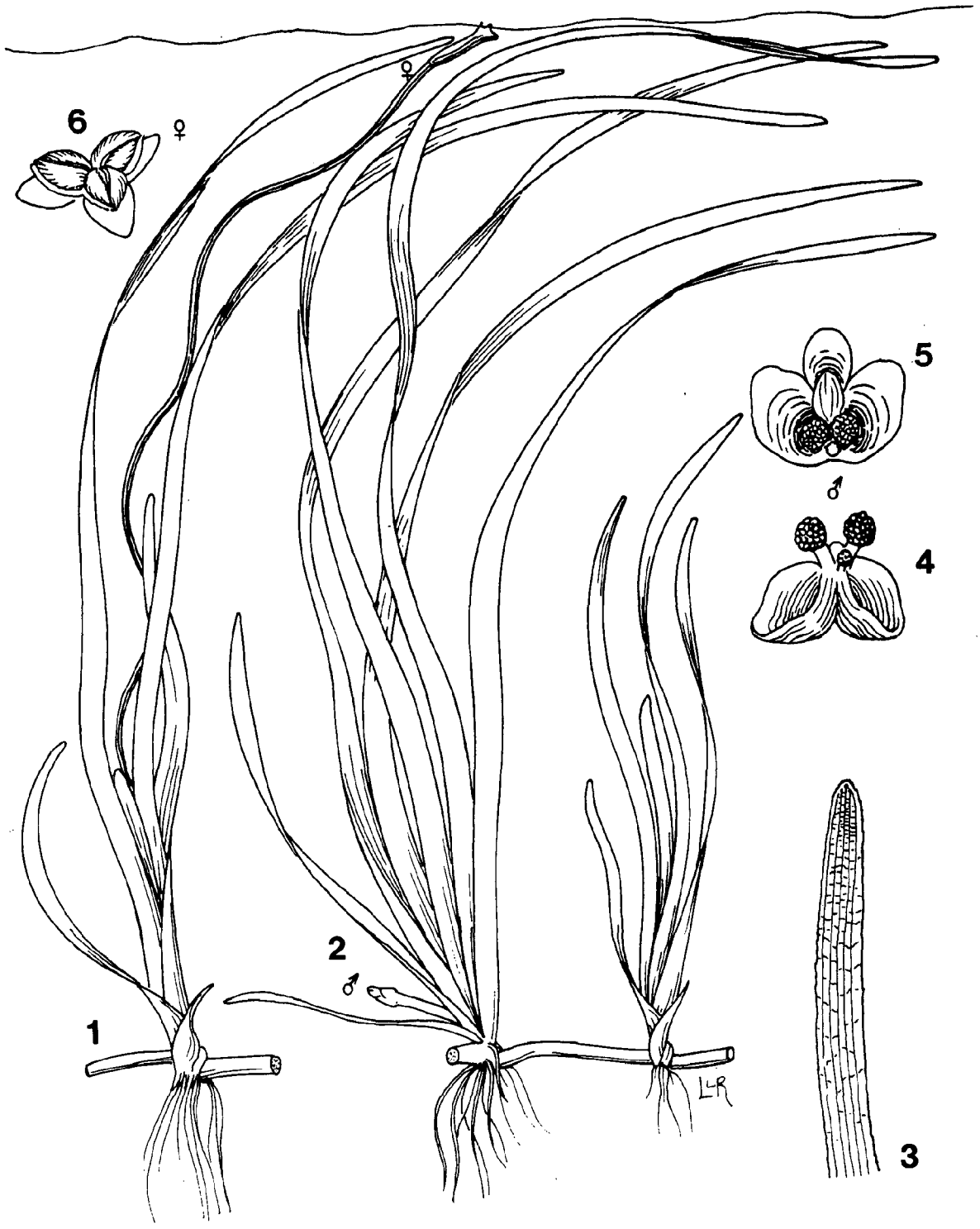


Figure 33. Illustration of *Vallisneria americana* (Tapegrass): 1. female plant; 2. male plant; 3. leaf tip with longitudinal air channels; 4-5. male flower (two views); 6. female flower.

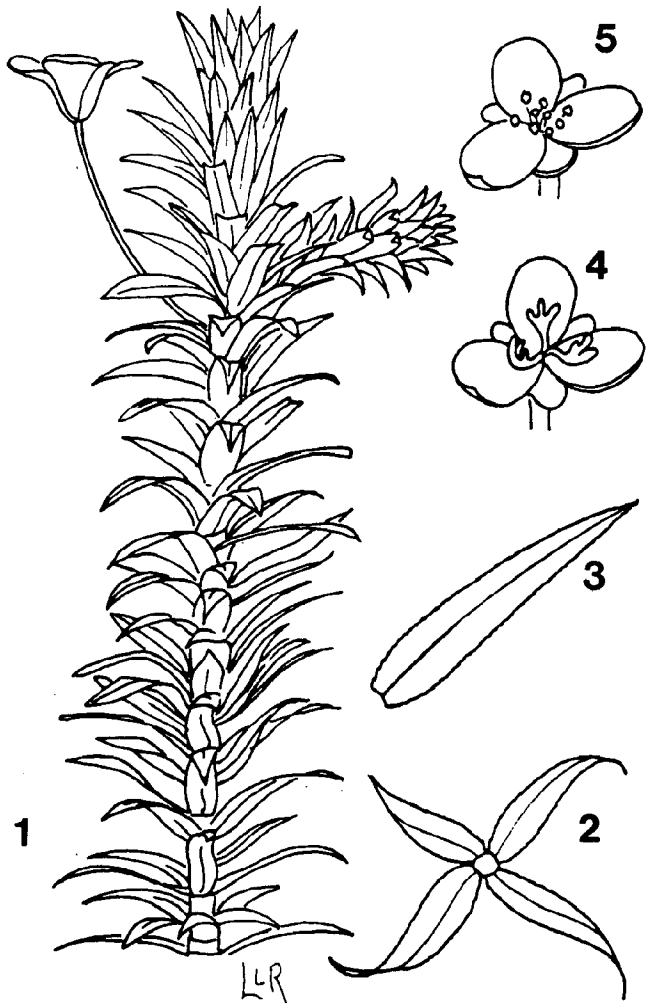


Figure 34. Illustration of *Egeria* spp. (Water-weed): 1. habit, end of branched stem with flower; 2. leaf whorl; 3. leaf; 4. female flower; 5. male flower.

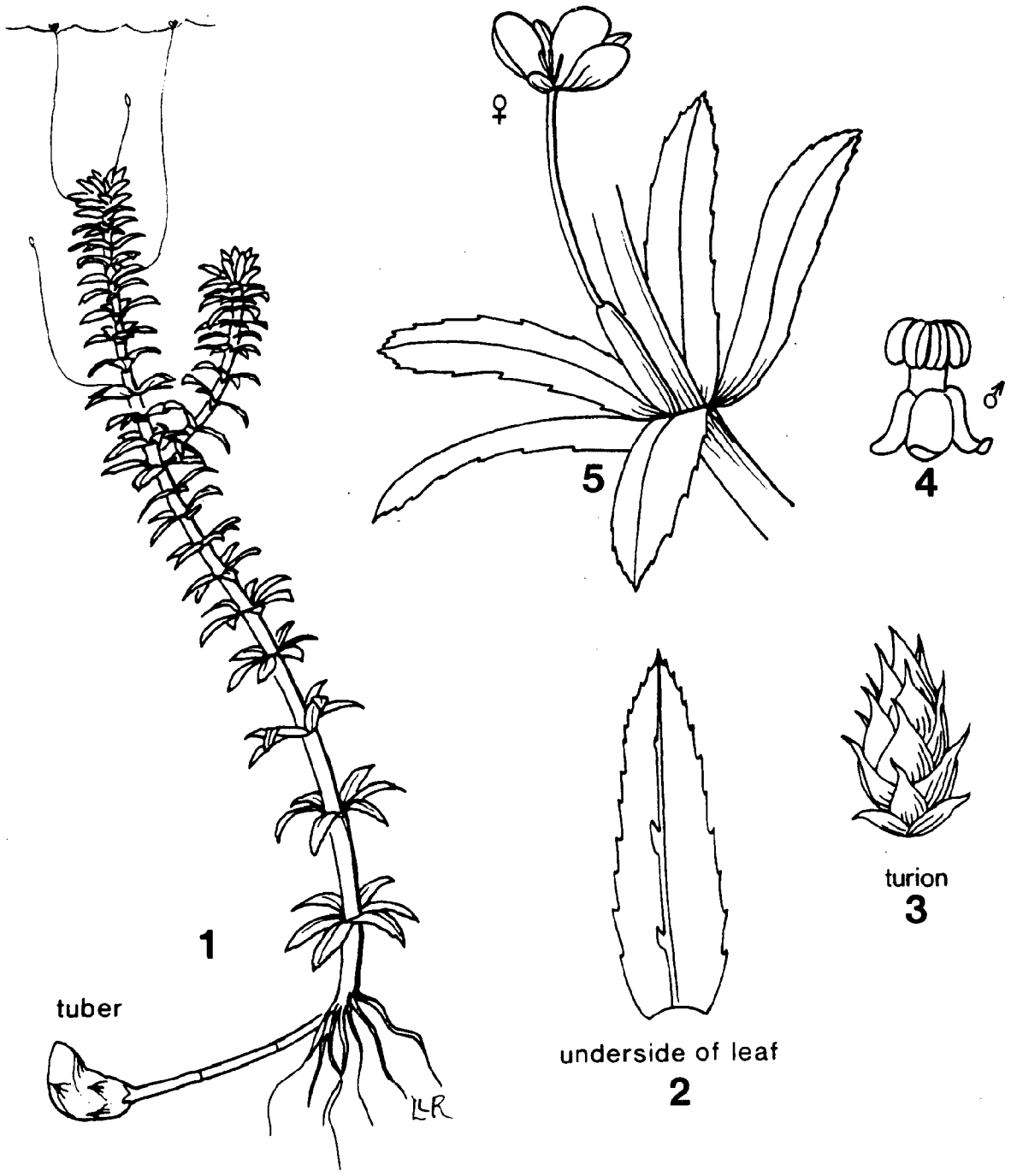


Figure 35. Illustration of *Hydrilla verticillata* (Hydrilla): 1. habit, entire plant; 2. leaf; 3. turion; 4. male flower; 5. female flower and leaf whorl.

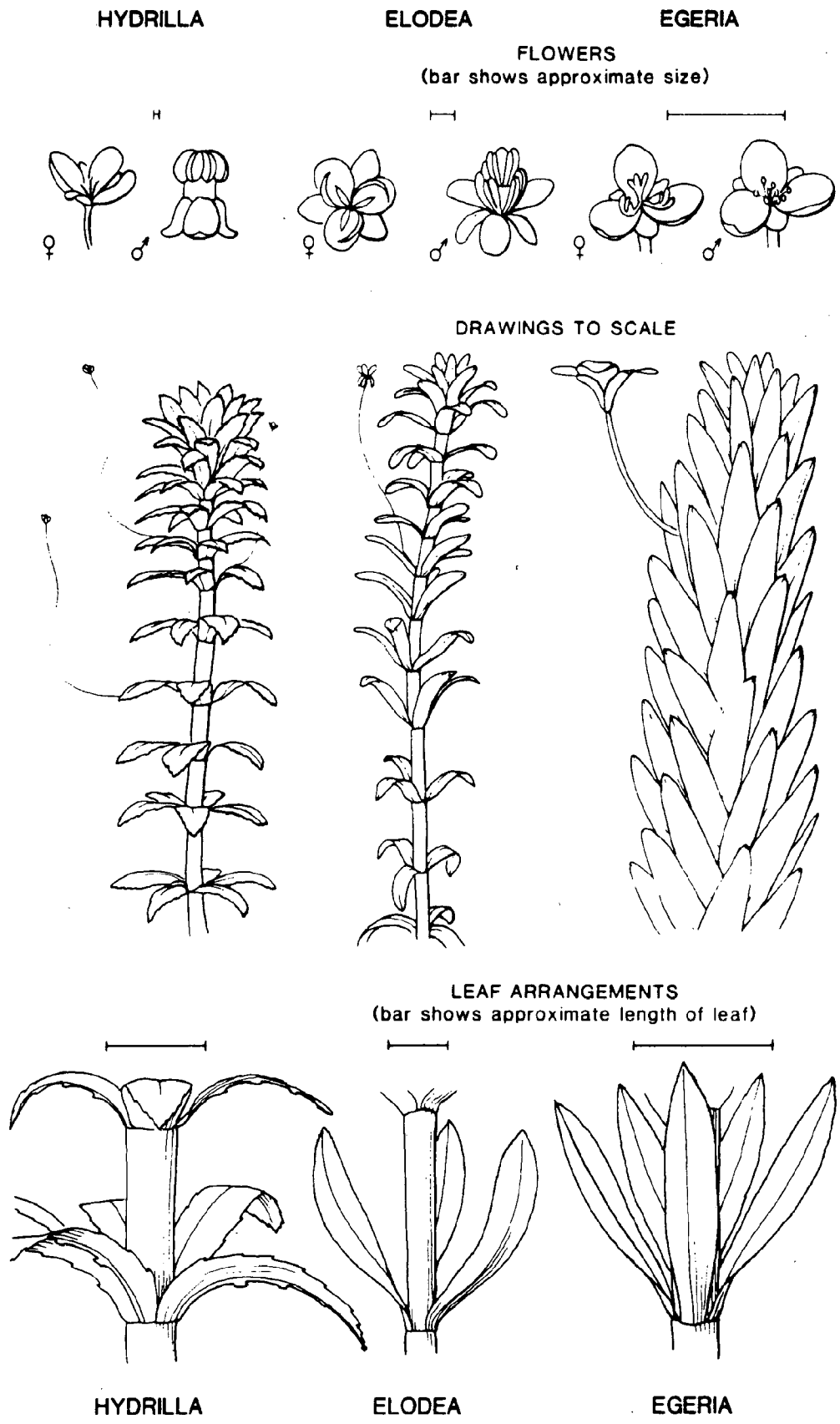


Figure 36. A comparison: illustrations of *Hydrilla verticillata*, *Elodea canadensis*, and *Egeria* spp.

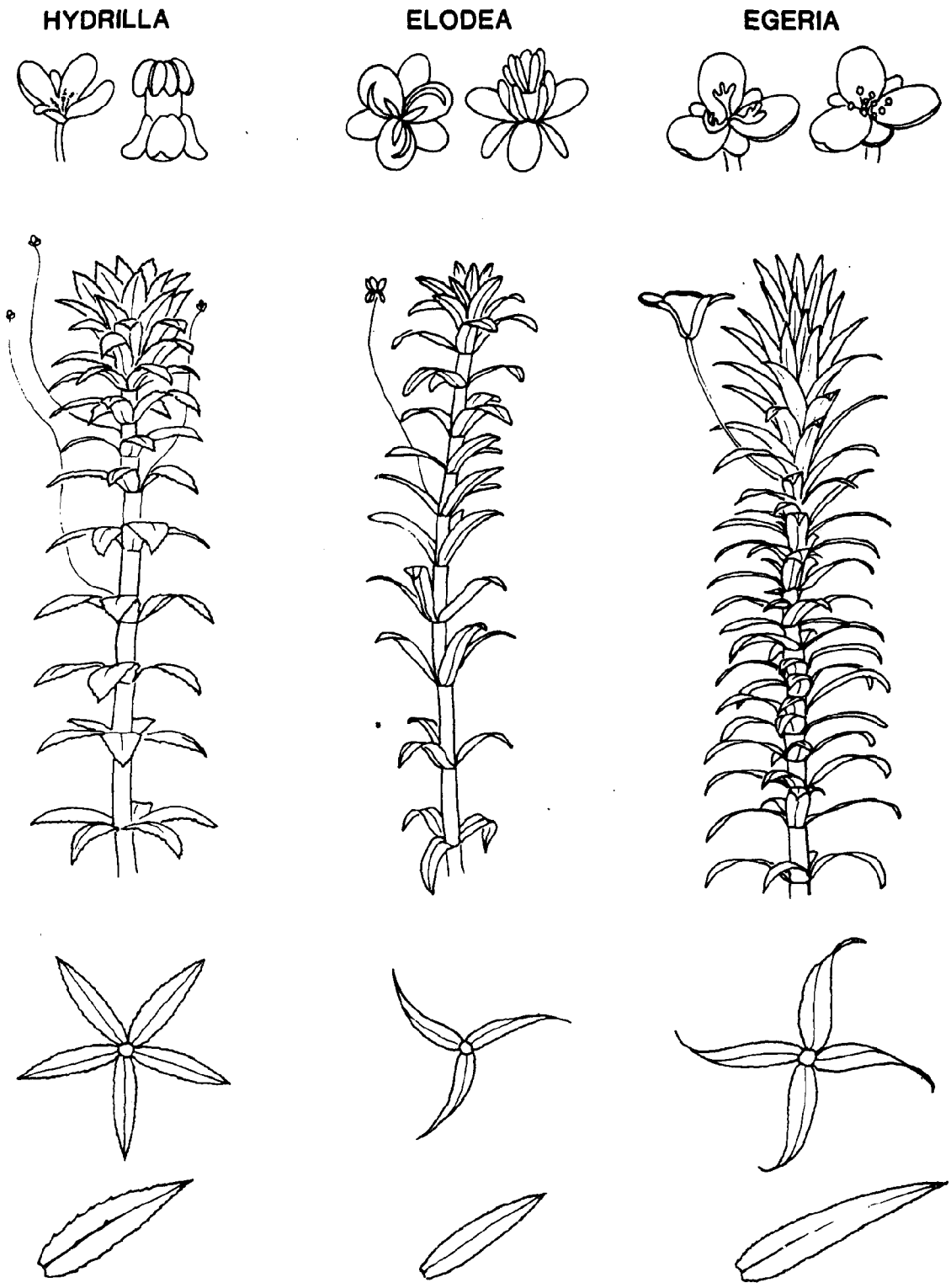


Figure 37. A comparison: illustrations of *Hydrilla verticillata*, *Elodea canadensis*, and *Egeria* spp. showing ends of stems with flowers; leaf whorls; single leaves.

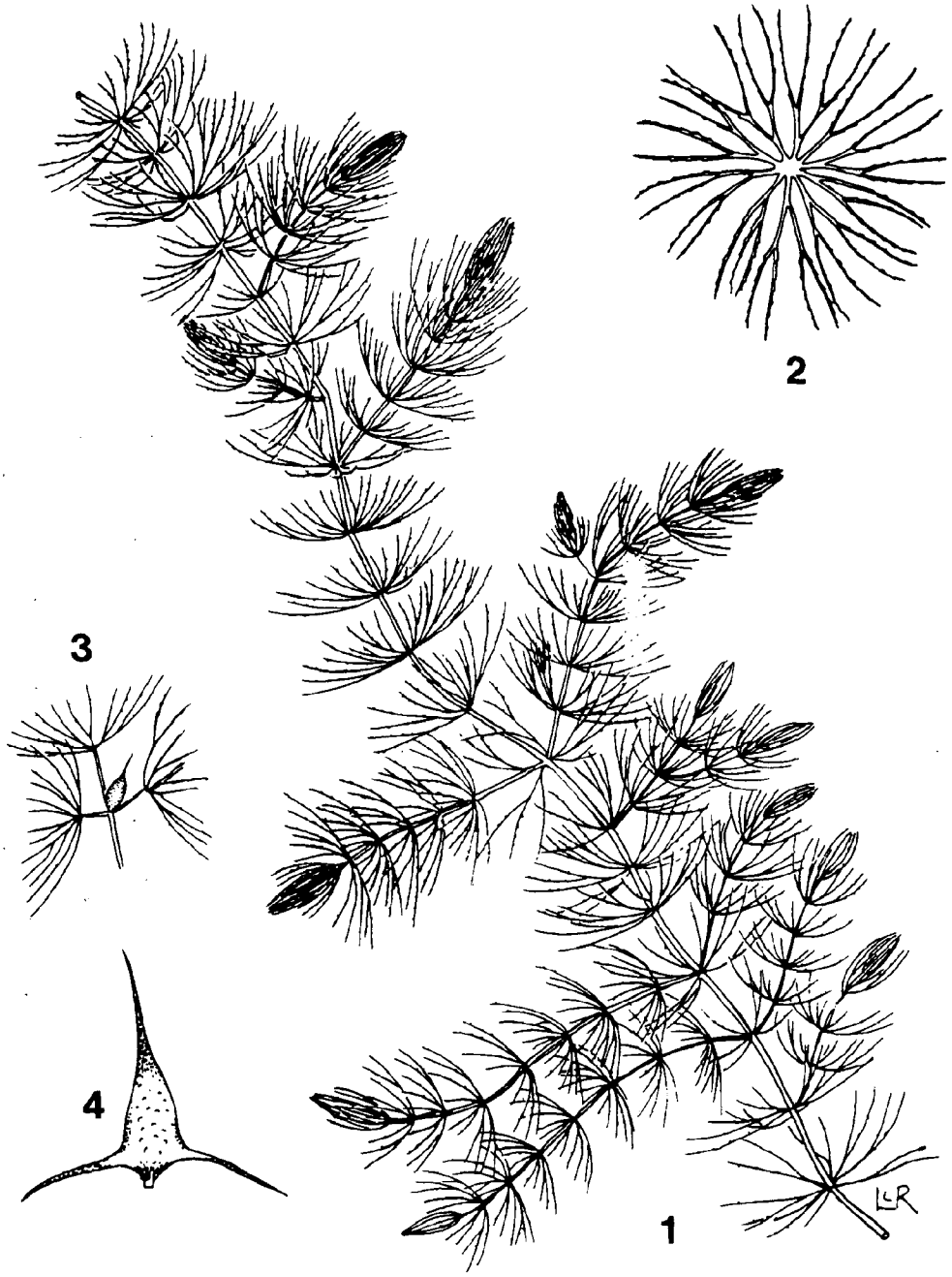


Figure 38. Illustration of *Ceratophyllum demersum* (Coontail): 1. habit, portion of plant; 2. leaf whorl; 3. flower in axil of whorl with branches; 4. fruit.

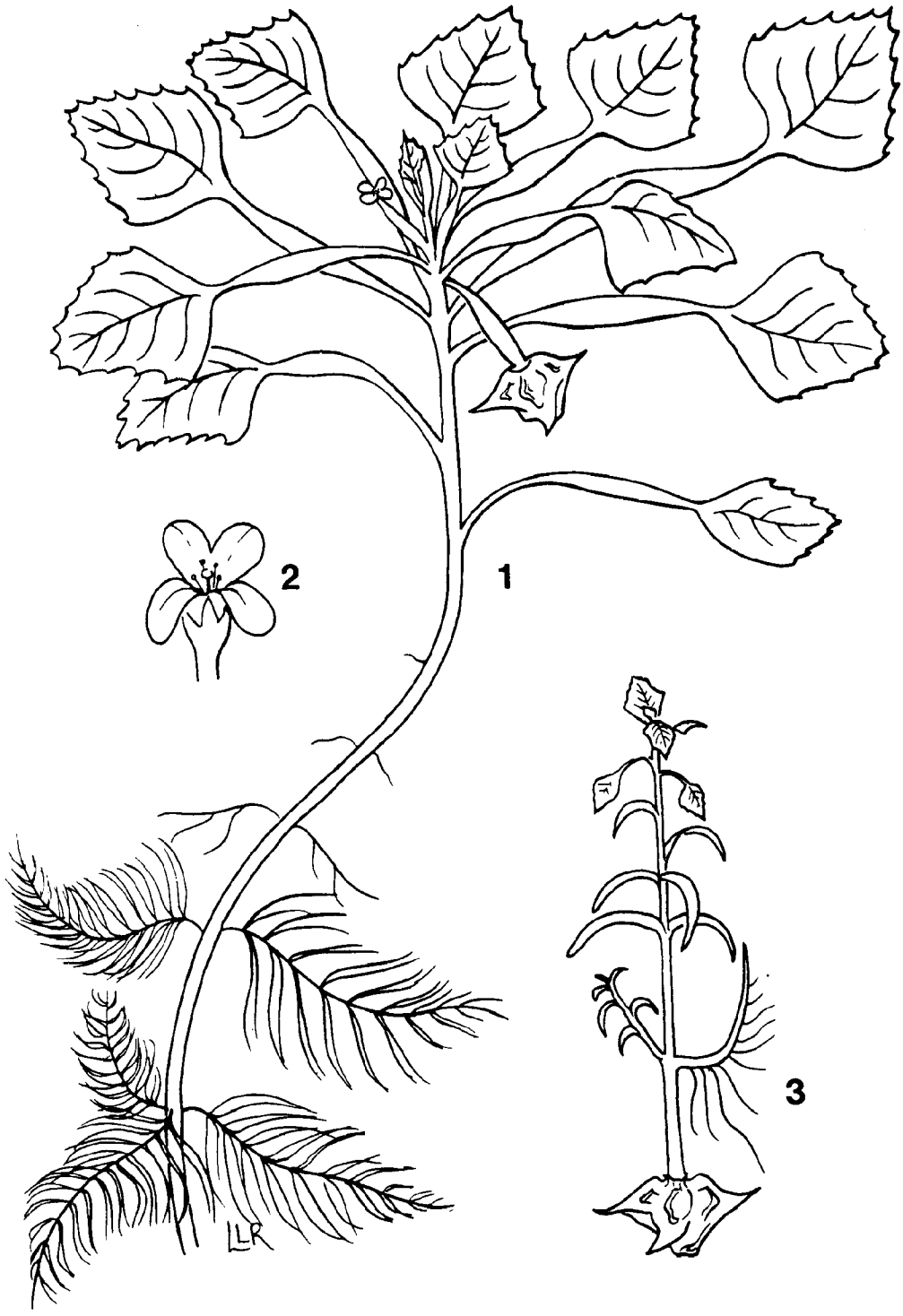


Figure 39. Illustration of *Trapa natans* (Water chestnut): 1. habit, portion of mature plant; 2. flower; 3. seedling.

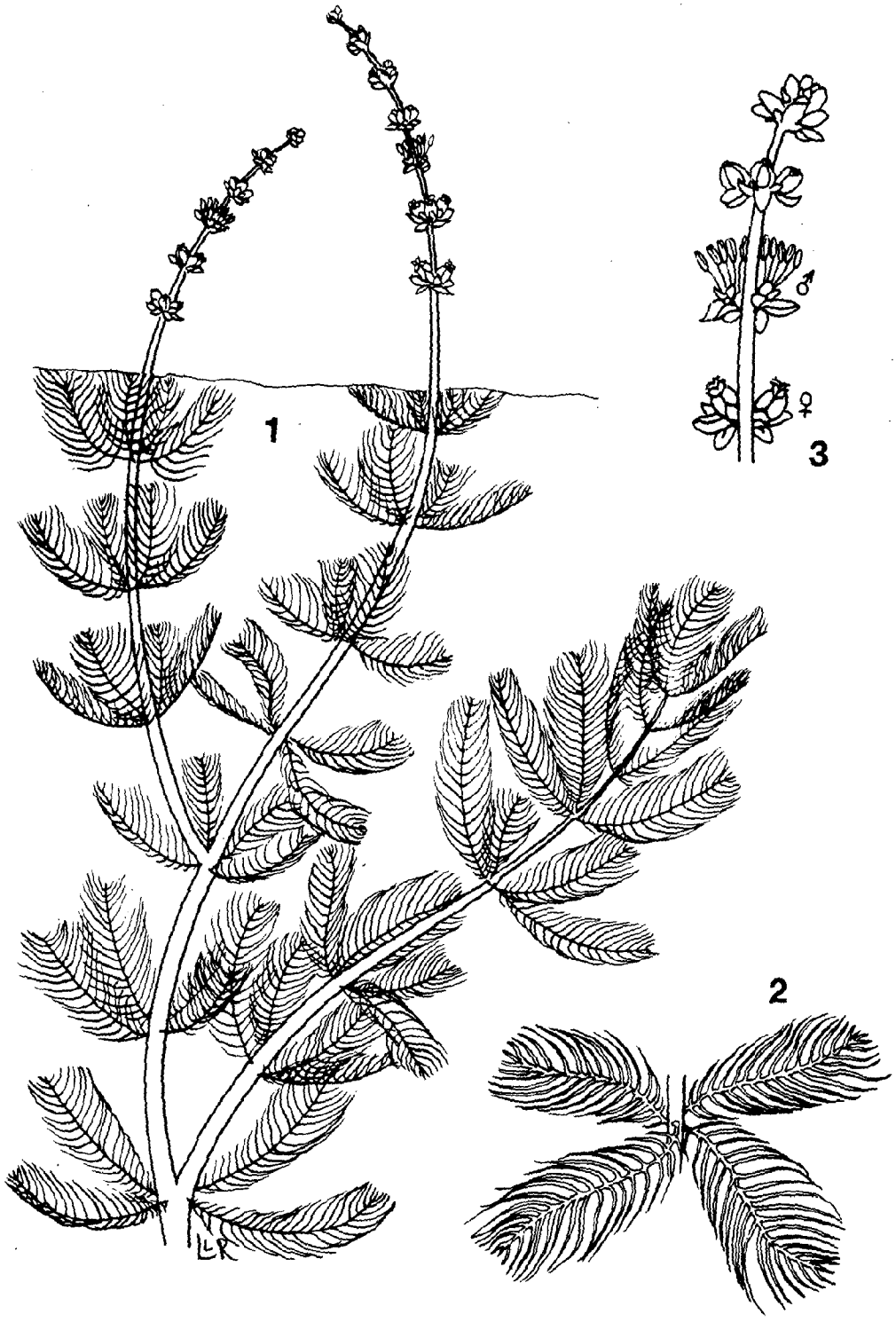


Figure 40. Illustration of *Myriophyllum spicatum* (Eurasian watermilfoil): 1. habit, upper portion of plant with flower spike borne above water; 2. leaf whorl; 3. female and male flowers on spike.

APPENDIX B

Latitude and Longitude Coordinate Points Defining the 21 Major Chesapeake Bay Sections and Chincoteague Bay. (For Section Locations and Descriptions See Fig. 7 and Table 3.)

	Latitude Deg Min	Longitude Deg Min
SEC. 1. Susquehanna Flats		
	39 27.00	76 10.00
	39 39.15	76 10.00
	39 39.15	75 51.00
	39 27.50	76 00.00
	39 26.50	76 01.31
SEC. 2. Upper Eastern Shore		
	39 10.00	76 20.00
	39 20.00	76 12.50
	39 26.50	76 01.31
	39 27.50	76 00.00
	39 39.15	75 51.00
	39 39.15	75 45.00
	39 19.50	75 45.00
	39 20.00	76 00.00
	39 12.55	76 10.40
	39 09.25	76 16.00
SEC. 3. Upper Western Shore		
	39 12.40	76 49.00
	39 30.00	76 20.00
	39 27.00	76 10.00
	39 26.50	76 01.31
	39 20.00	76 12.50
	39 10.00	76 20.00
	39 00.00	76 20.00
	39 03.50	76 32.30
	39 06.82	76 35.40
	39 11.15	76 40.00
SEC. 4. Chester River		
	39 00.00	76 20.00
	39 10.00	76 20.00
	39 09.25	76 16.00
	39 12.55	76 10.40
	39 20.00	76 00.00
	39 19.50	75 45.00
	39 05.00	75 45.00
	39 05.00	76 00.00
	38 57.10	76 11.85
	39 00.00	76 19.10
SEC. 5. Central Western Shore		
	38 42.90	76 35.00
	38 55.00	76 37.50
	39 12.40	76 49.00
	39 11.15	76 40.00
	39 06.82	76 35.40
	39 03.50	76 32.30
	39 00.00	76 20.00
	38 55.00	76 25.00
	38 45.00	76 25.00
SEC. 6. Eastern Bay		
	38 45.00	76 25.00
	38 55.00	76 25.00
	39 00.00	76 20.00
	39 00.00	76 19.10
	38 57.10	76 11.85
	39 05.00	76 00.00
	38 50.00	76 01.65
	38 44.10	76 10.50
	38 50.00	76 16.50
	38 45.00	76 20.00
	38 42.50	76 20.50
SEC. 7. Choptank River		
	38 23.50	76 20.00
	38 45.00	76 25.00
	38 42.50	76 20.50
	38 45.00	76 20.00
	38 50.00	76 16.50
	38 44.10	76 10.50
	38 50.00	76 01.65
	39 05.00	76 00.00
	39 05.00	75 45.00
	38 45.00	75 45.00
	38 45.00	75 50.00
	38 21.93	75 55.00
	38 25.00	76 06.80

	Latitude Deg Min	Longitude Deg Min
SEC. 8. Patuxent River		
	38 15.00	76 25.45
	38 35.00	77 00.00
	38 58.00	76 45.00
	38 55.00	76 37.50
	38 42.90	76 35.00
	38 30.00	76 32.30
	38 21.66	76 23.50
	38 18.00	76 22.83
SEC. 9. Middle Western Shore		
	38 02.85	76 19.40
	38 05.00	76 21.54
	38 15.00	76 25.45
	38 18.00	76 22.83
	38 21.66	76 23.50
	38 30.00	76 32.30
	38 42.90	76 35.00
	38 45.00	76 25.00
	38 23.50	76 20.00
	38 05.00	76 10.00
SEC. 10. Lower Potomac River		
	37 53.40	76 14.45
	37 55.50	76 18.15
	37 53.85	76 28.00
	38 06.15	76 53.00
	38 15.00	77 06.40
	38 20.00	77 09.40
	38 24.20	77 14.08
	38 35.00	77 00.00
	38 15.00	76 25.45
	38 05.00	76 21.54
	38 02.85	76 19.40
	38 05.00	76 10.00
	37 50.00	76 10.00

	Latitude Deg Min	Longitude Deg Min
SEC. 11. Upper Potomac River		
	38 15.00	77 06.40
	38 20.00	77 24.80
	38 27.65	77 25.00
	39 01.80	77 17.10
	38 58.00	76 45.00
	38 35.00	77 00.00
	38 24.20	77 14.08
	38 20.00	77 09.40
SEC. 12. Middle Eastern Shore		
	38 11.10	76 13.30
	38 23.50	76 20.00
	38 25.00	76 06.80
	38 21.93	75 55.00
	38 45.00	75 50.00
	38 40.00	75 37.00
	38 00.00	75 38.00
	38 00.73	75 49.50
	37 57.10	75 50.30
	37 55.00	75 55.10
	38 11.70	75 59.00
	38 13.60	76 05.83
SEC. 13. Mid-Bay Island Complex		
	37 45.00	75 58.30
	37 50.00	76 10.00
	38 05.00	76 10.00
	38 11.10	76 13.30
	38 13.60	76 05.83
	38 11.70	75 59.00
	37 55.00	75 55.10
SEC. 14. Lower Eastern Shore		
	37 00.00	75 58.95
	37 20.00	76 10.00
	37 38.75	76 10.00
	37 50.00	76 10.00
	37 45.00	75 58.30
	37 55.00	75 55.10
	37 57.10	75 50.30
	38 00.73	75 49.50
	38 00.00	75 38.00
	38 00.00	75 30.00
	37 46.45	75 39.30
	37 20.00	75 55.50

	Latitude Deg Min	Longitude Deg Min
SEC. 15. Reedville		
	37 38.75	76 10.00
	37 37.40	76 21.40
	37 38.05	76 23.50
	37 44.35	76 23.00
	37 48.00	76 28.00
	37 53.85	76 28.00
	37 55.50	76 18.15
	37 53.40	76 14.45
	37 50.00	76 10.00
SEC. 16. Rappahannock River Complex		
	37 26.50	76 10.00
	37 25.00	76 18.08
	37 28.00	76 20.00
	37 29.00	76 25.00
	37 32.00	76 35.00
	37 49.15	76 48.00
	37 53.73	76 49.65
	37 58.00	76 45.45
	37 48.00	76 28.00
	37 44.35	76 23.00
	37 38.05	76 23.50
	37 37.40	76 21.40
	37 38.75	76 10.00
SEC. 17. New Point Comfort Region		
	37 17.45	76 16.16
	37 19.45	76 16.62
	37 20.00	76 17.40
	37 21.00	76 17.40
	37 22.25	76 19.50
	37 25.00	76 18.00
	37 26.50	76 10.00
	37 20.00	76 10.00

	Latitude Deg Min	Longitude Deg Min
SEC. 18. Mobjack Bay Complex		
	37 17.00	76 19.33
	37 16.25	76 22.50
	37 17.00	76 25.42
	37 16.50	76 28.50
	37 20.00	76 31.88
	37 25.75	76 31.00
	37 29.00	76 25.00
	37 28.00	76 20.00
	37 25.00	76 18.00
	37 22.25	76 19.50
	37 21.00	76 17.40
	37 20.00	76 17.40
	37 19.30	76 16.62
	37 17.45	76 16.16
SEC. 19. York River		
	37 14.00	76 22.50
	37 13.25	76 24.00
	37 12.50	76 27.50
	37 07.30	76 28.20
	37 14.00	76 36.50
	37 16.72	76 43.65
	37 26.29	76 49.77
	37 30.55	76 40.00
	37 28.56	76 35.00
	37 20.00	76 31.88
	37 16.50	76 28.50
	37 17.00	76 25.42
	37 16.25	76 22.50
	37 17.00	76 19.33
	37 14.00	76 19.33

Latitude Deg Min	Longitude Deg Min

SEC. 20. Lower Western Shore

Latitude Deg Min	Longitude Deg Min
36 49.11	75 58.05
36 45.75	76 07.00
36 55.85	76 16.00
36 57.79	76 16.00
36 58.00	76 17.70
37 01.05	76 18.52
37 03.68	76 19.80
37 00.60	76 24.00
37 07.30	76 28.20
37 12.50	76 27.50
37 13.25	76 24.00
37 14.00	76 22.50
37 14.00	76 19.33
37 17.00	76 19.33
37 17.45	76 16.16
37 20.00	76 10.00
37 00.00	75 58.95

SEC. 21. James River

Latitude Deg Min	Longitude Deg Min
36 45.75	76 07.00
36 40.00	76 10.00
36 40.00	76 30.00
36 40.00	76 40.00
36 55.63	76 40.00
37 17.30	77 18.00
37 20.15	77 14.00
37 27.45	77 08.10
37 26.29	76 49.77
37 16.72	76 43.65
37 14.00	76 36.50
37 07.30	76 28.20
37 00.60	76 24.00
37 03.68	76 19.80
37 01.05	76 18.52
36 58.00	76 17.70
36 57.79	76 16.00
36 55.85	76 16.00

Latitude Deg Min	Longitude Deg Min

Chincoteague Bay

Latitude Deg Min	Longitude Deg Min
37 52.50	75 30.00
38 00.00	75 30.00
38 07.50	75 22.50
38 15.00	75 17.50
38 15.00	75 15.00
38 22.50	75 15.00
38 30.00	75 10.00
38 30.00	75 02.50
38 22.50	75 02.50
38 15.00	75 07.50
38 07.50	75 10.00
38 00.00	75 15.00
37 52.50	75 20.00
37 51.00	75 22.30
37 51.00	75 30.00

APPENDIX C

Topographic Quadrangles for the Chesapeake Bay and Chincoteague Bay Showing the 1991 Distribution and Abundance of SAV. [Boundaries of Individual SAV Beds Are Delineated by Solid Lines. Each Bed Is Identified with an Unique Two Letter (AA-ZA, AB-ZB, etc.) and One Number (1-4) Designation. These Numbers Represent the Density Classification Discussed in the Text and Fig. 6, i.e. 1 = <10%; 2 = 10-40%; 3 = 40-70%; 4 = 70-100%. Ground Truthing Represented by Symbols and Species Codes which Are Explained in the Legend.]

KEY FOR 1991 SAV MAPS

SPECIES

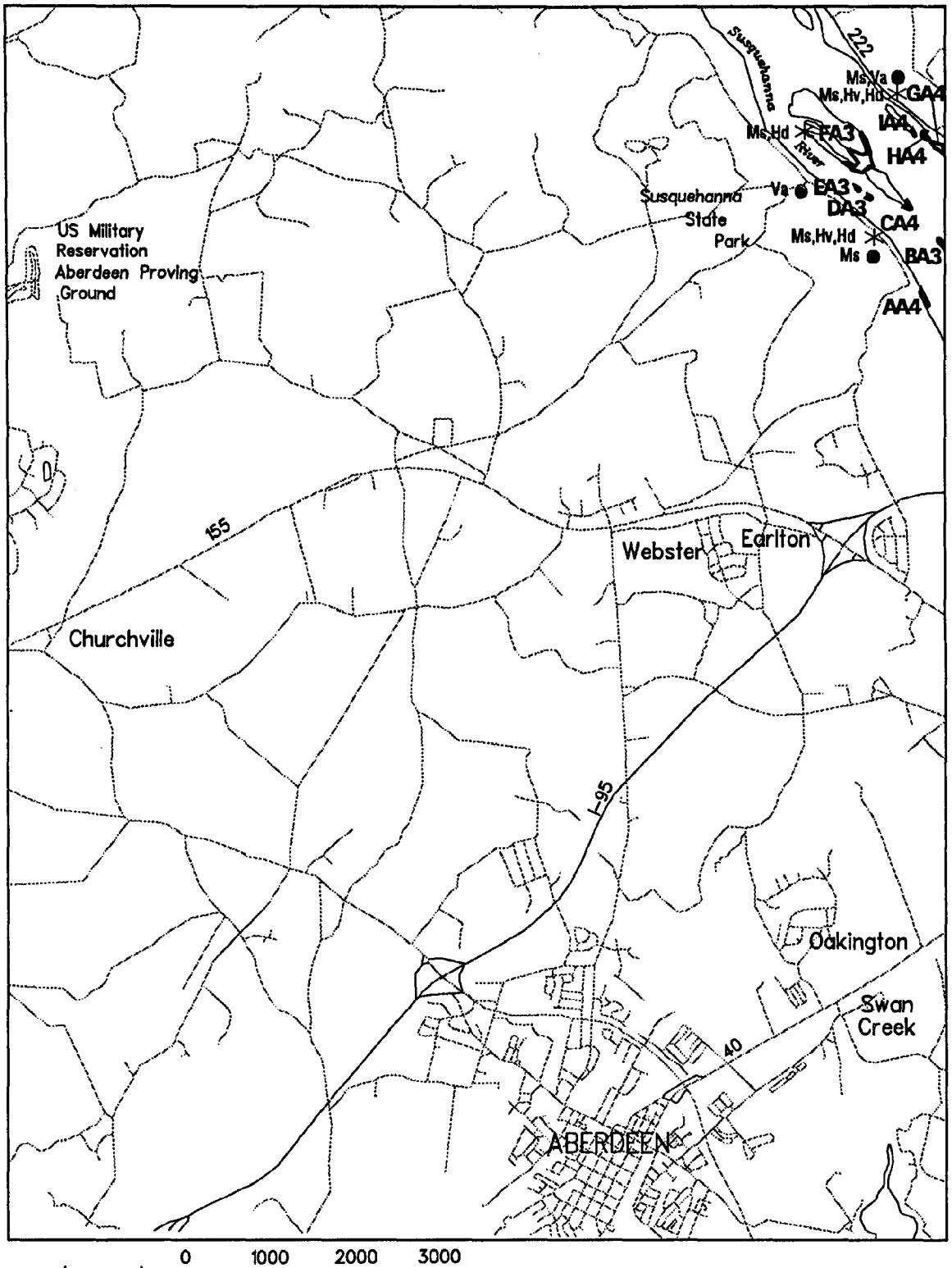
Zm	*Zostera marina (eelgrass)*
Rm	*Ruppia maritima (widgeon grass)*
Ms	*Myriophyllum spicatum (Eurasian watermilfoil)*
Ppf	*Potamogeton perfoliatus (redhead-grass)*
Ppc	*Potamogeton pectinatus (sago pondweed)*
Zp	*Zannichellia palustris (horned pondweed)*
N	*Najas spp. (naiad)*
Ec	*Elodea canadensis (common elodea)*
Va	*Vallisneria americana (wild celery)*
Tn	*Trapa natans (water chestnut)*
Pe	*Potamogeton epihydrus (leafy pondweed)*
Hv	*Hydrilla verticillata (hydrilla)*
Hd	*Heteranthera dubia (water stargrass)*
Pcr	*Potamogeton crispus (curly pondweed)*
Cd	*Ceratophyllum demersum (coontail)*
Ppu	*Potamogeton pusillus (slender pondweed)*
Ngu	*Najas guadalupensis (southern naiad)*
Ngr	*Najas gracillima (naiad)*
C	*Chara sp. (muskgrass)*
Nm	*Najas minor (slender naiad)*
U	*Unknown species composition*

SURVEY STATIONS

- ▲ *VIMS Field Survey*
- ✳ *Harford Community College*
- ▼ *University MD-HPEL*
- ★ *USFWS Survey*
- ◆ *Council of Governments*
- ■ *MD Dept. of Natural Resources*
- ● *Citizens Field Observation*
- ⚑ *National Park Service*
- ⊠ *Essex Community College*

Indicates 'NO SAV' polygon

SUBMERGED AQUATIC VEGETATION 1991
Aberdeen, MD. (002)



Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-29-91

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College of William and Mary

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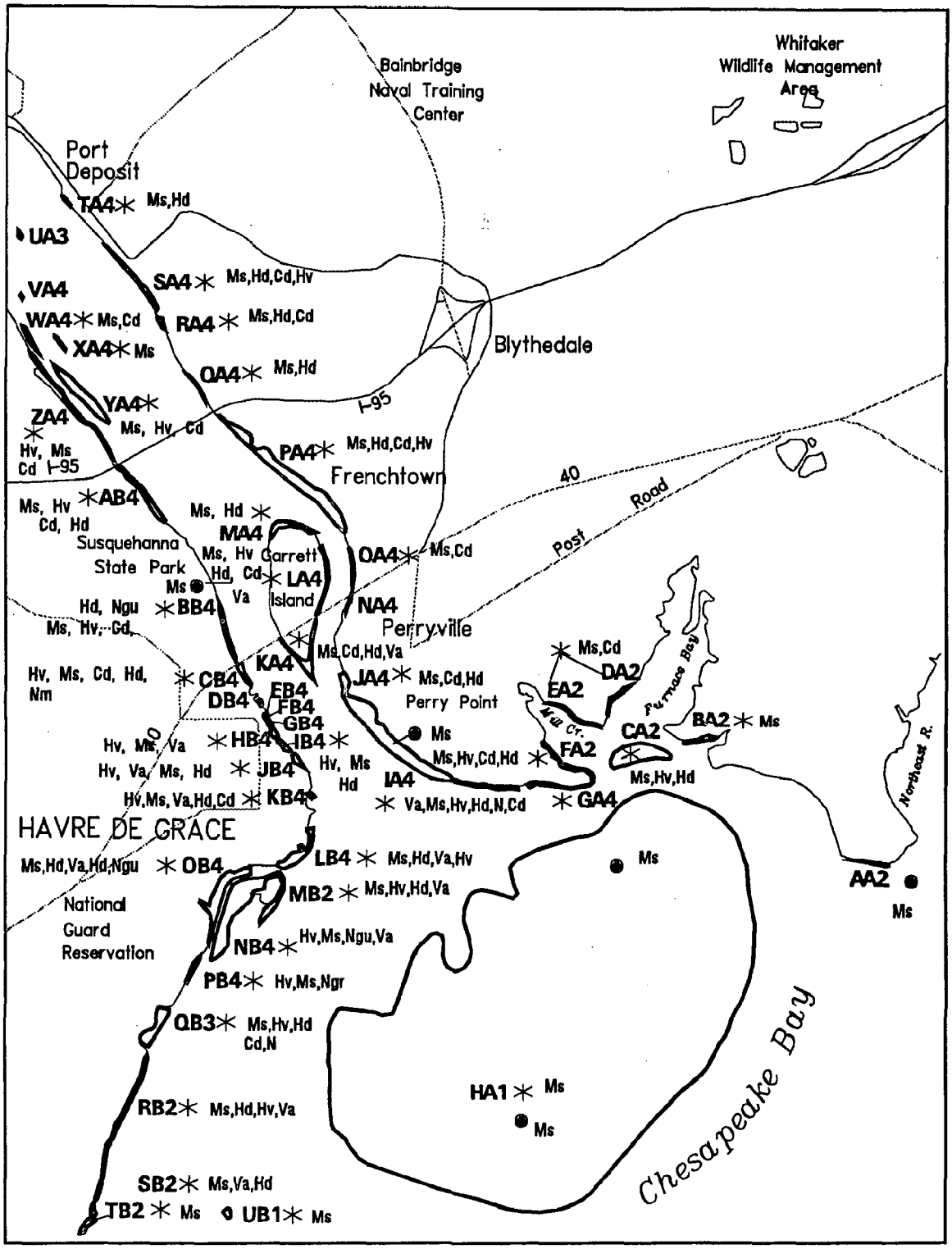
Havre de Grace, MD. (003)



Scale (meters):

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U.S. Geological Survey

Date Flown: 08-01-91

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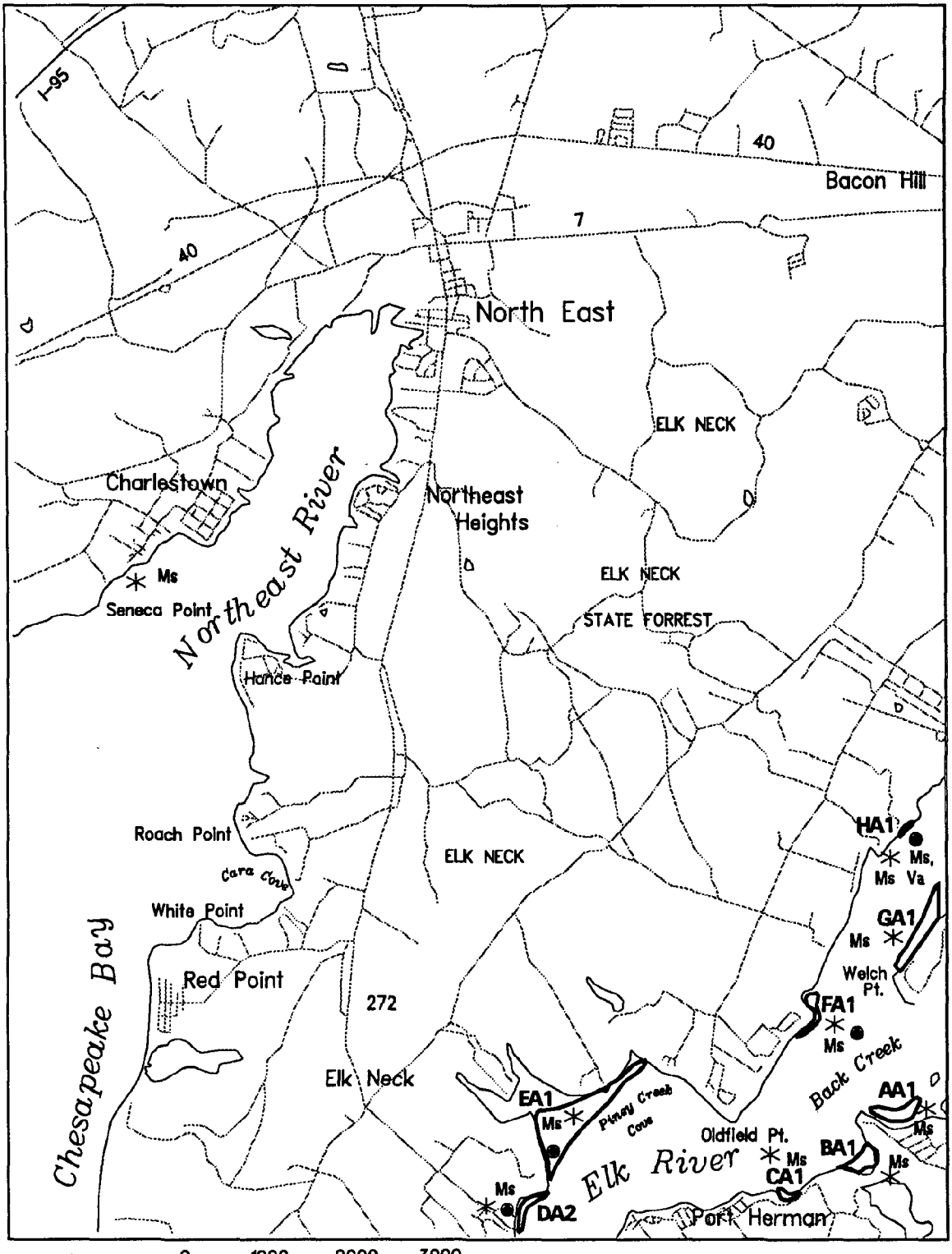
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
North East, MD. (004)



Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

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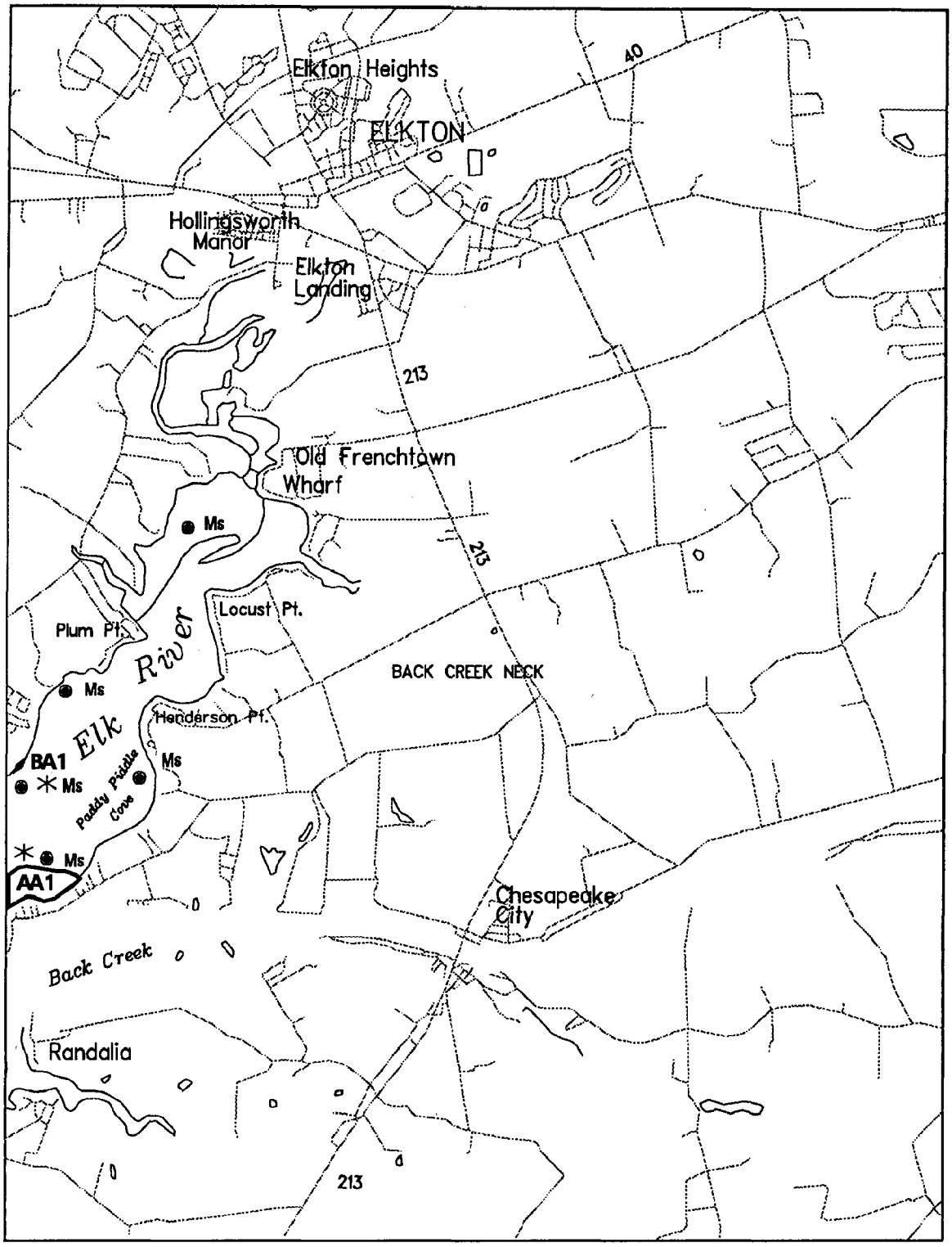
Elkton, MD.-DEL. (005)



Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-01-91

Produced by:
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College of William and Mary

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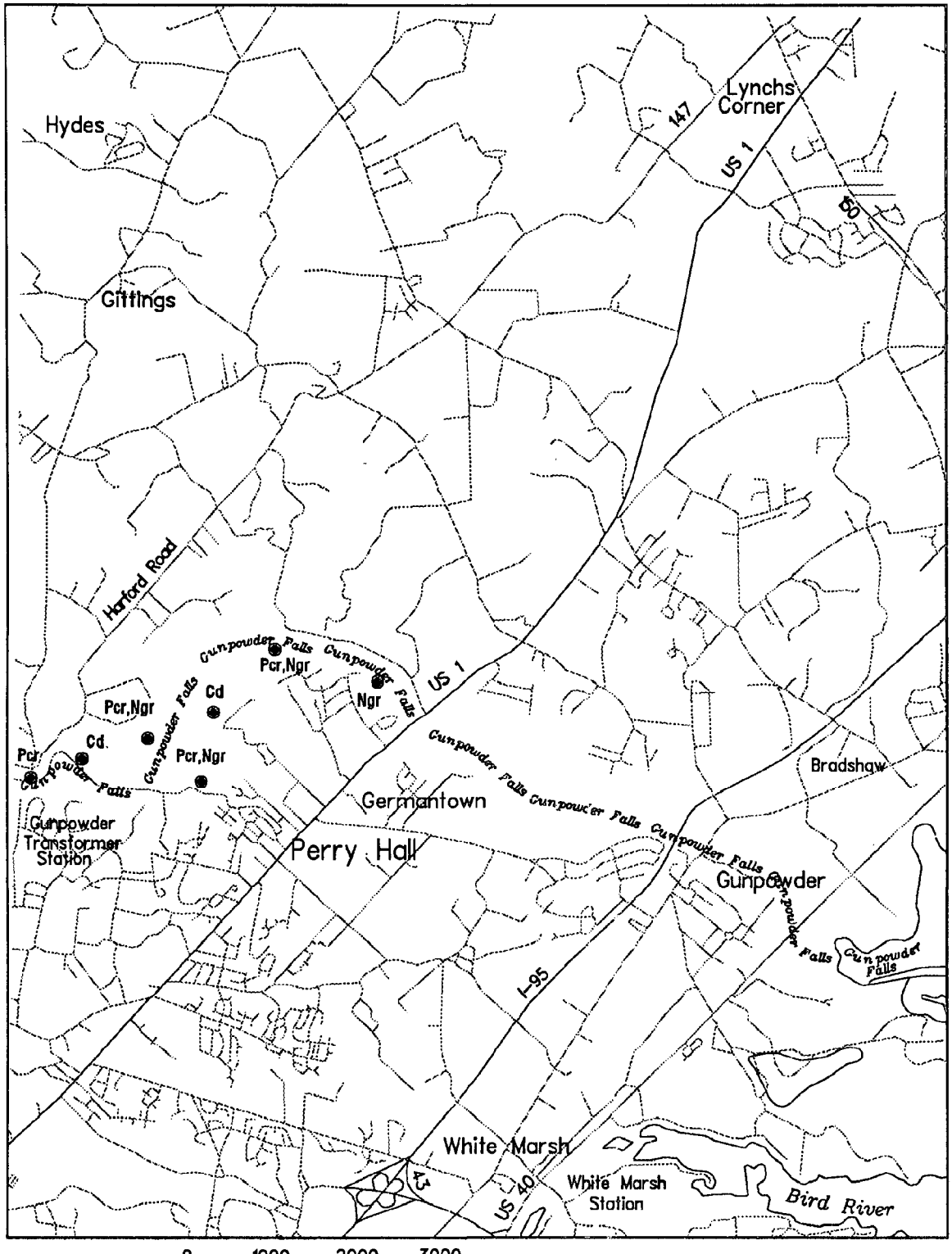
White Marsh, MD. (006)



Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

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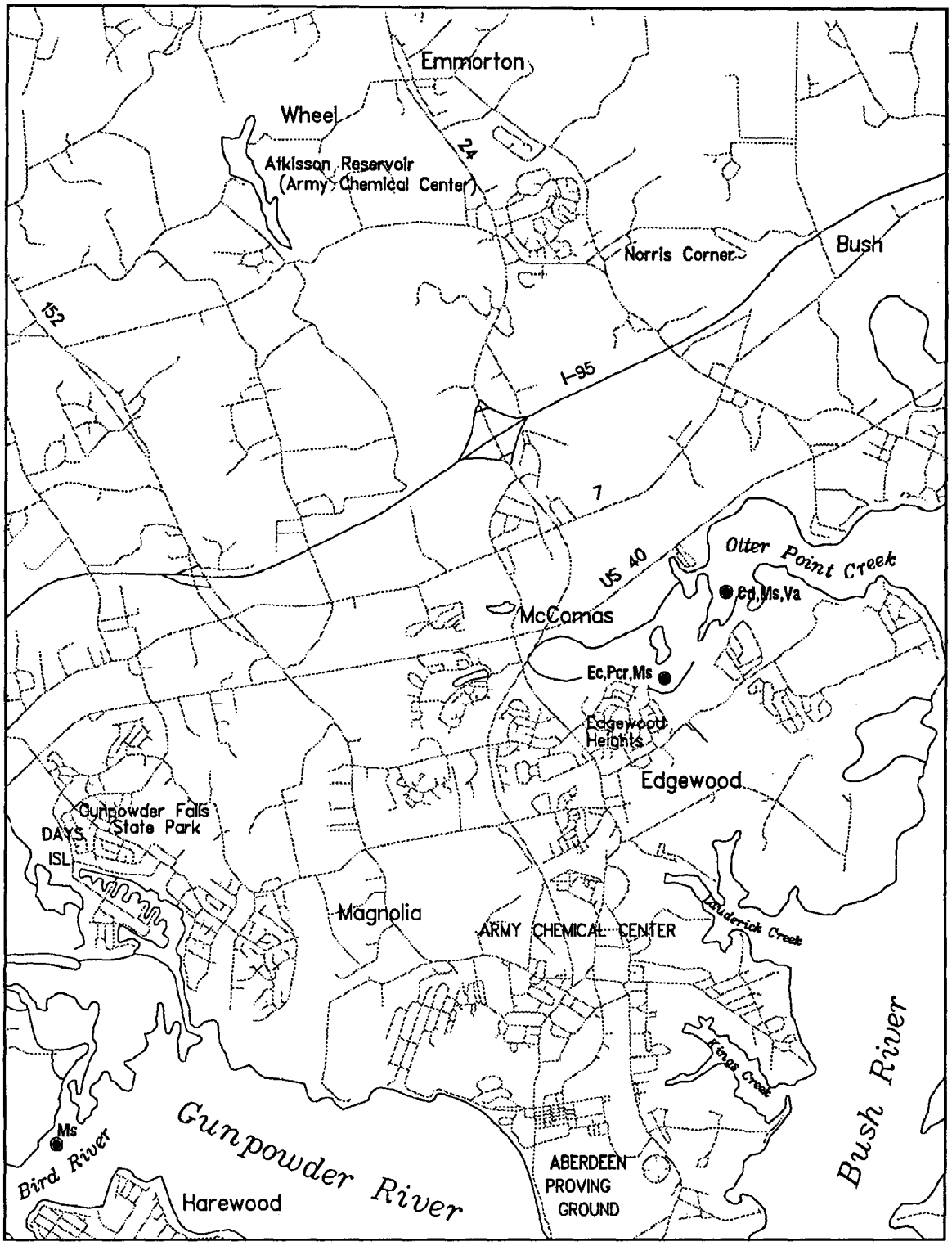
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Edgewood, MD. (007)



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Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 09-02-91

Produced by:
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College of William and Mary

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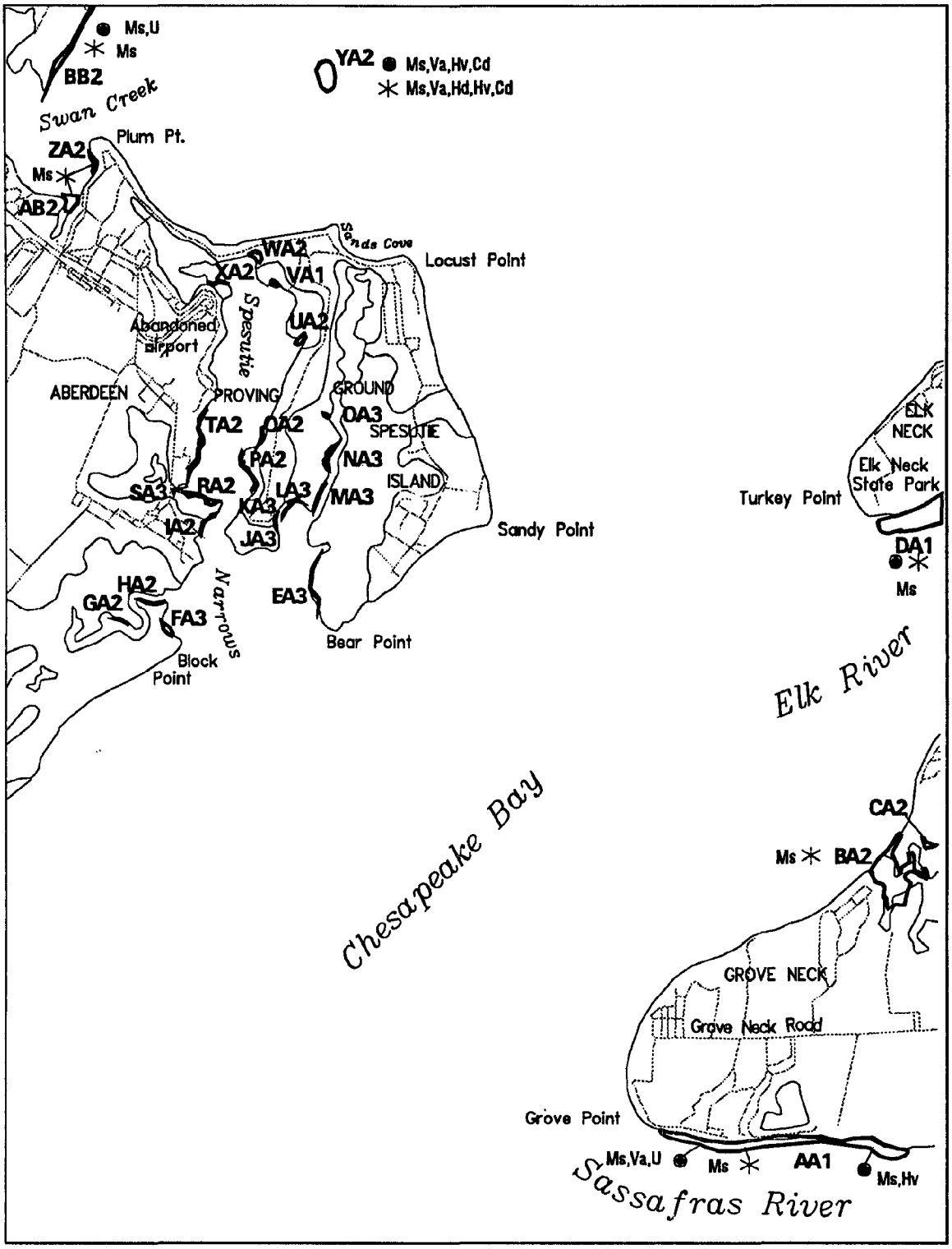
Spesutie, MD. (009)



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Scale (meters):

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Produced by:
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College of William and Mary

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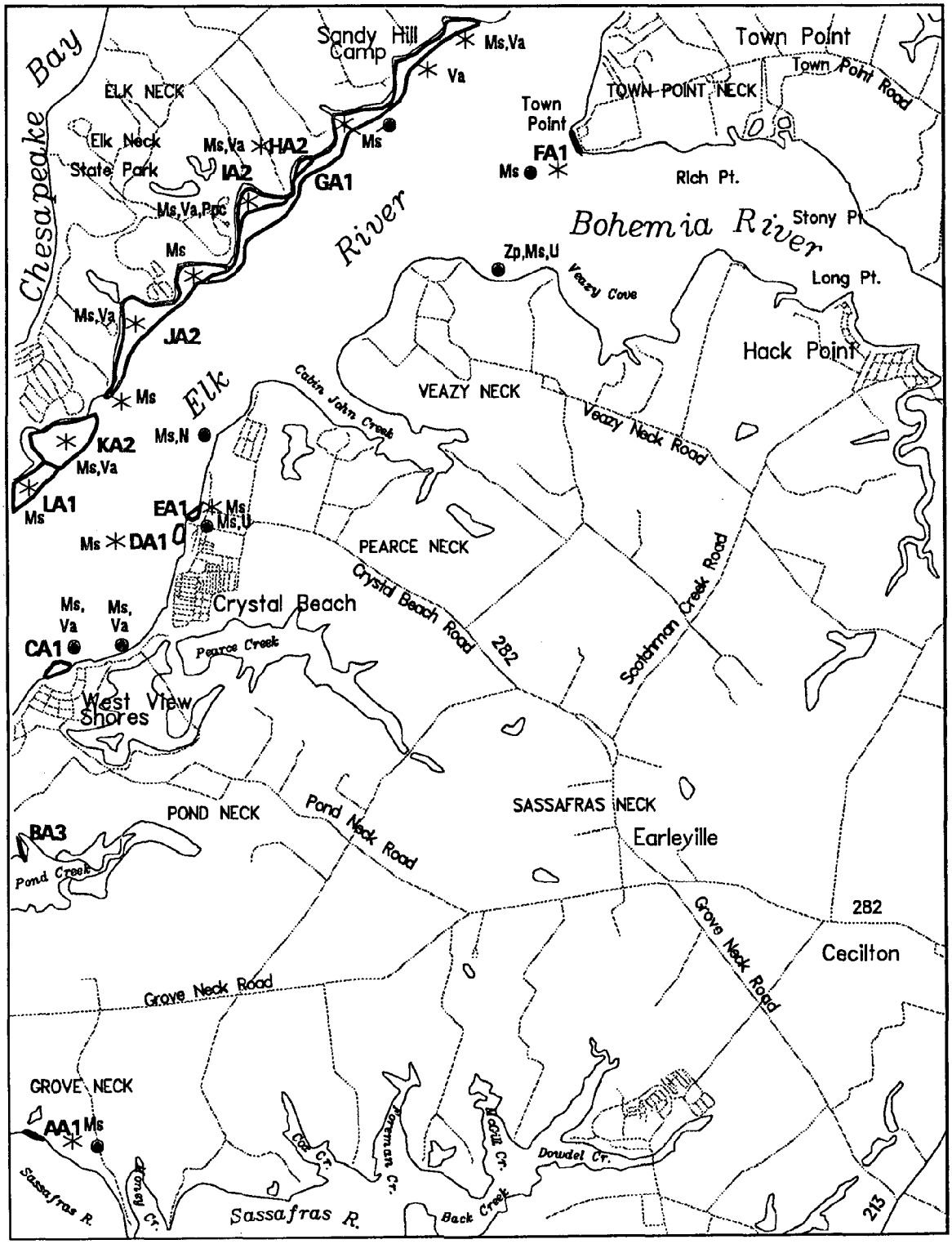
Earleville, MD. (010)



Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-01-91

Produced by:
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College of William and Mary

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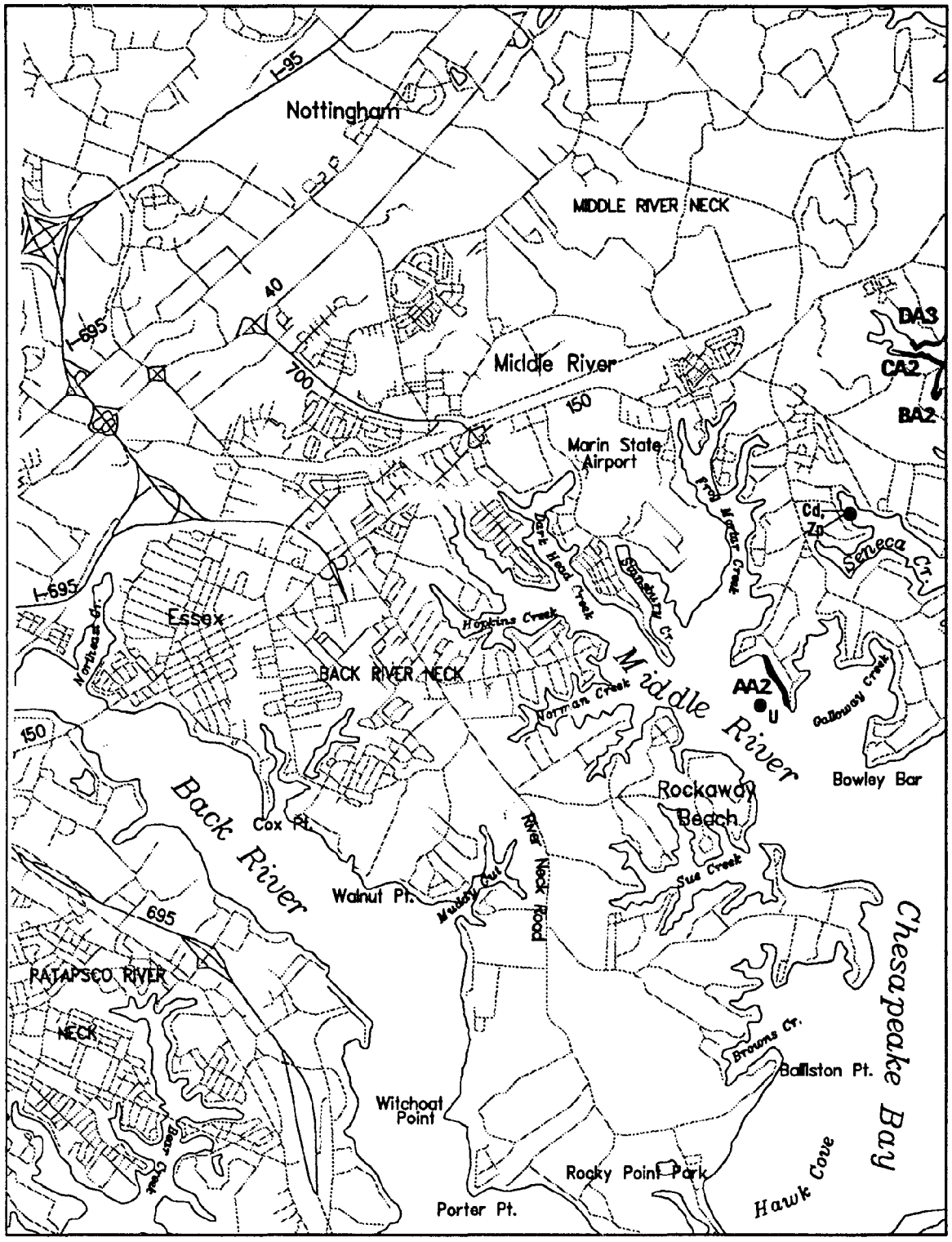
Middle River, MD. (013)



Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 09-02-91

Produced by:
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College of William and Mary

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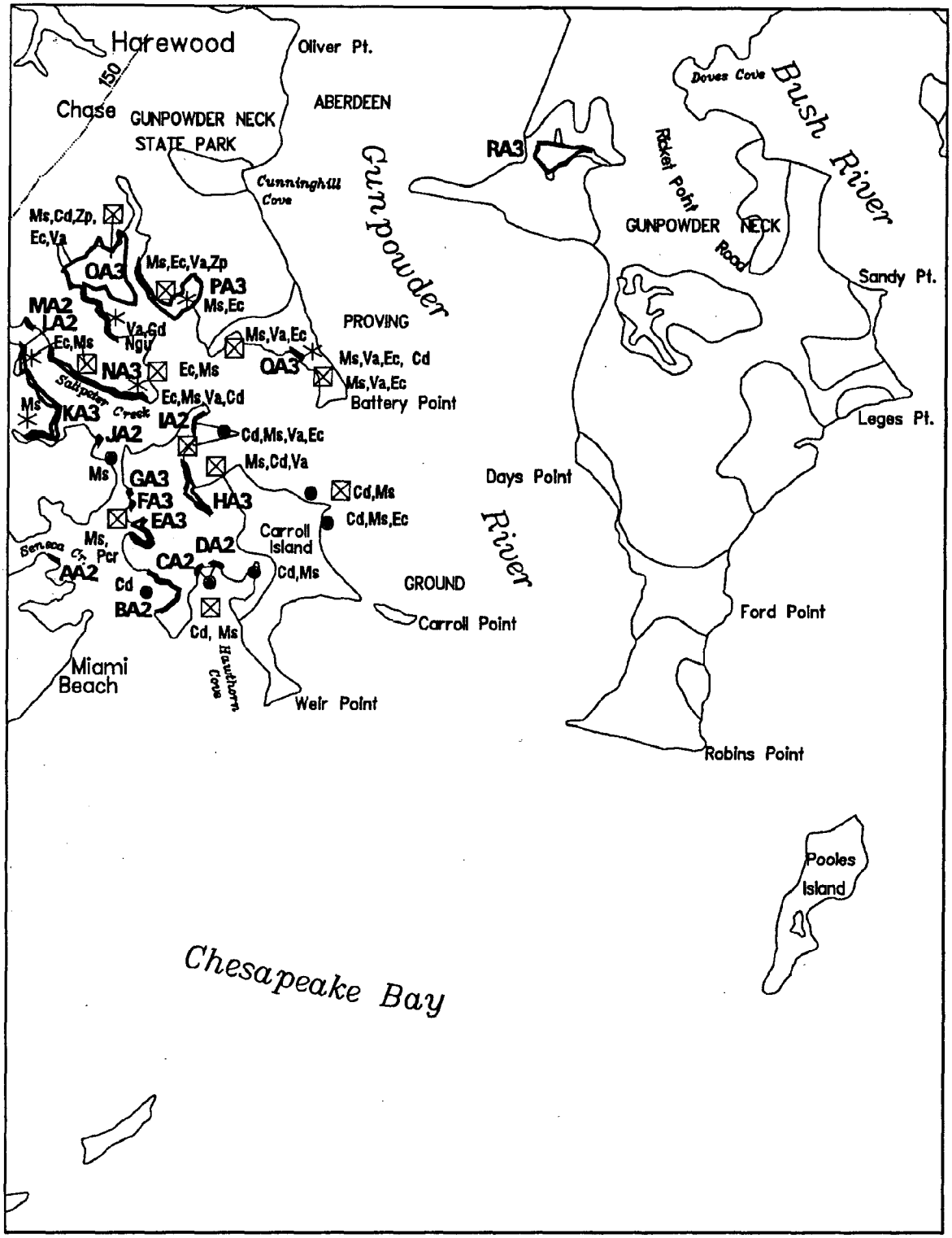
Gunpowder Neck, MD. (014)



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Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 09-02-91

Produced by:
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College of William and Mary

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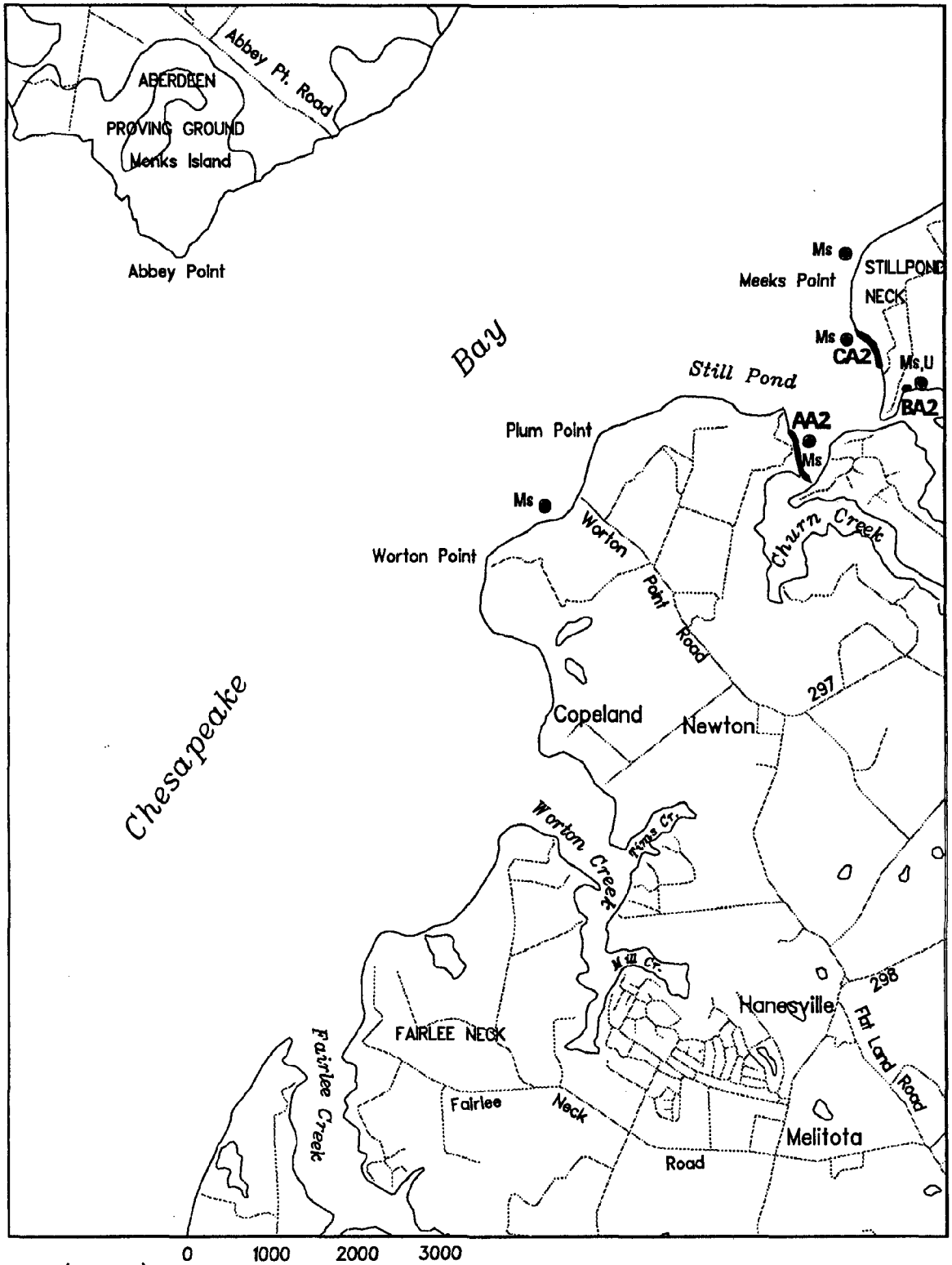
Hanesville, MD. (015)



Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

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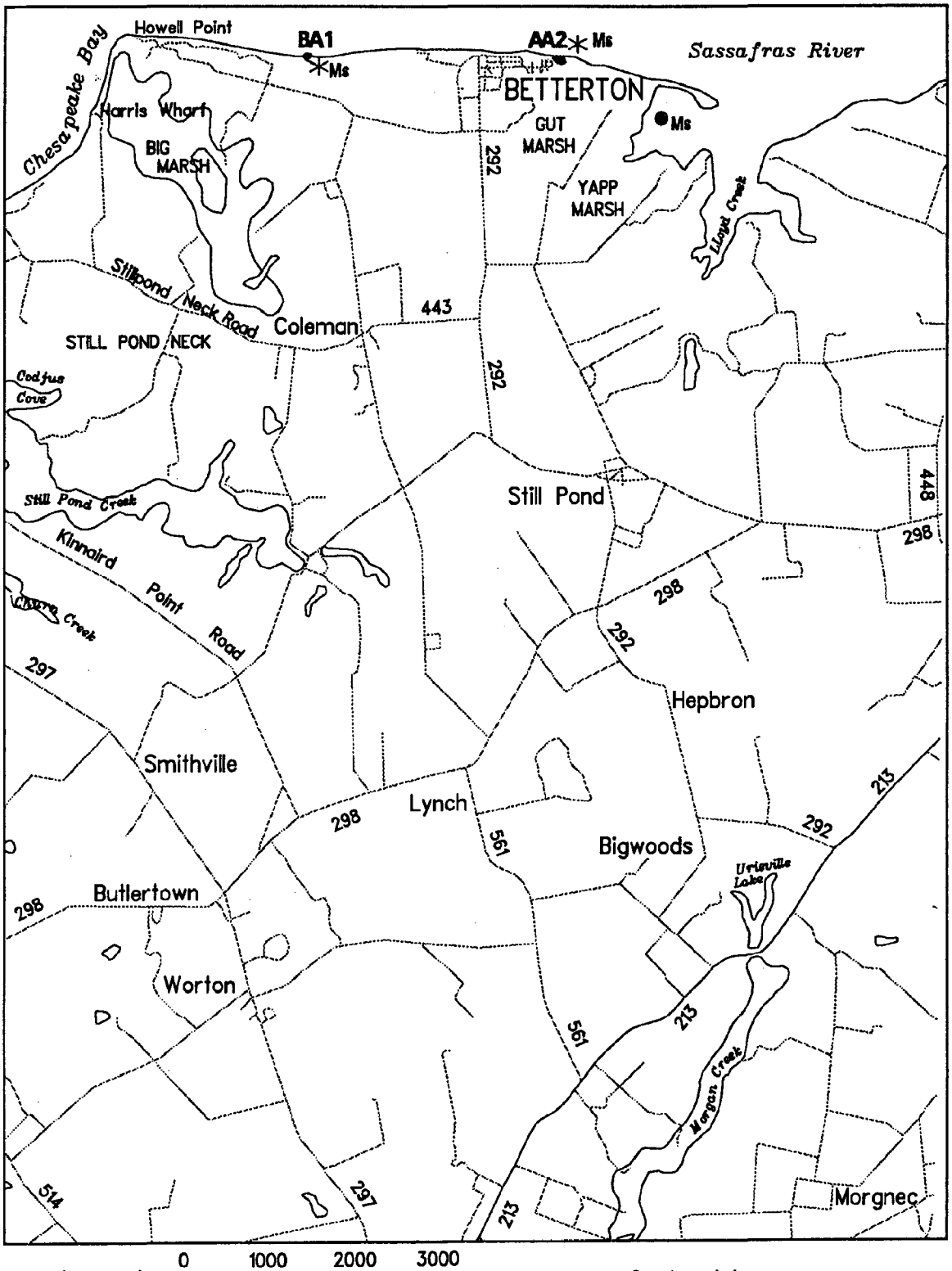
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Betterton, MD. (016)



Scale (meters):

Sources: Virginia Institute of Marine Science
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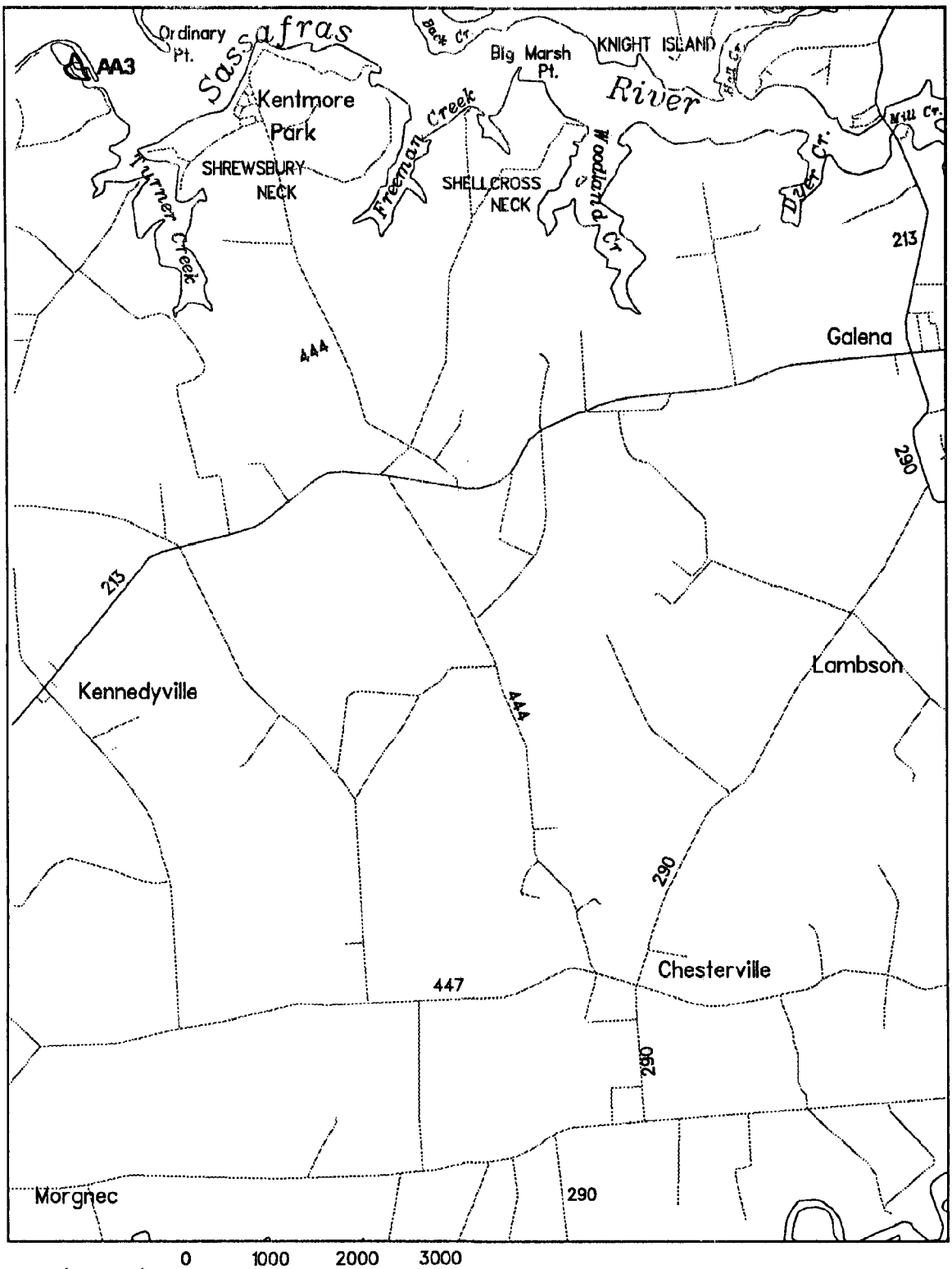
Galena, MD. (017)



Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-01-91

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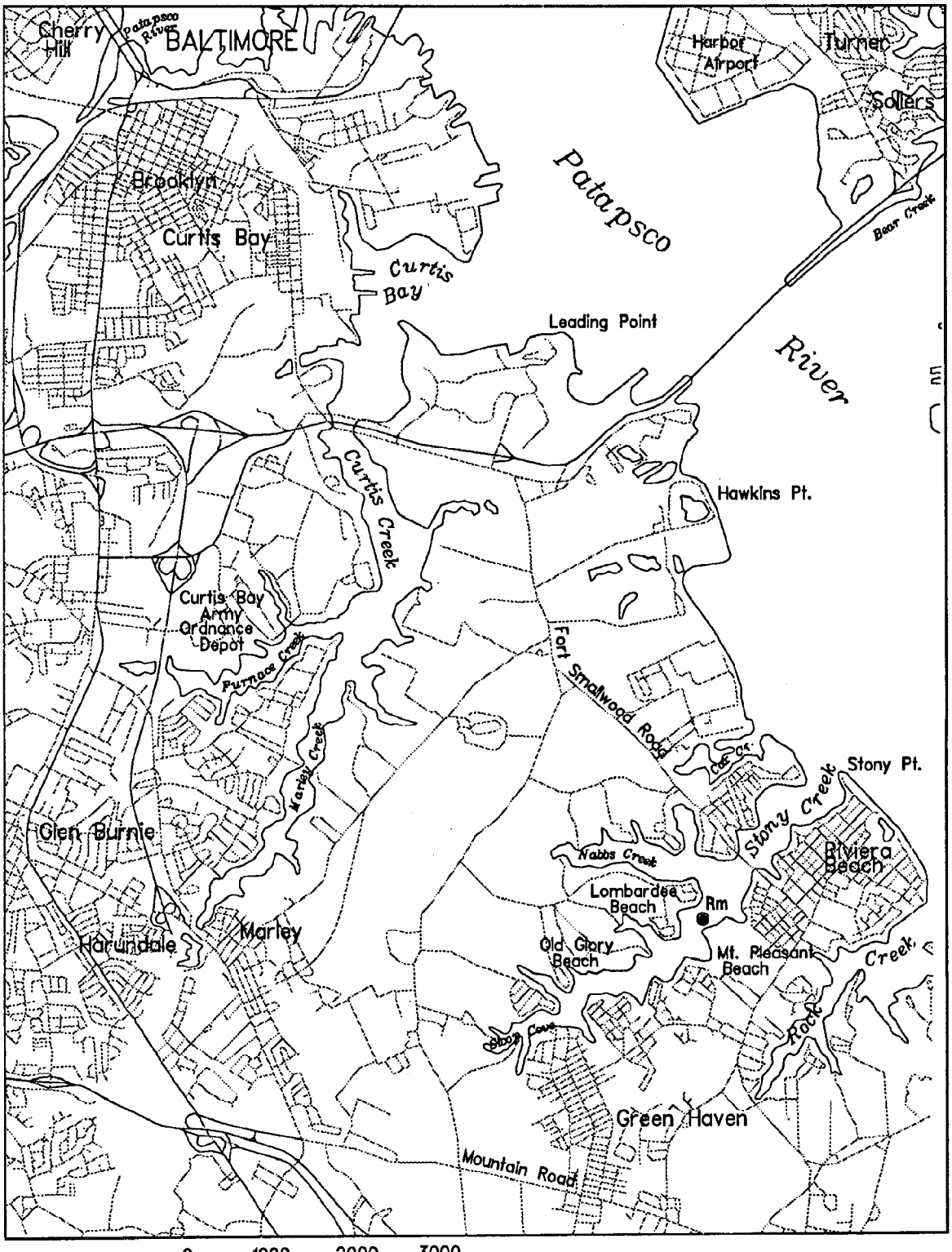
Curtis Bay, MD. (018)



Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-03-91

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College of William and Mary

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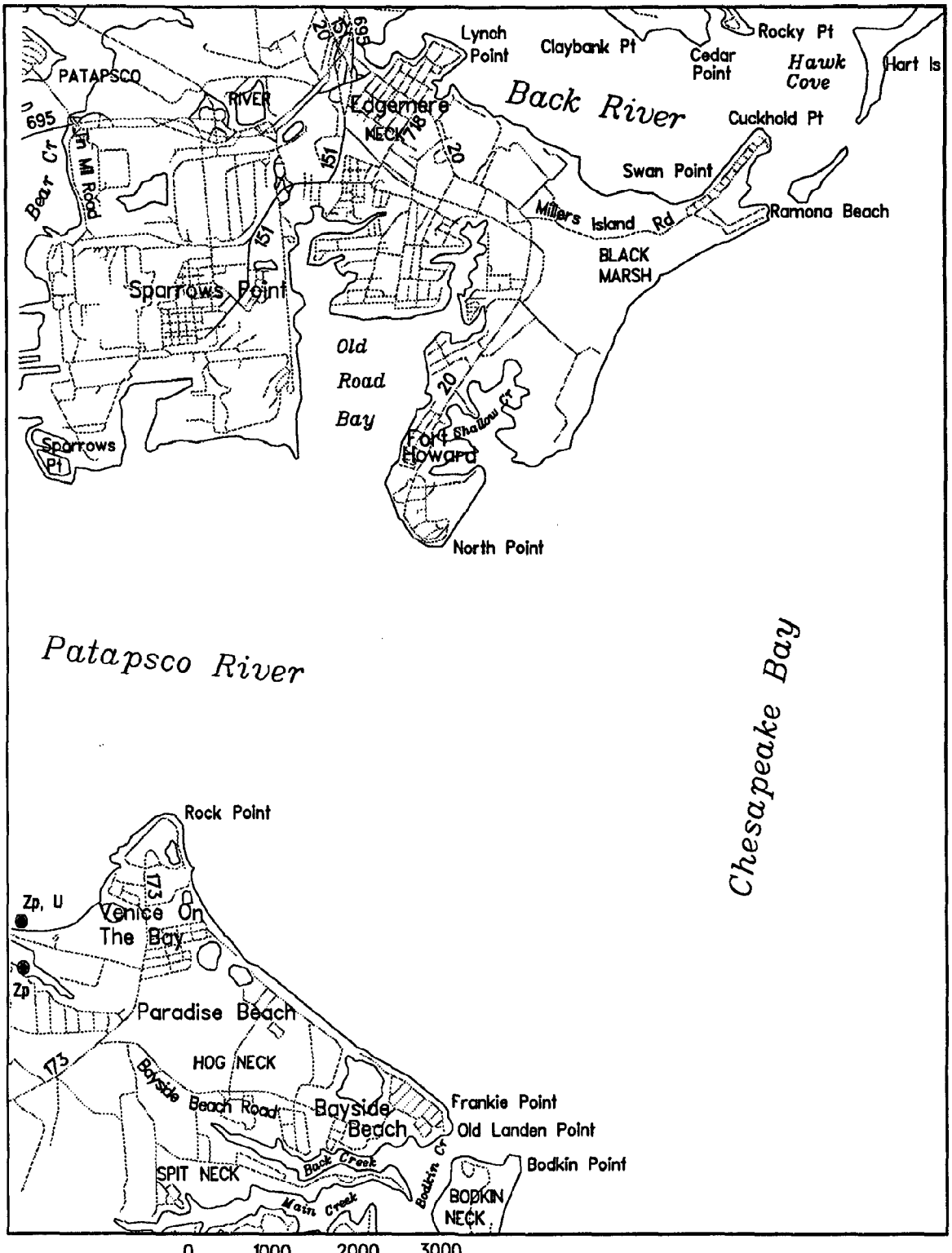
Sparrows Point, MD. (019)



Scale (meters):

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U.S. Geological Survey

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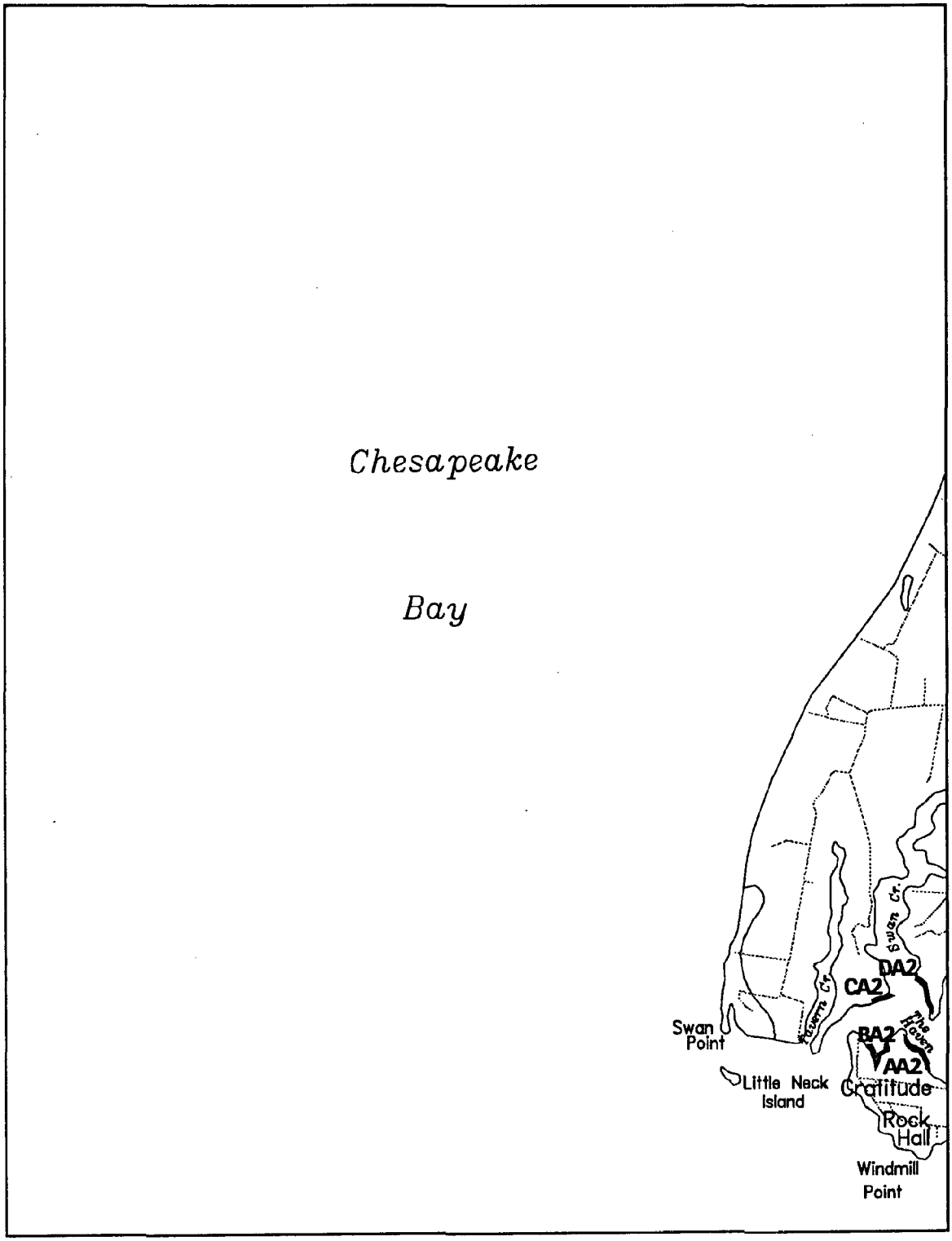
Swan Point, MD. (020)



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Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-03-91

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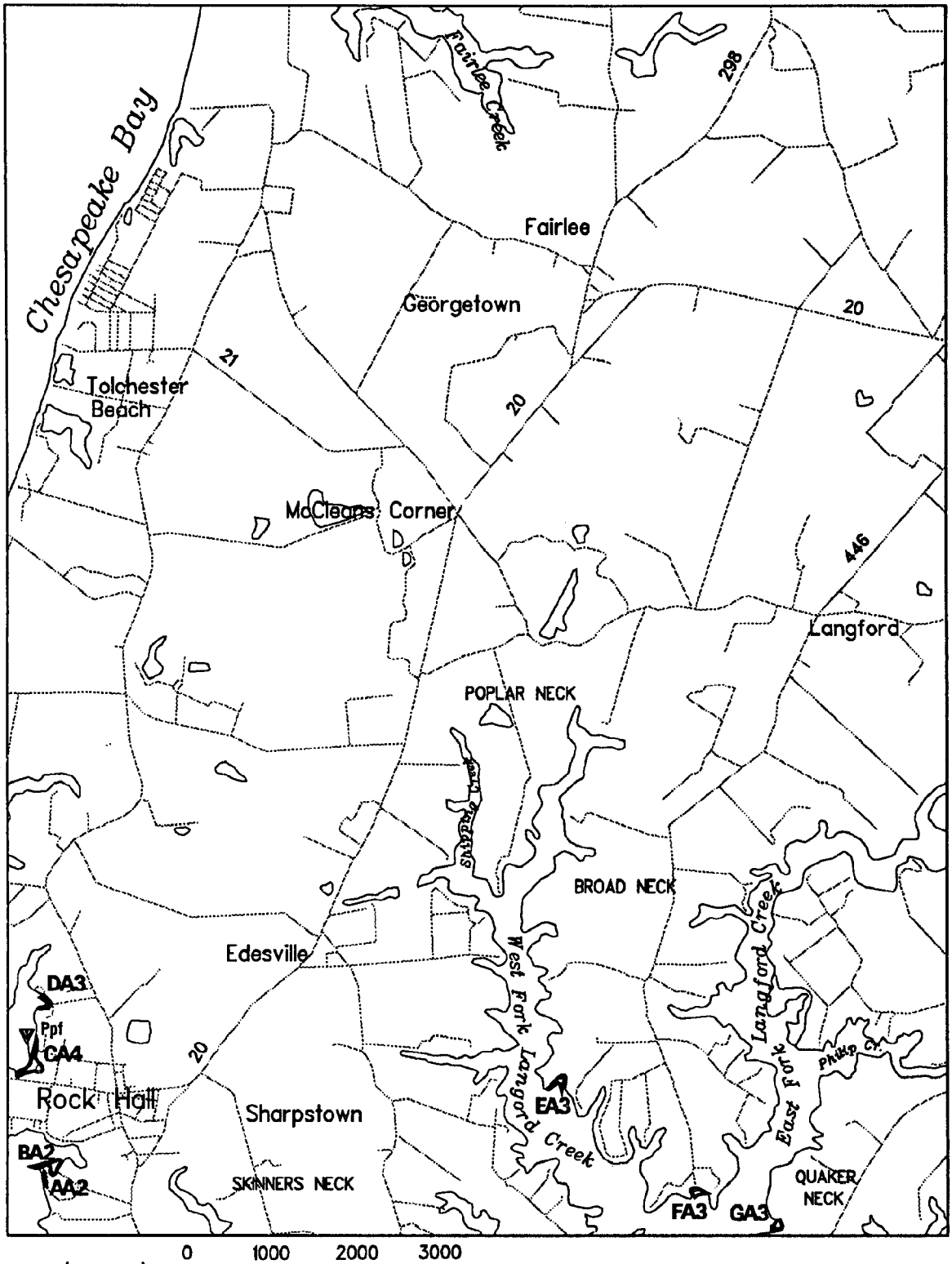
Rock Hall, MD. (021)



Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-03-91

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College of William and Mary

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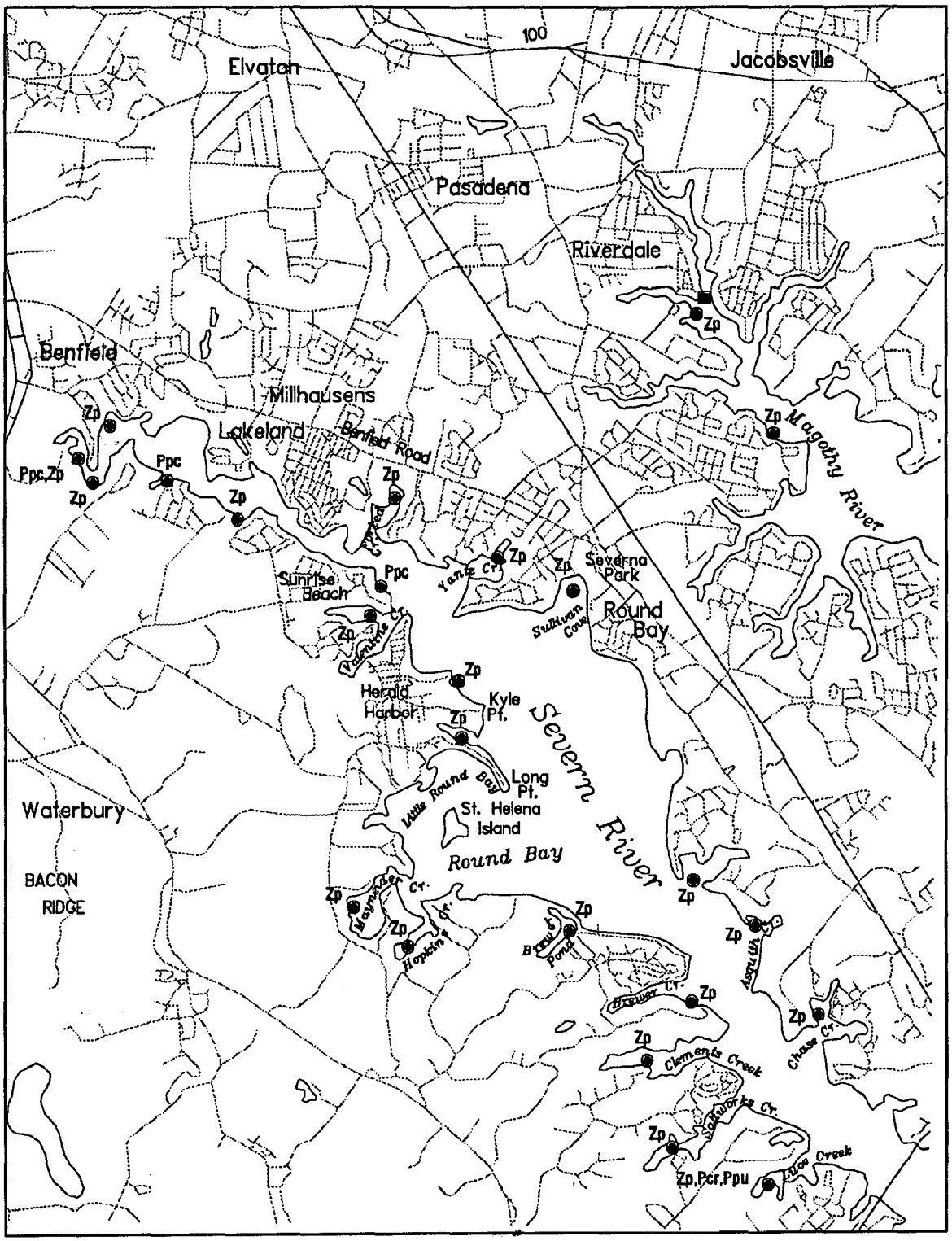
Round Bay, MD. (023)



Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 09-28-91

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College of William and Mary

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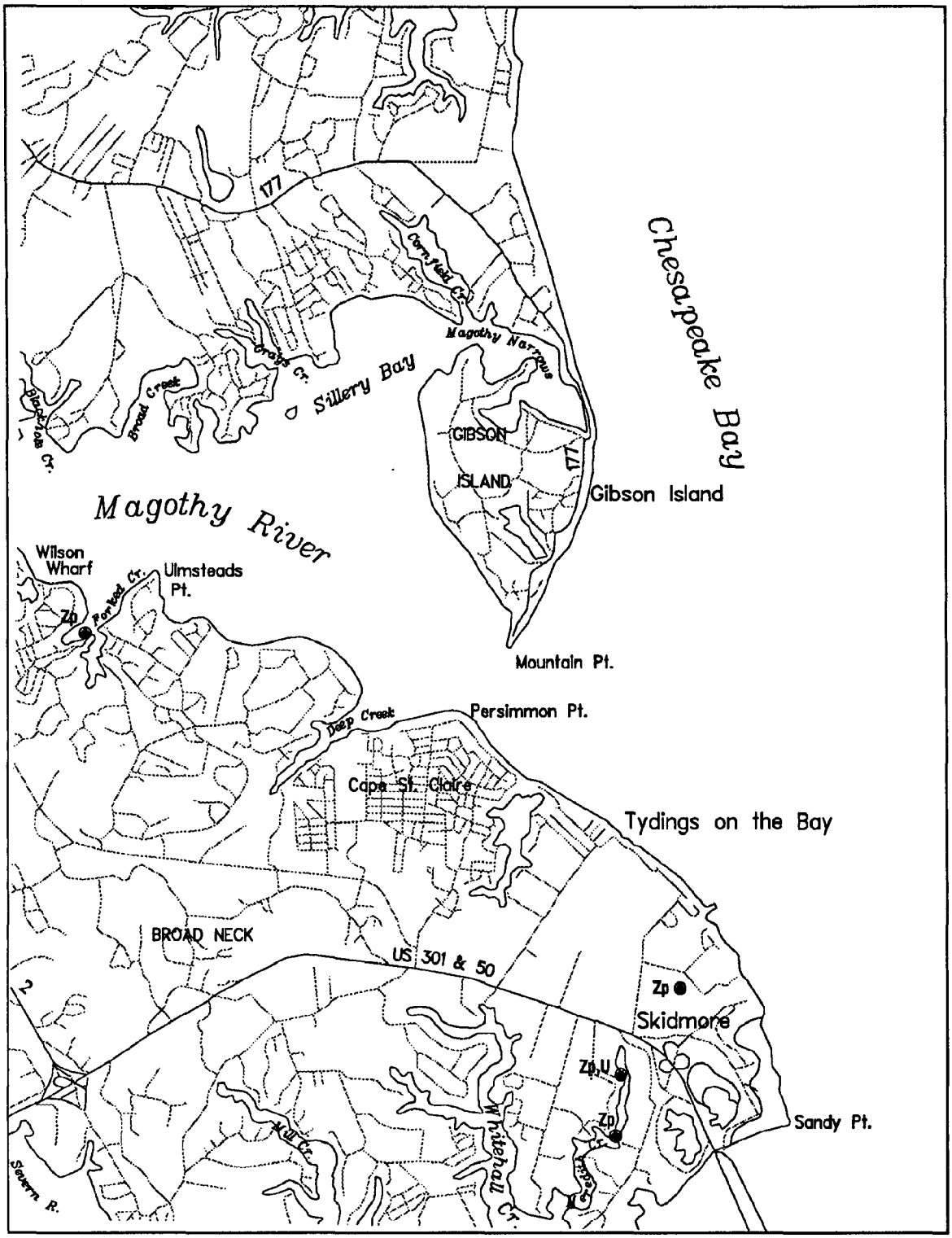
Gibson Island, MD. (024)



Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-03-91

Produced by:
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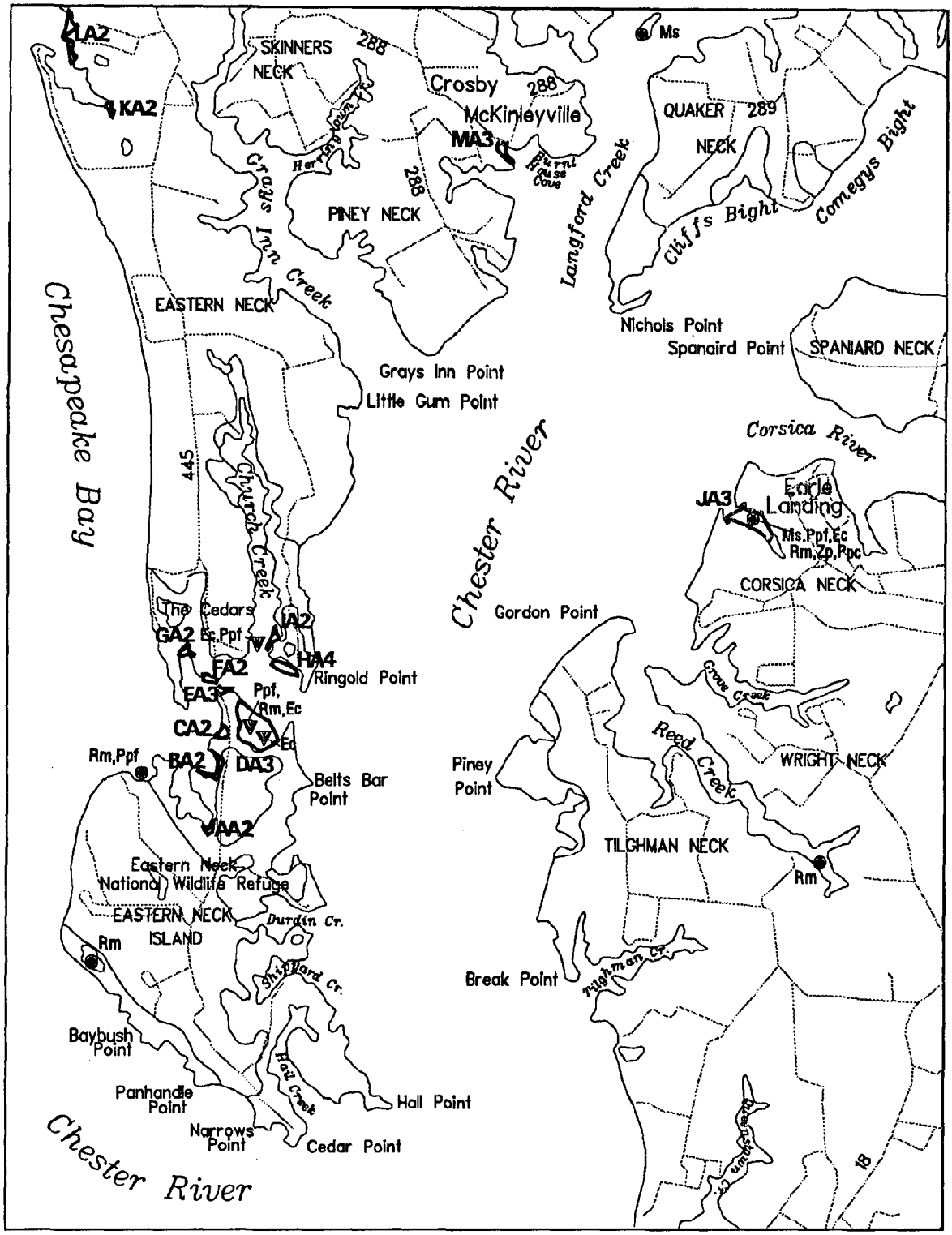
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Langford Creek, MD. (026)



Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-03-91

Produced by:
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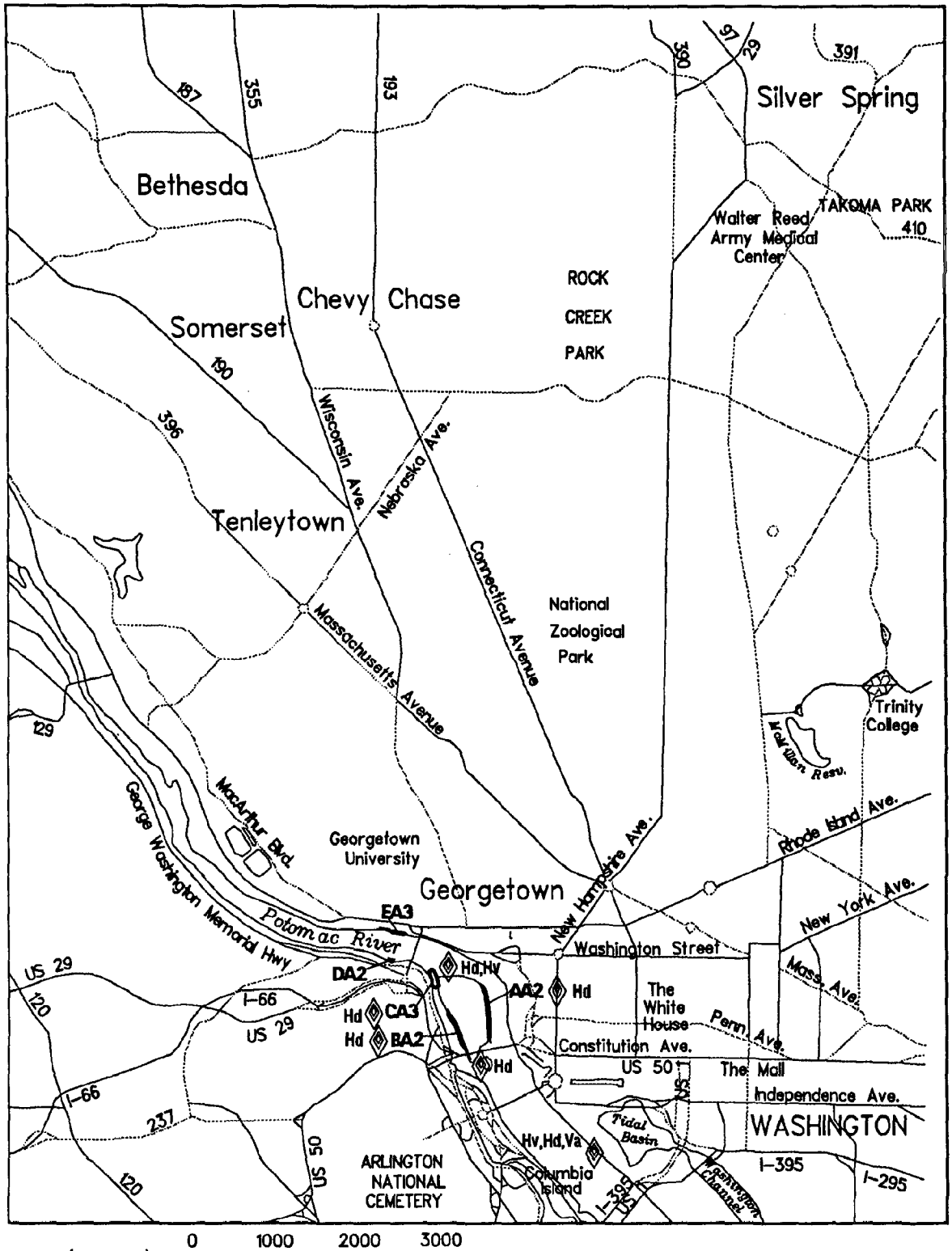
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Washington West, MD.-D.C.-VA. (028)



Scale (meters): 0 1000 2000 3000

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 10-08-91

Produced by:
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College of William and Mary

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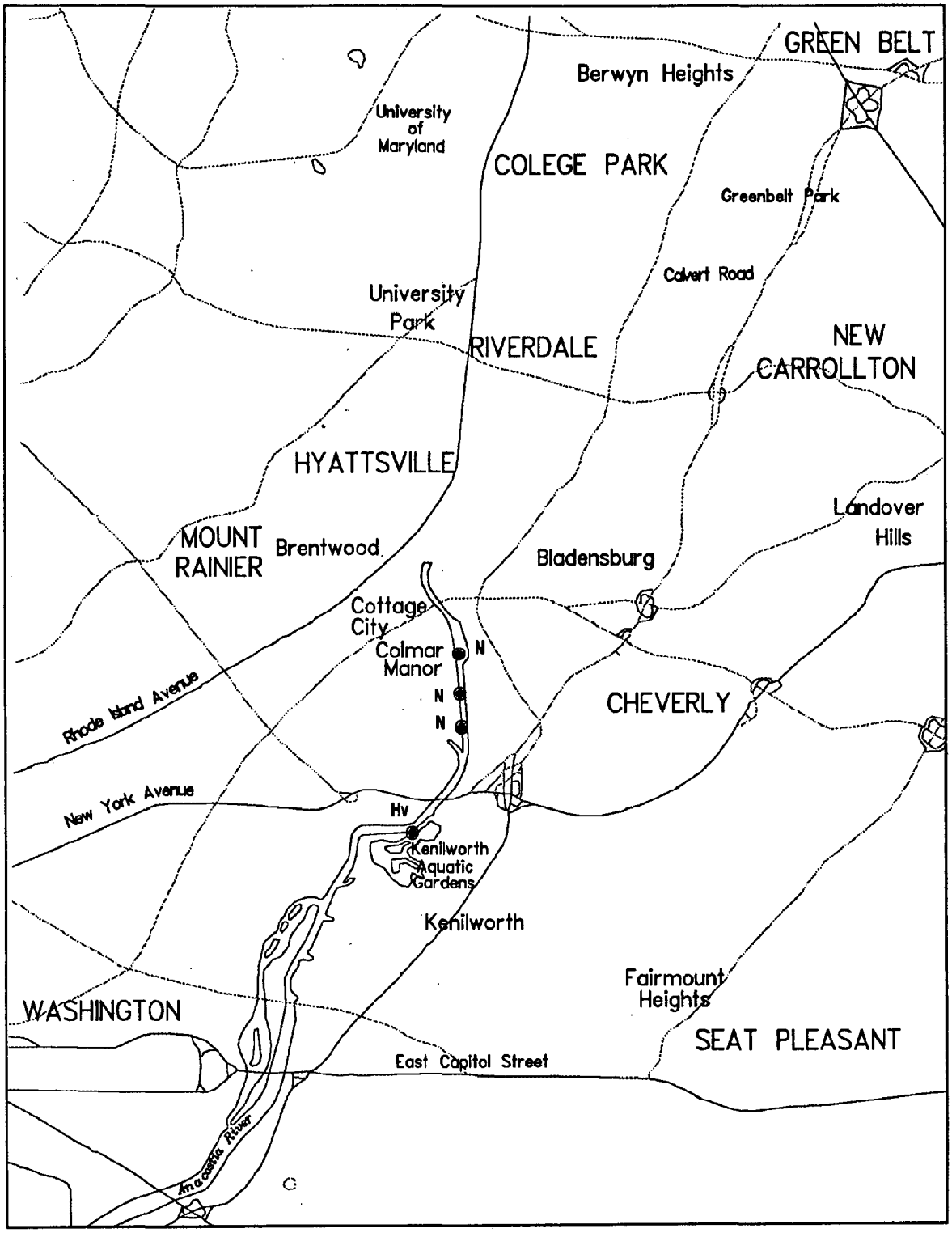
Washington East, D.C.-MD. (029)



Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 09-02-91

Produced by:
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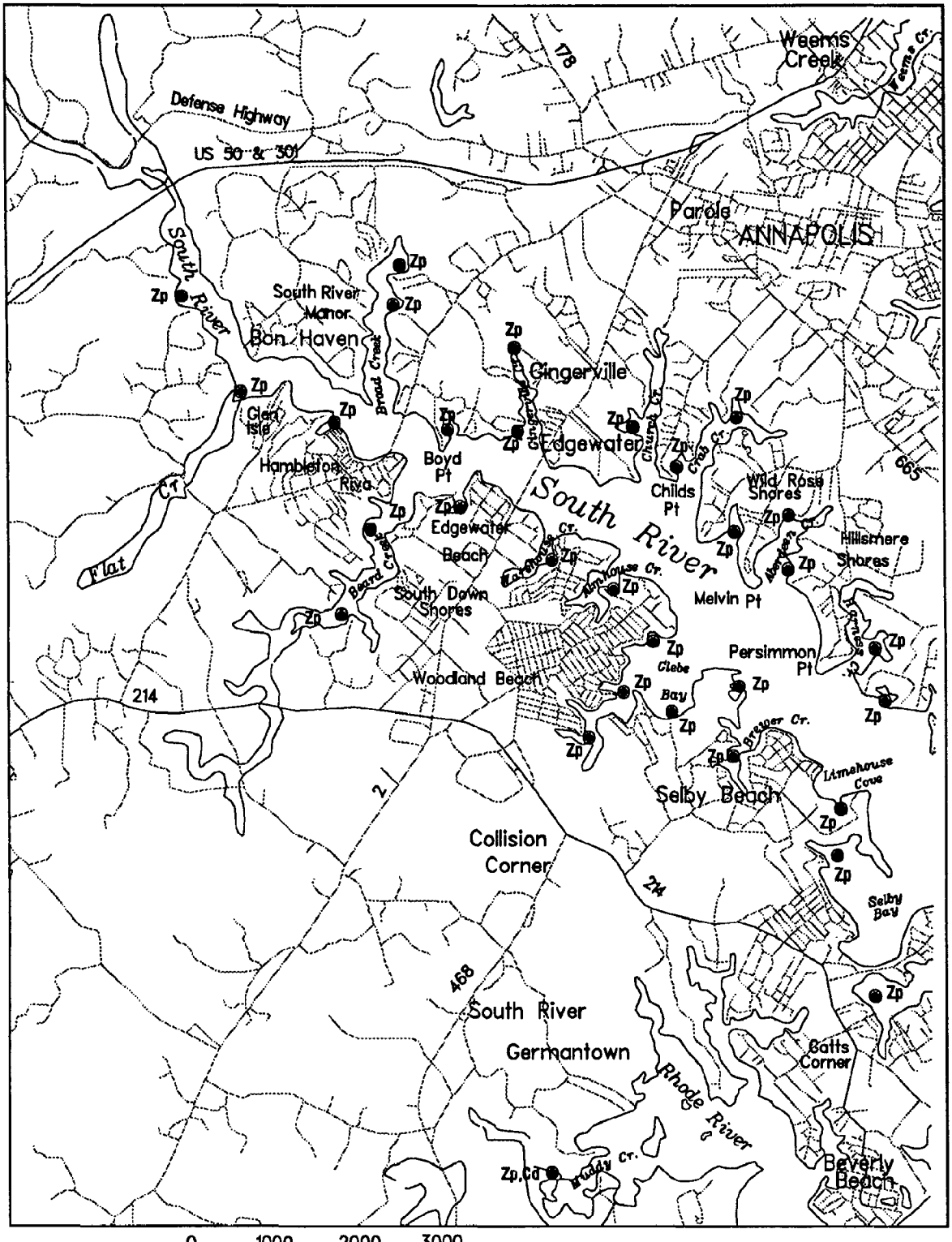
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
South River, MD. (030)



0 1000 2000 3000

Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 09-28-91

Produced by:
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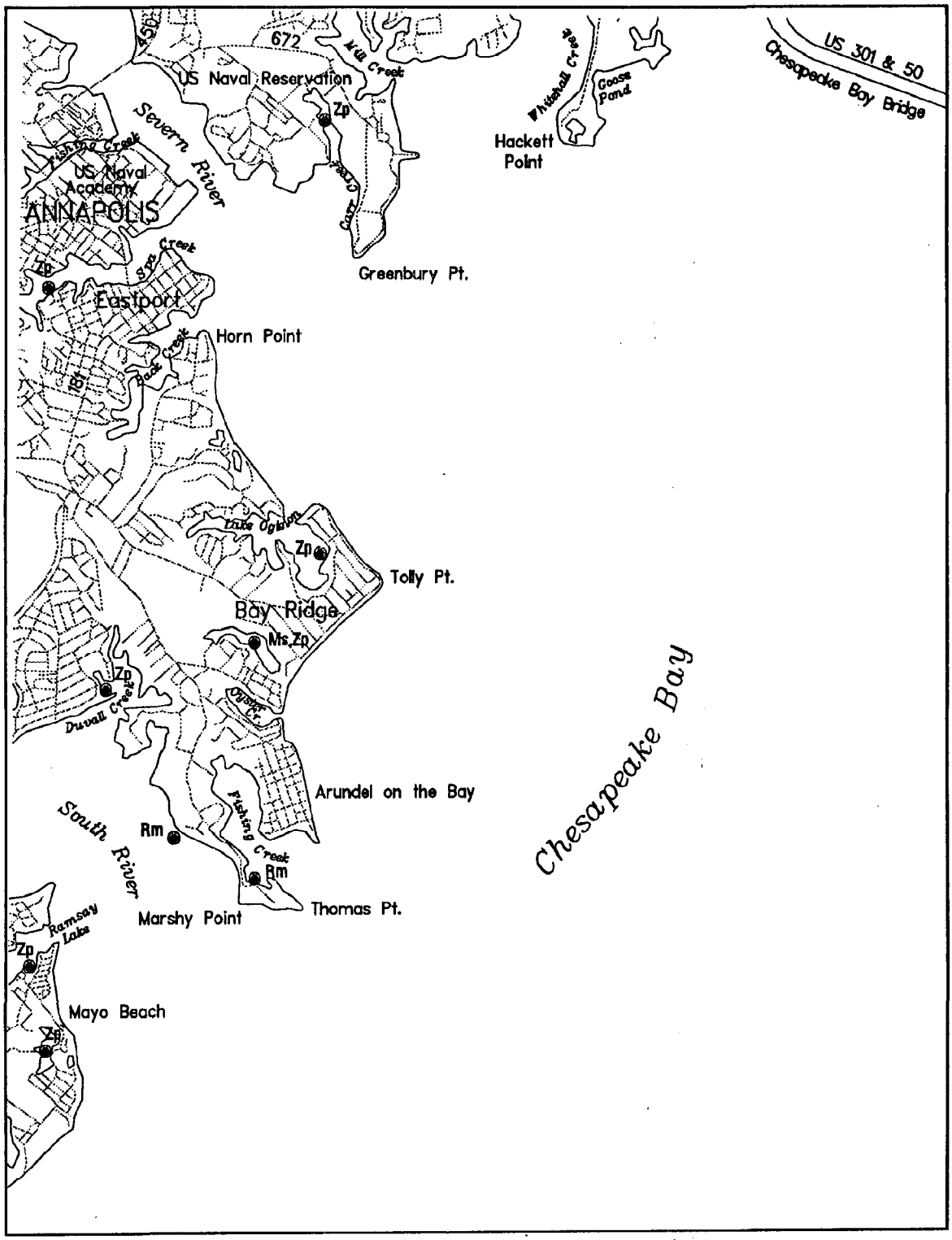
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Annapolis, MD. (031)



Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-03-91

Produced by:
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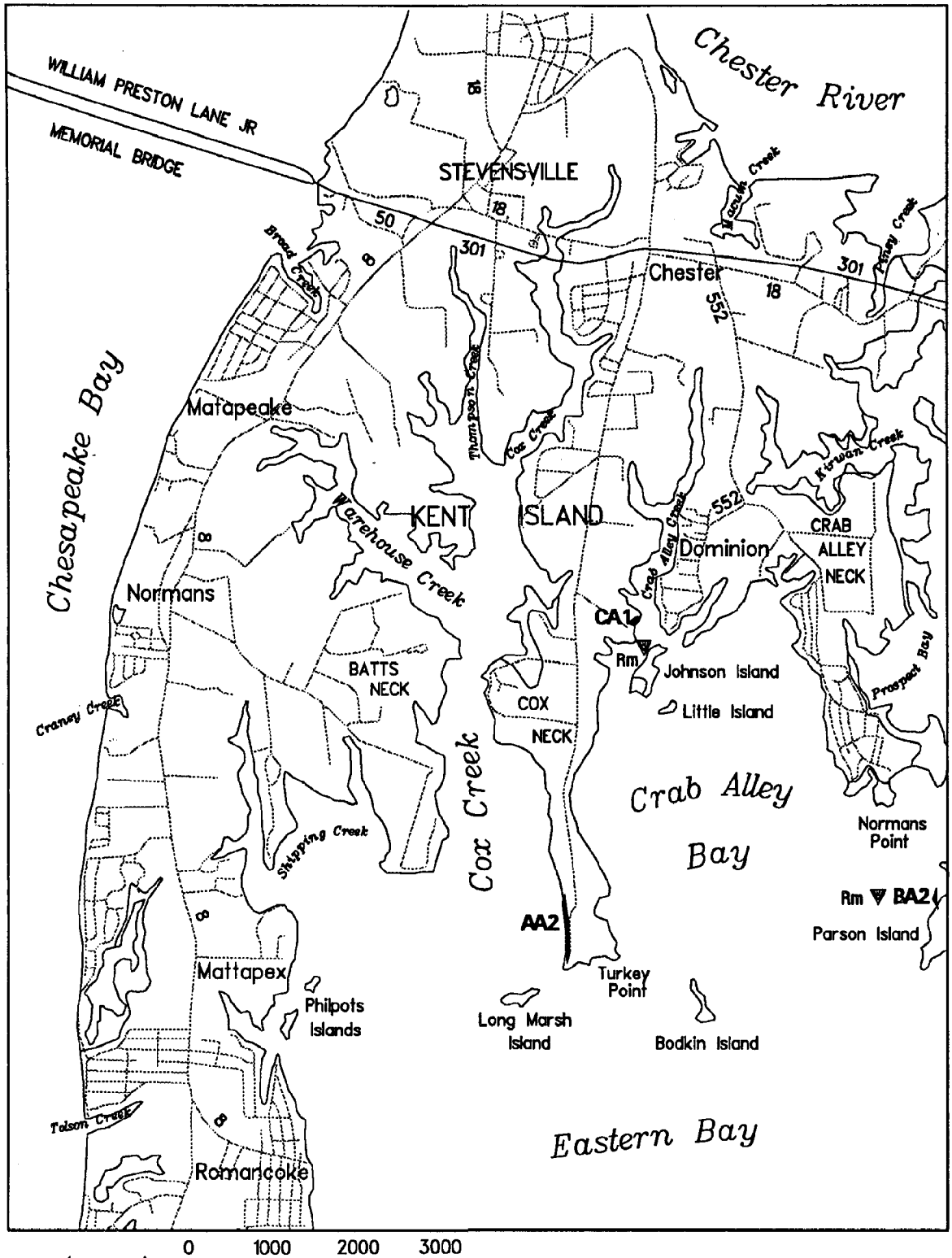
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Kent Island, MD. (032)



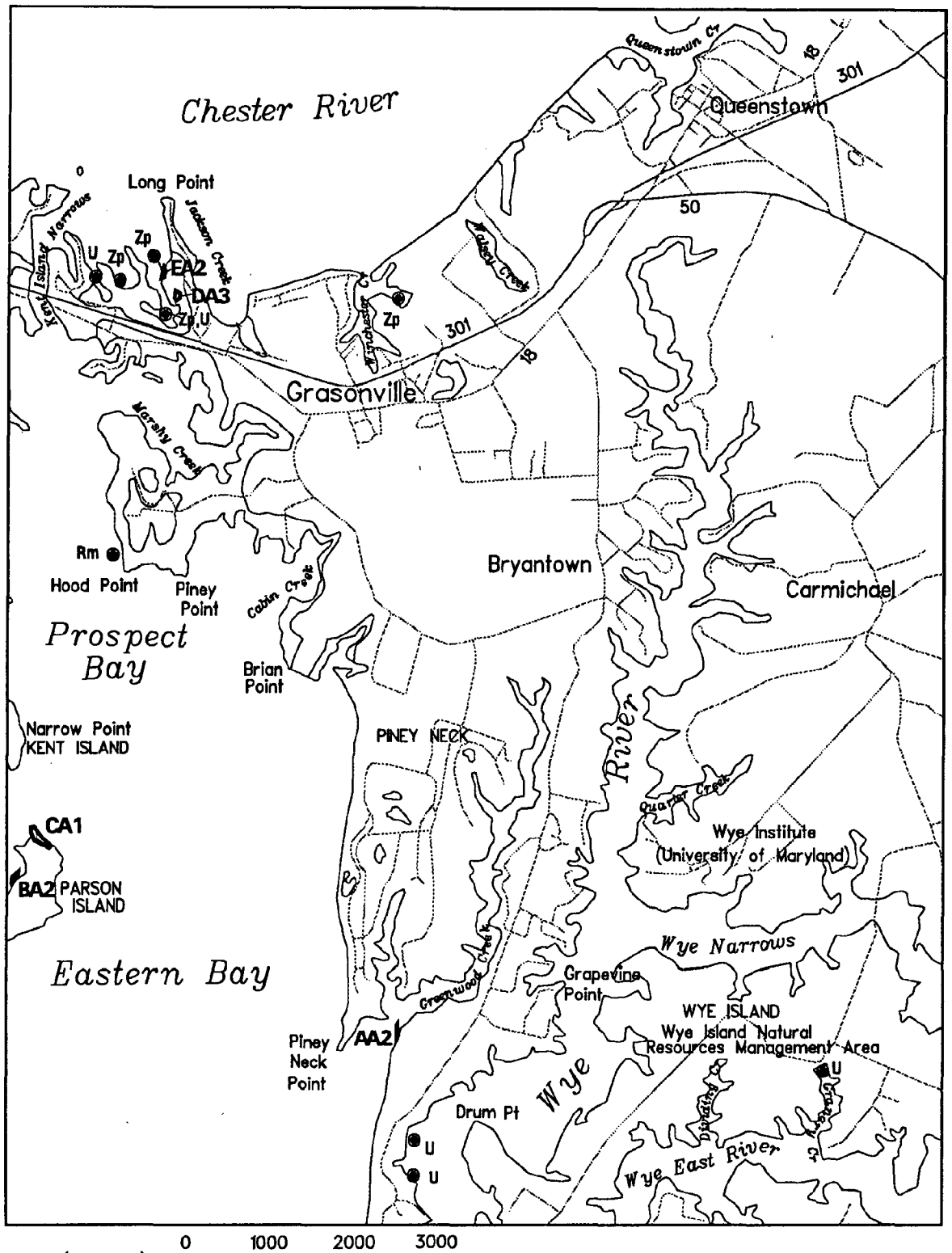
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 09-08-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Queenstown, MD. (033)



Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 09-09-91

Produced by:
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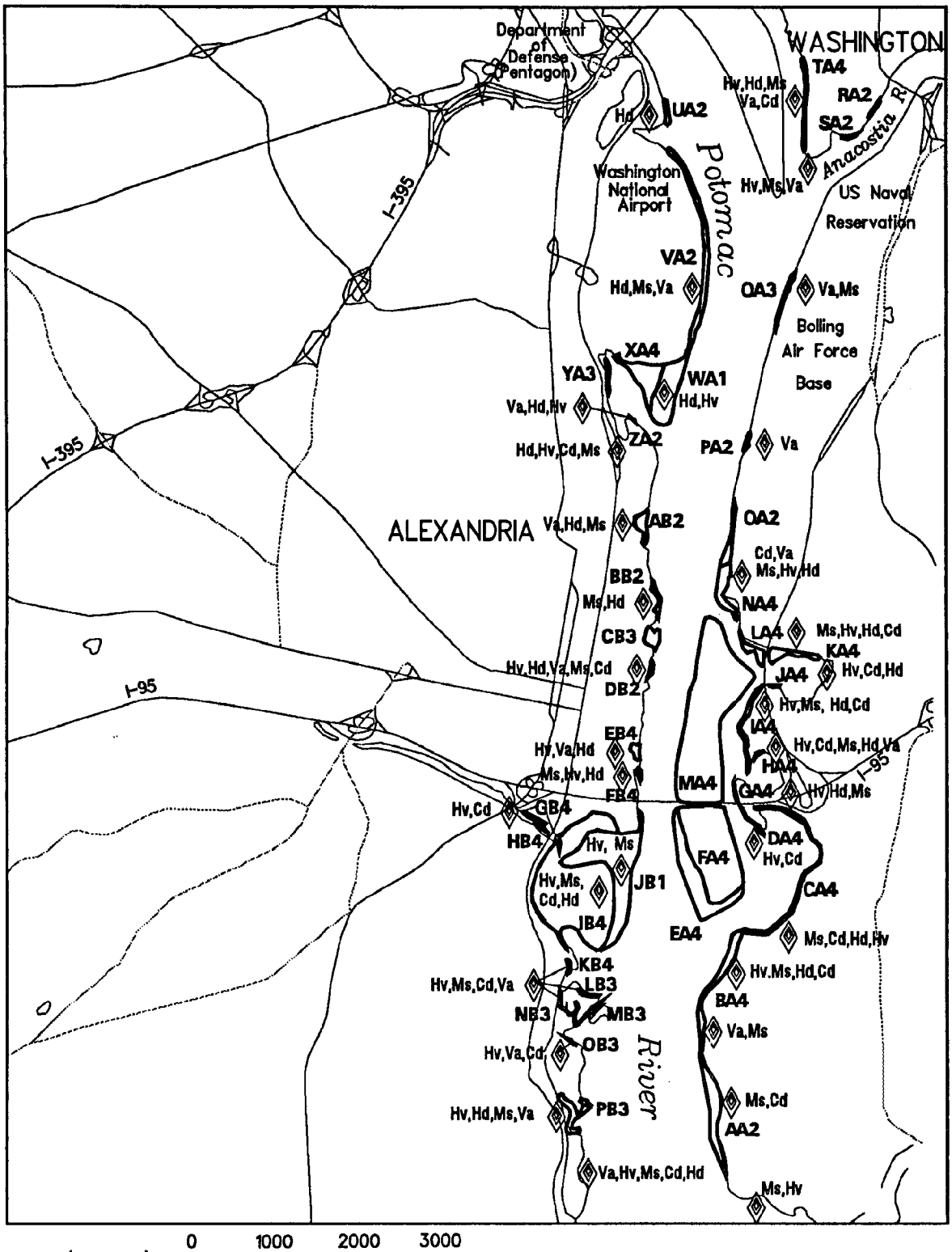
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Alexandria, VA.-D.C.-MD. (034)



Scale (meters):

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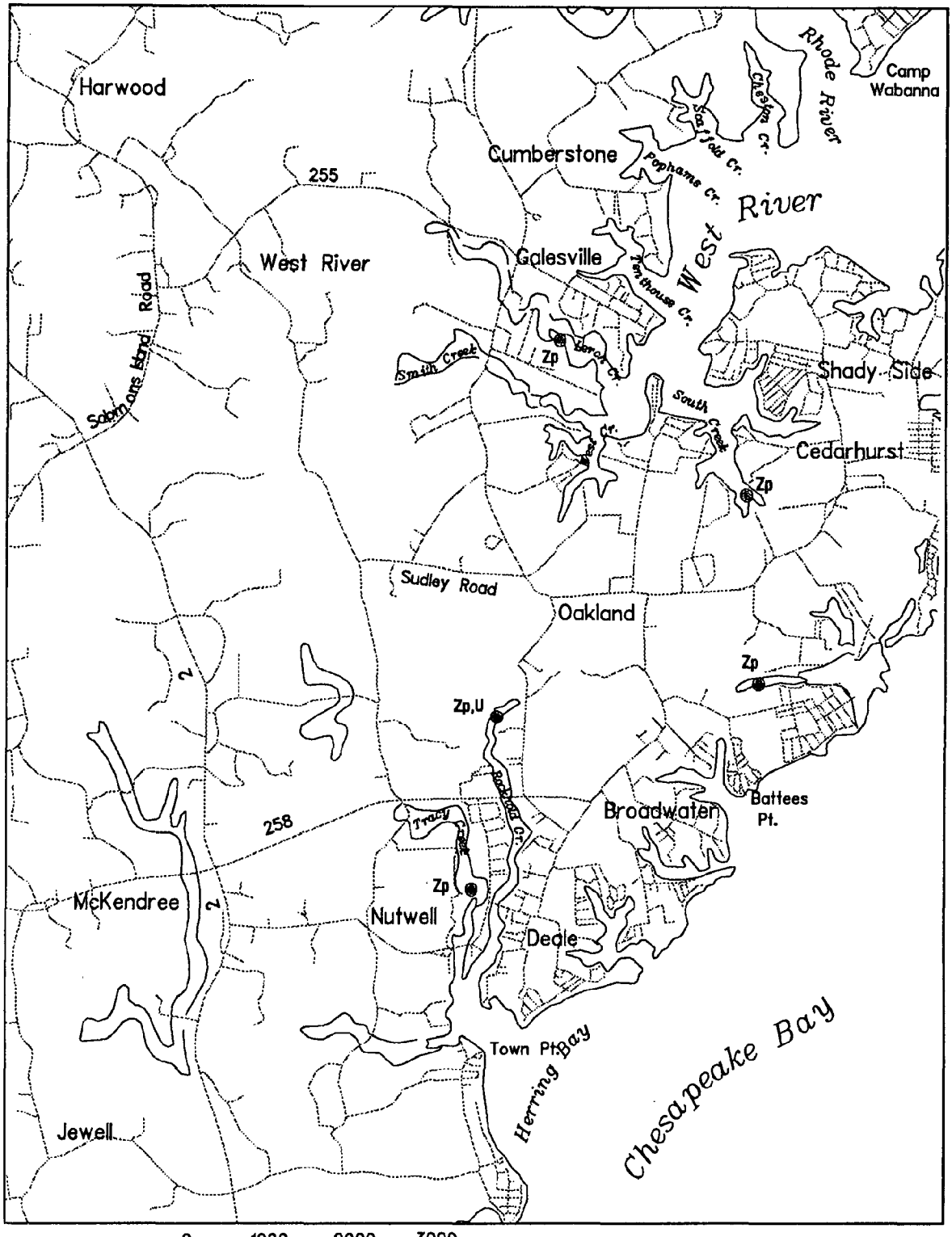
U.S. Geological Survey

Date Flown: 09-02-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Deale, MD. (035)



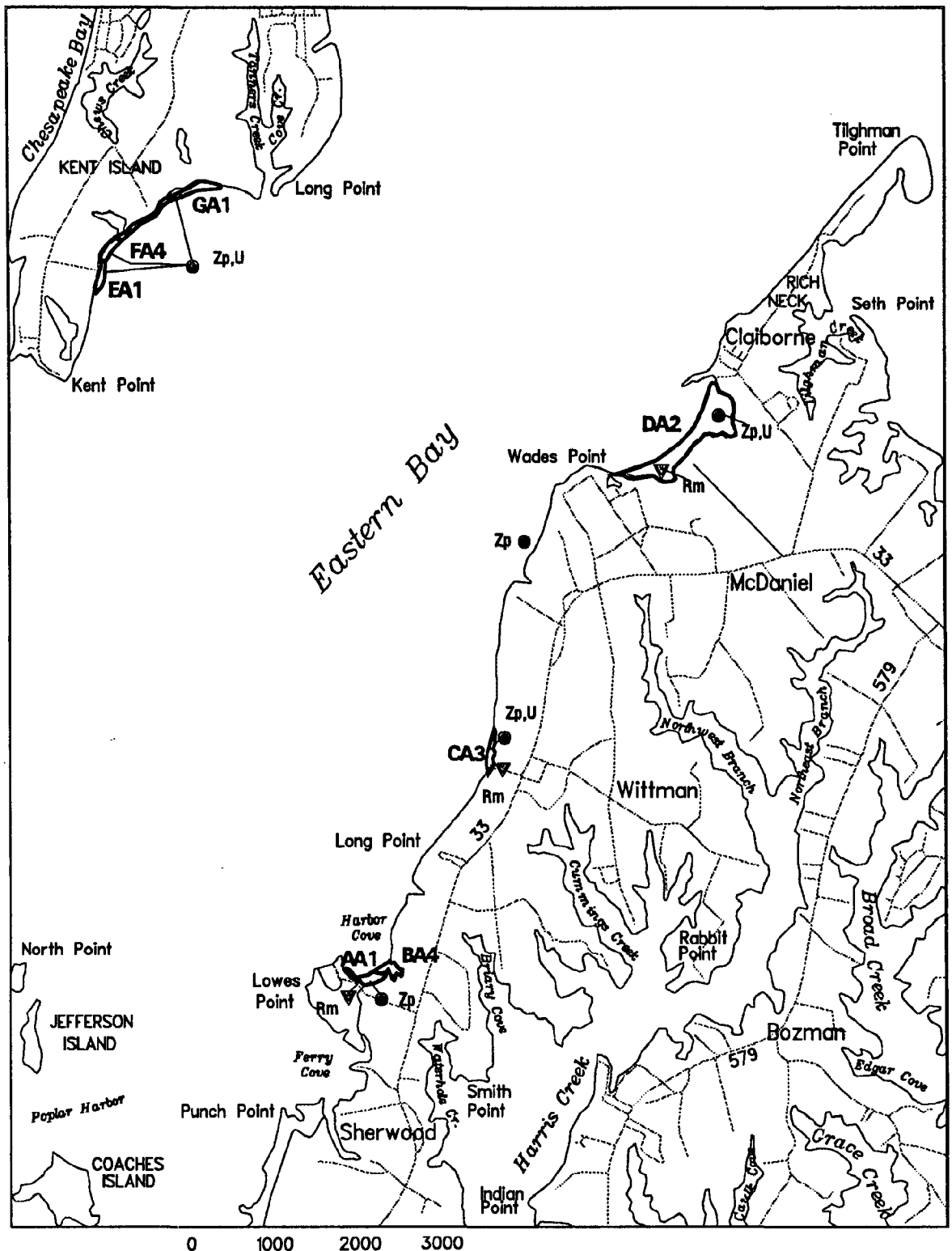
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 09-28-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Claiborne, MD. (036)



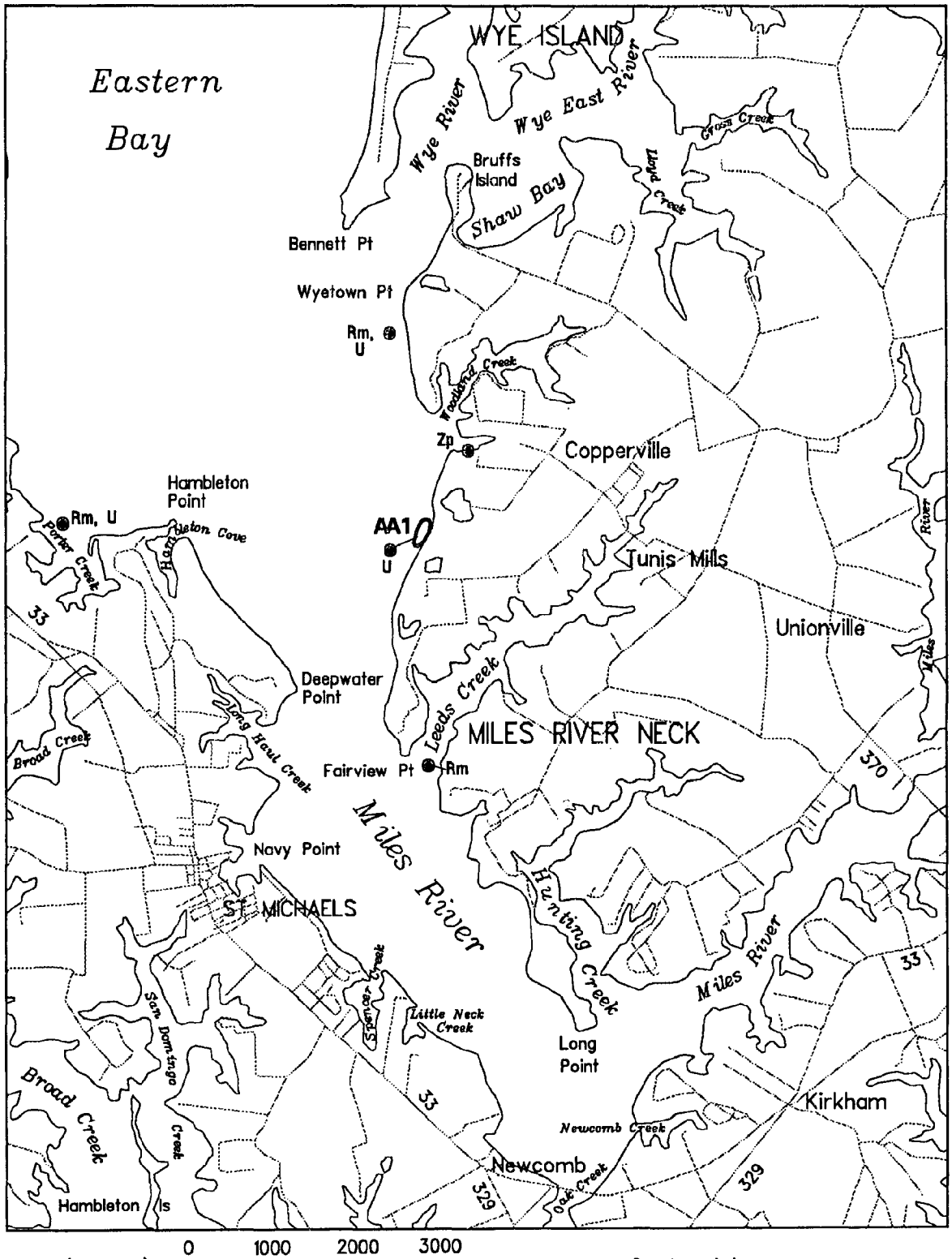
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 09-08-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
St. Michaels, MD. (037)



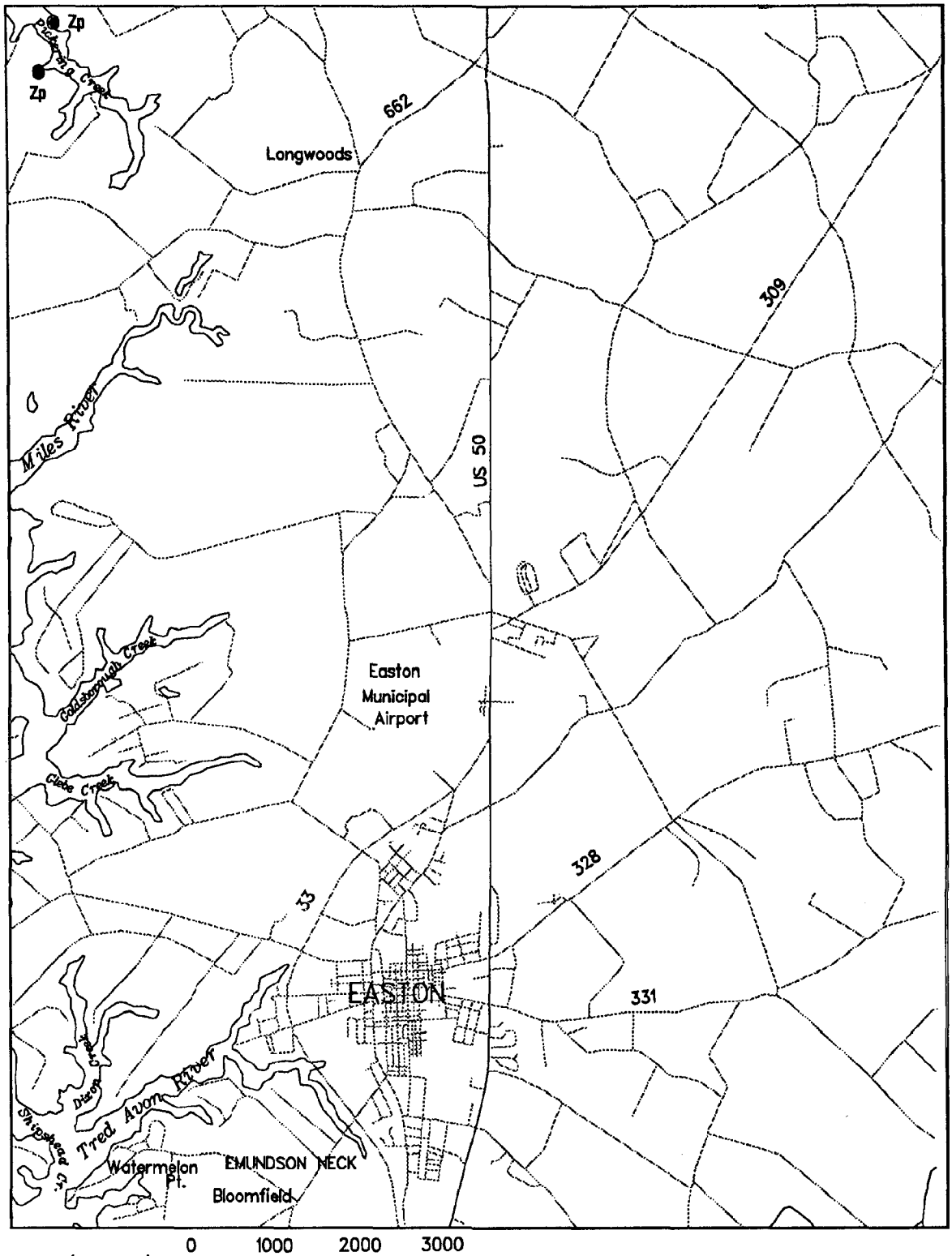
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 09-09-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Easton, MD. (038)



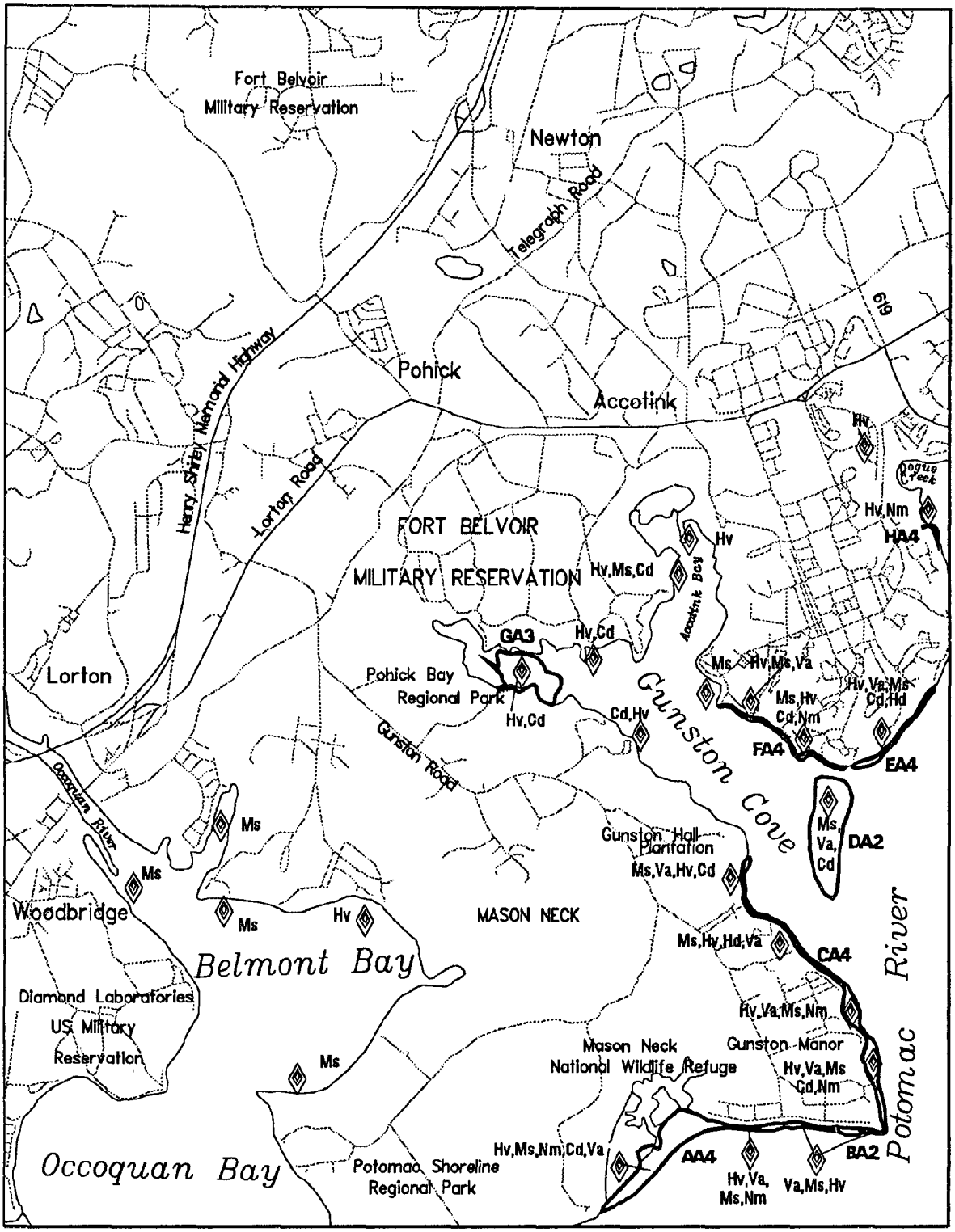
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 09-09-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Fort Belvoir, VA.-MD. (039)



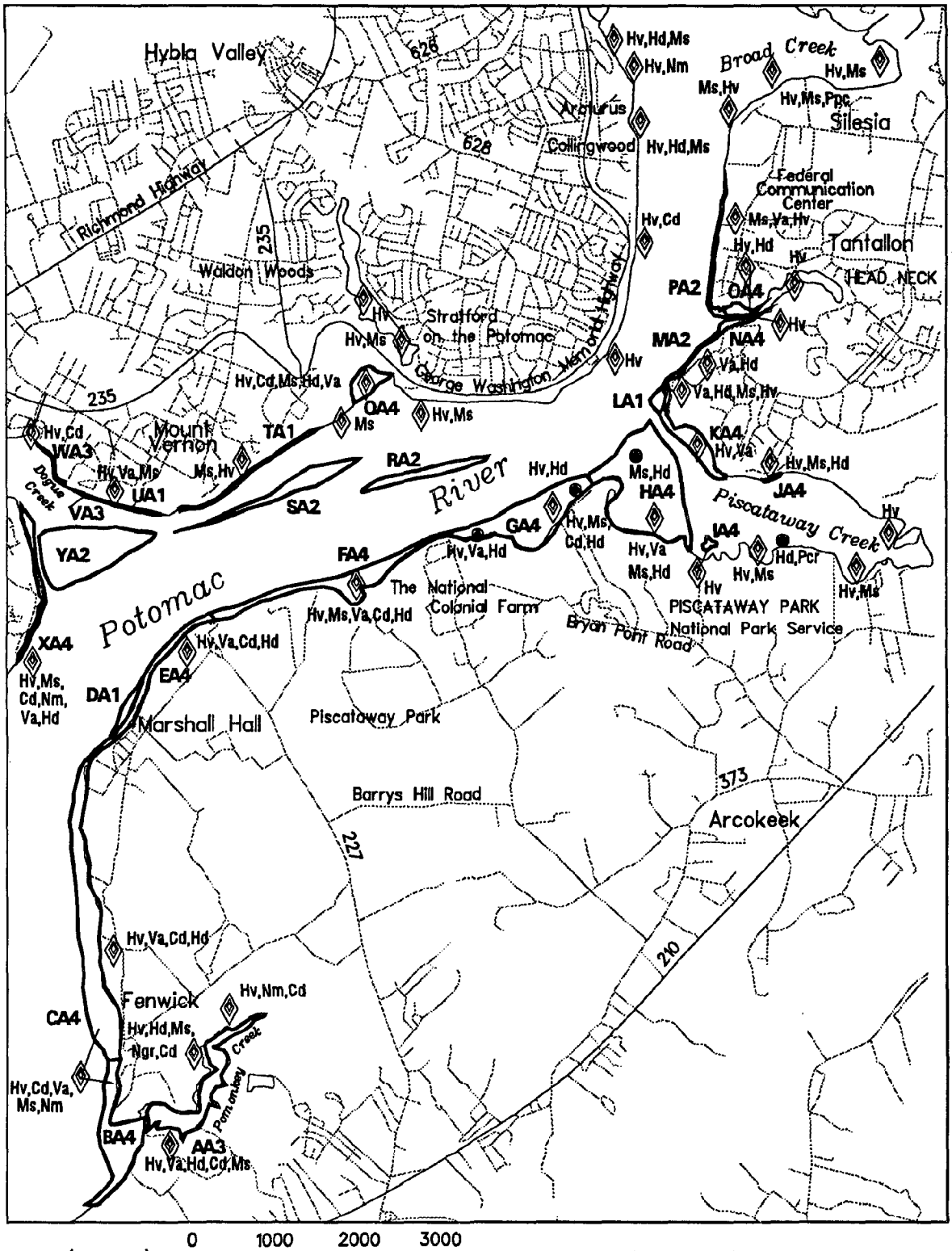
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 09-02-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Mt. Vernon, VA.-MD. (040)



0 1000 2000 3000

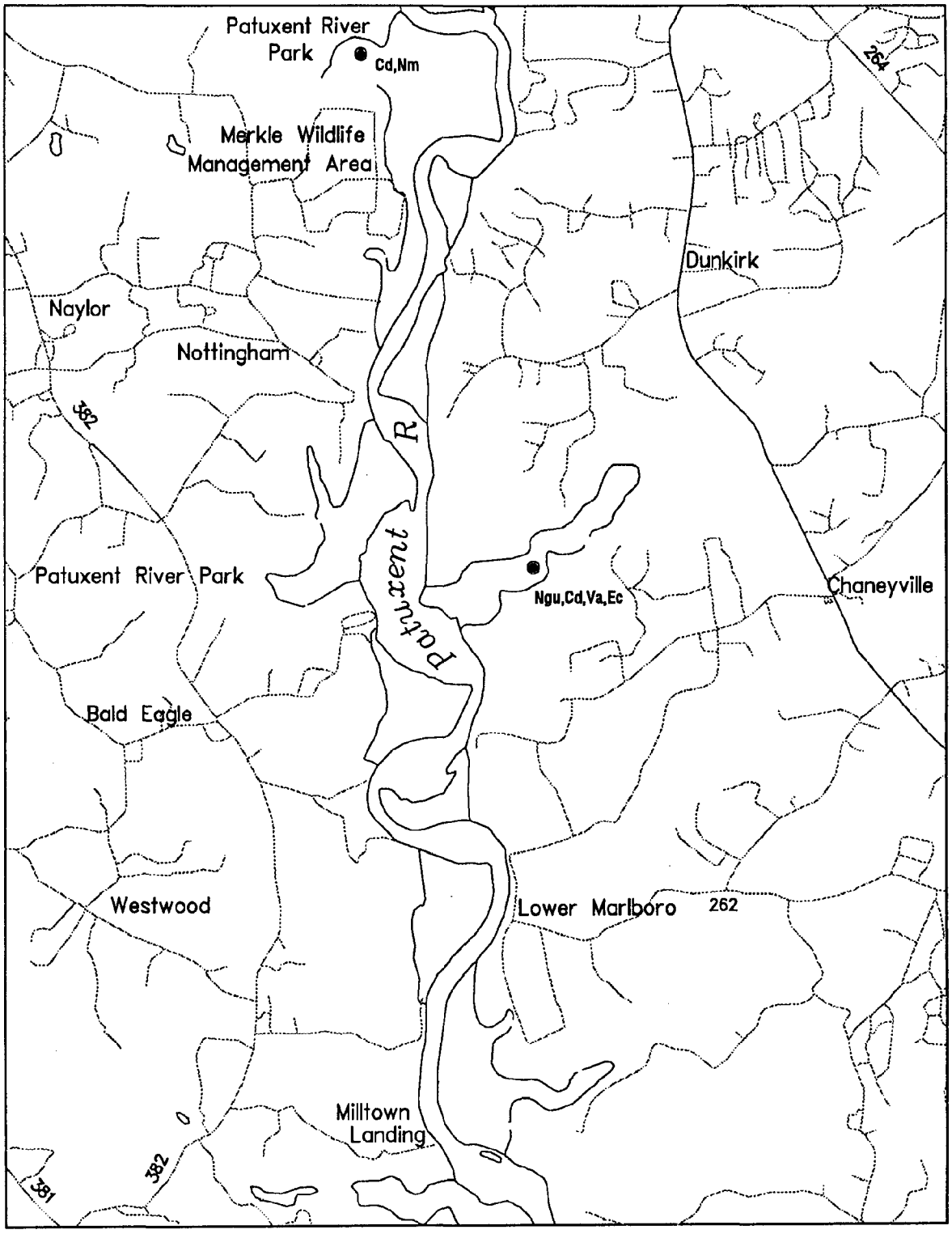
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 10-08-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Lower Marlboro, MD. (041)



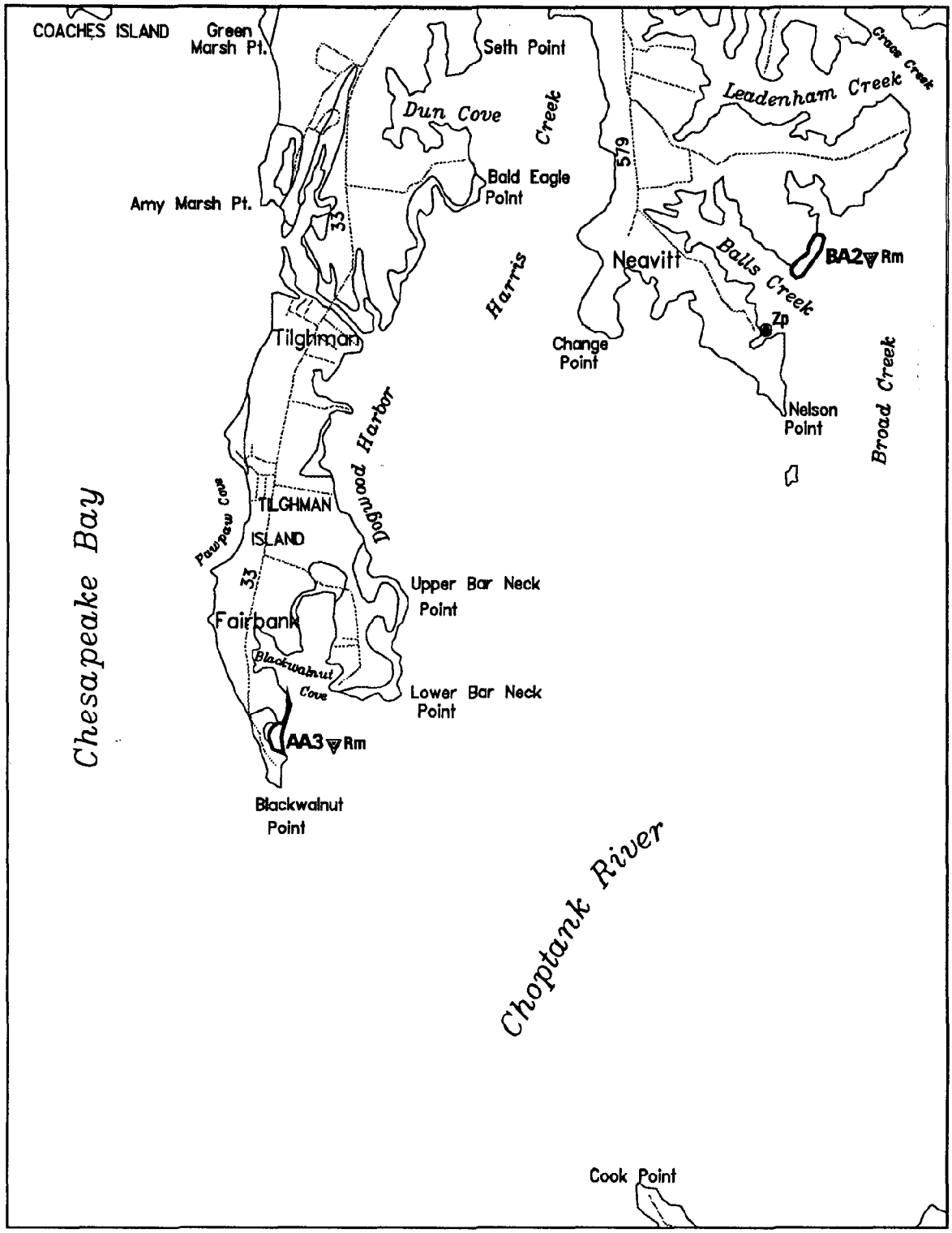
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-29-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Tilghman, MD. (043)



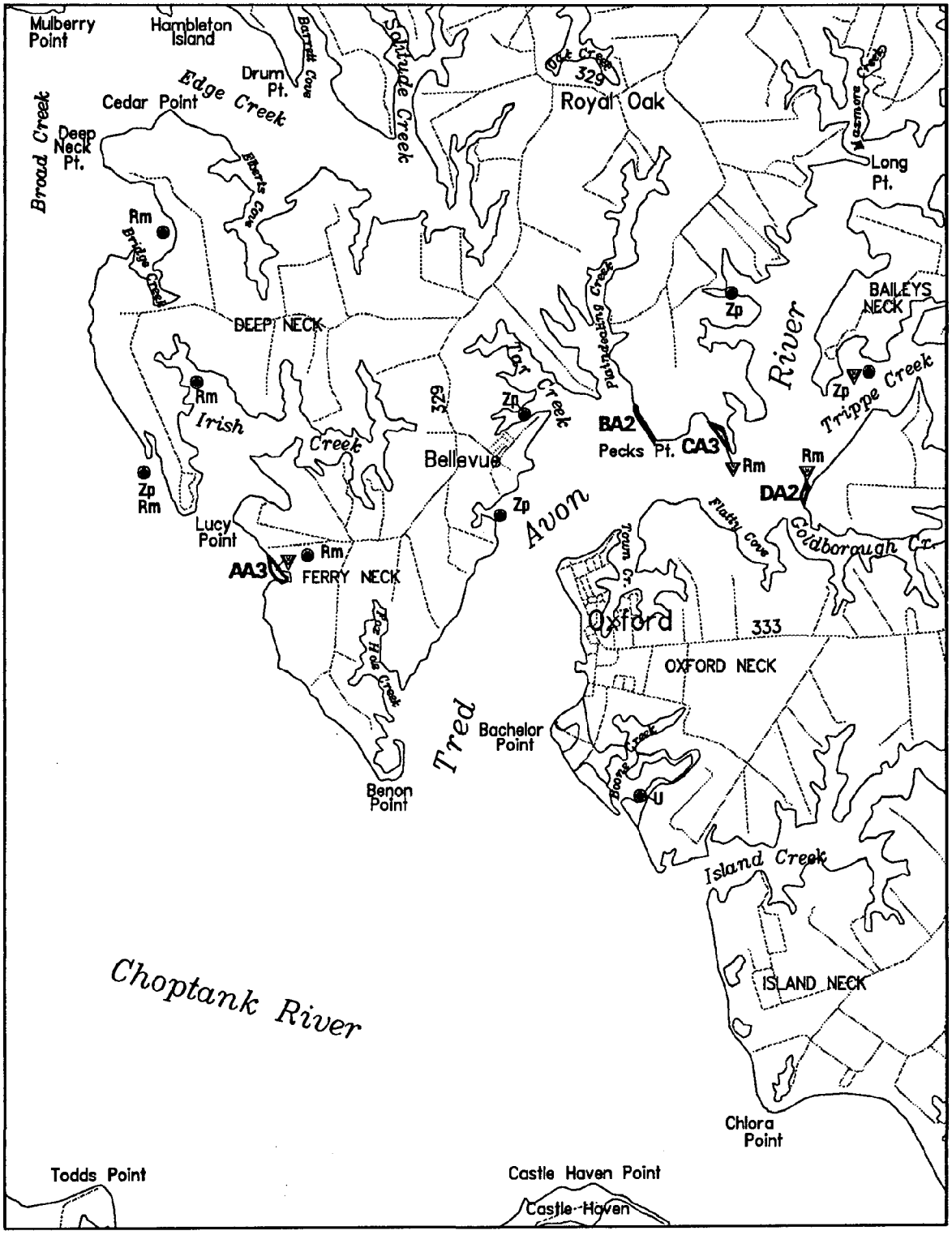
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 09-08-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Oxford, MD. (044)



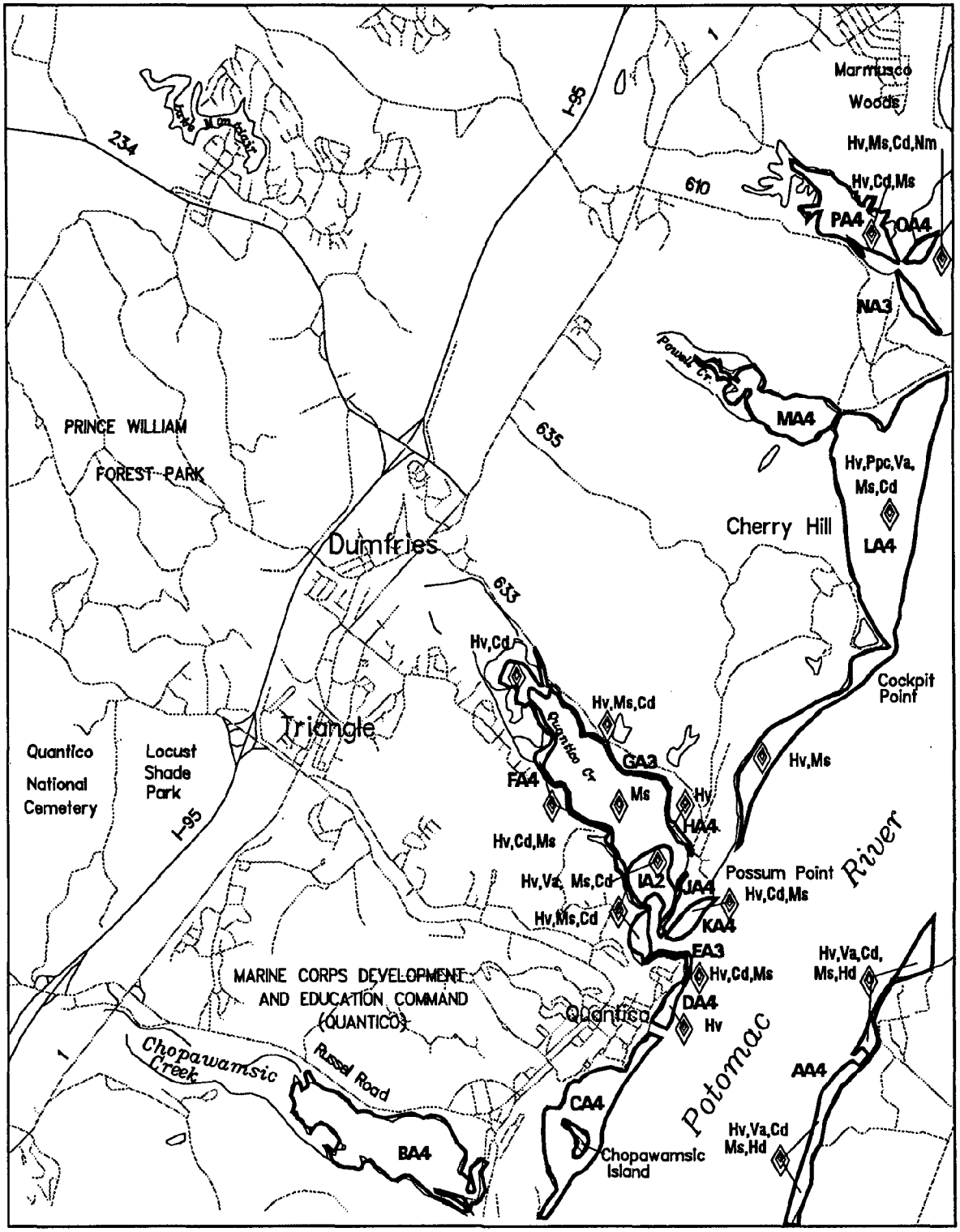
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 09-09-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Quantico, VA.-MD. (047)



0 1000 2000 3000

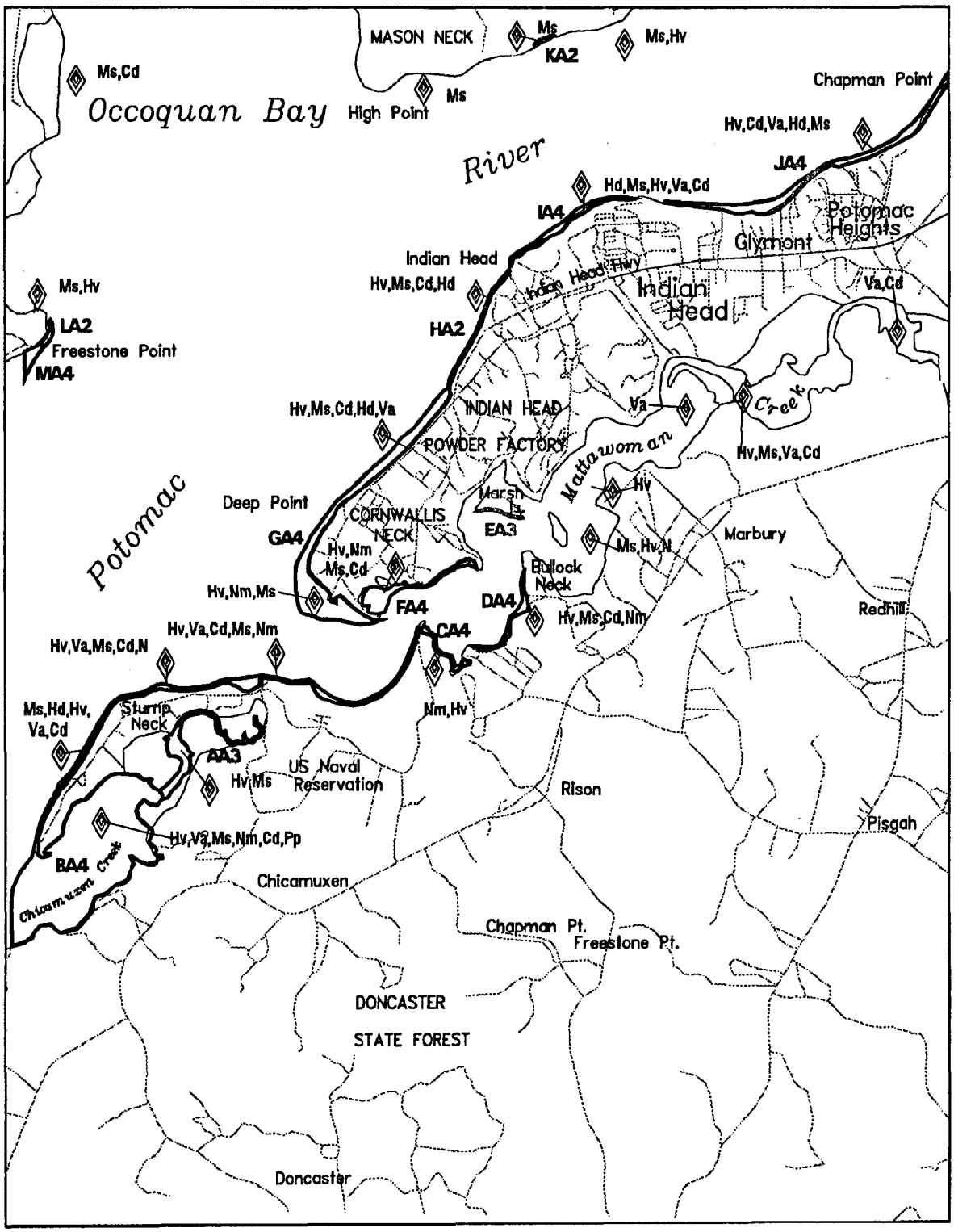
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-23-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Indian Head, MD.- VA. (048)



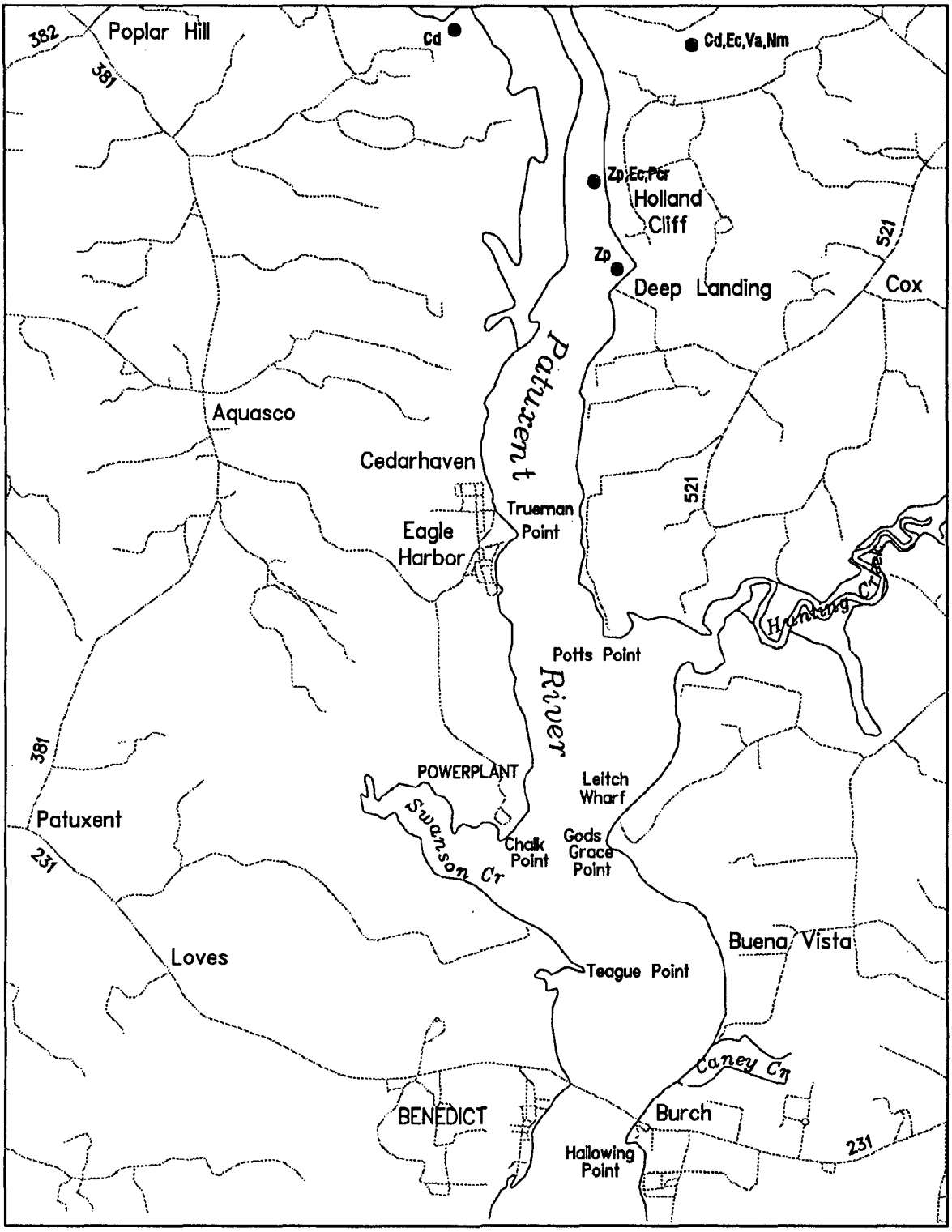
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 10-08-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Benedict, MD. (049)



0 1000 2000 3000

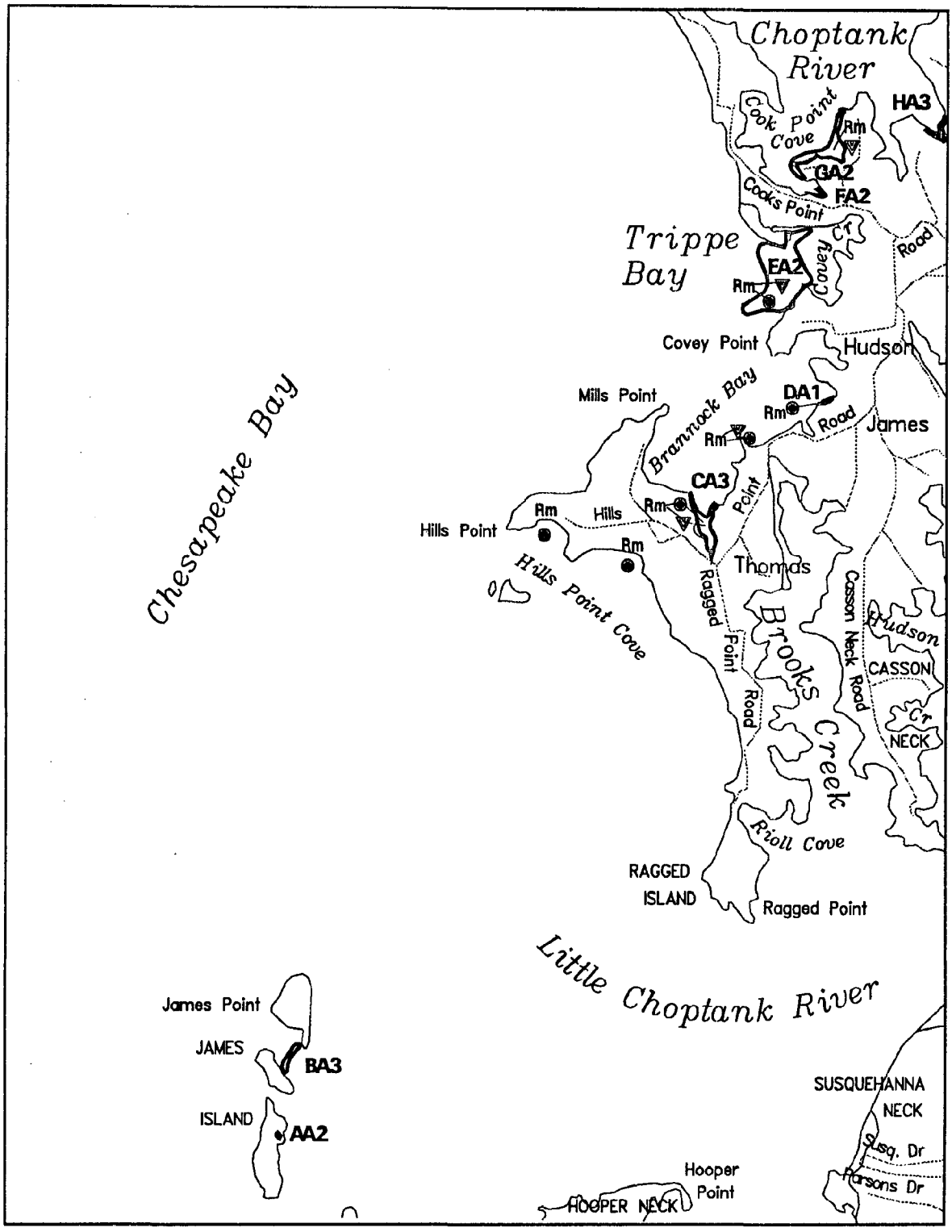
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-29-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Hudson, MD. (051)



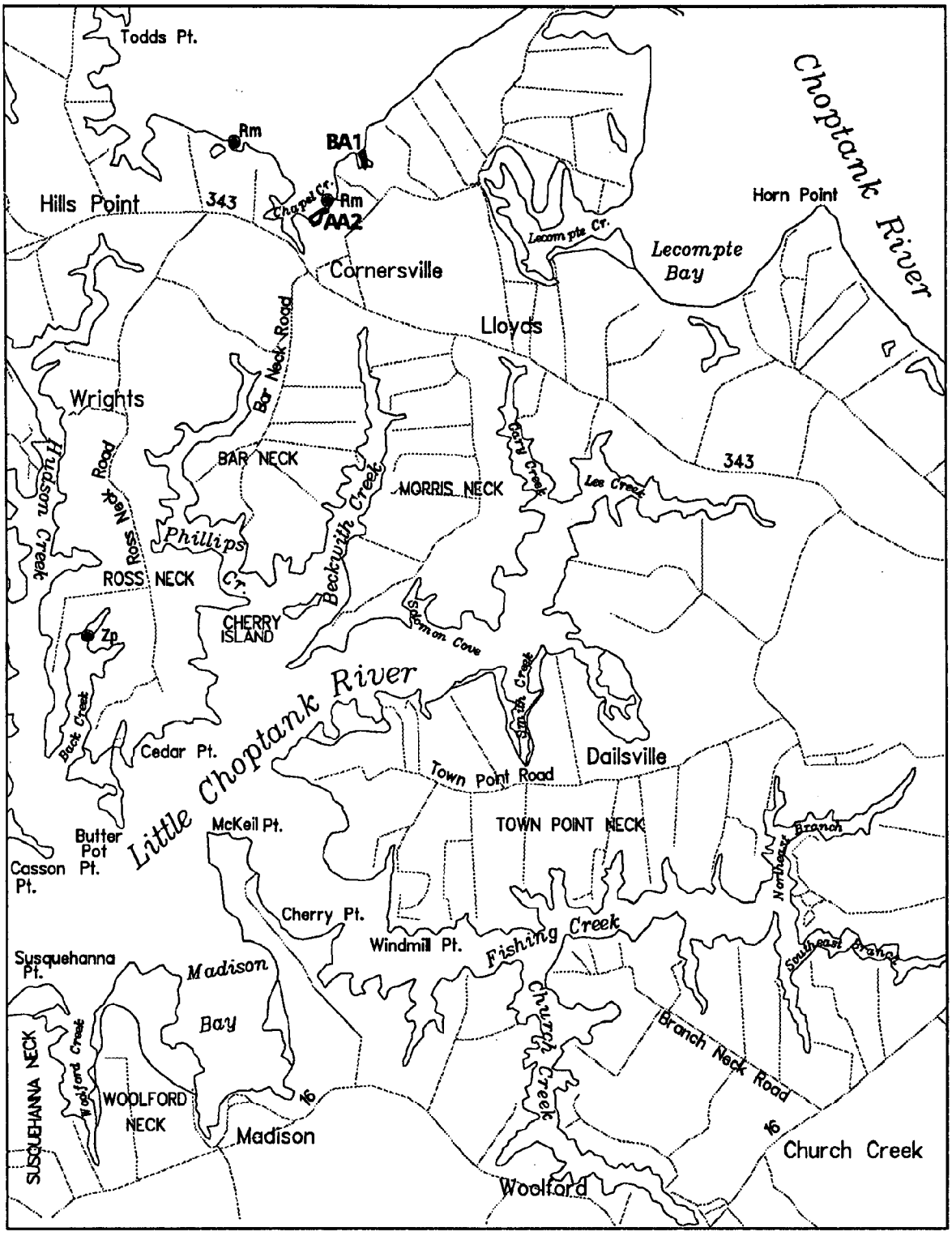
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 09-08-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Church Creek, MD. (052)



0 1000 2000 3000

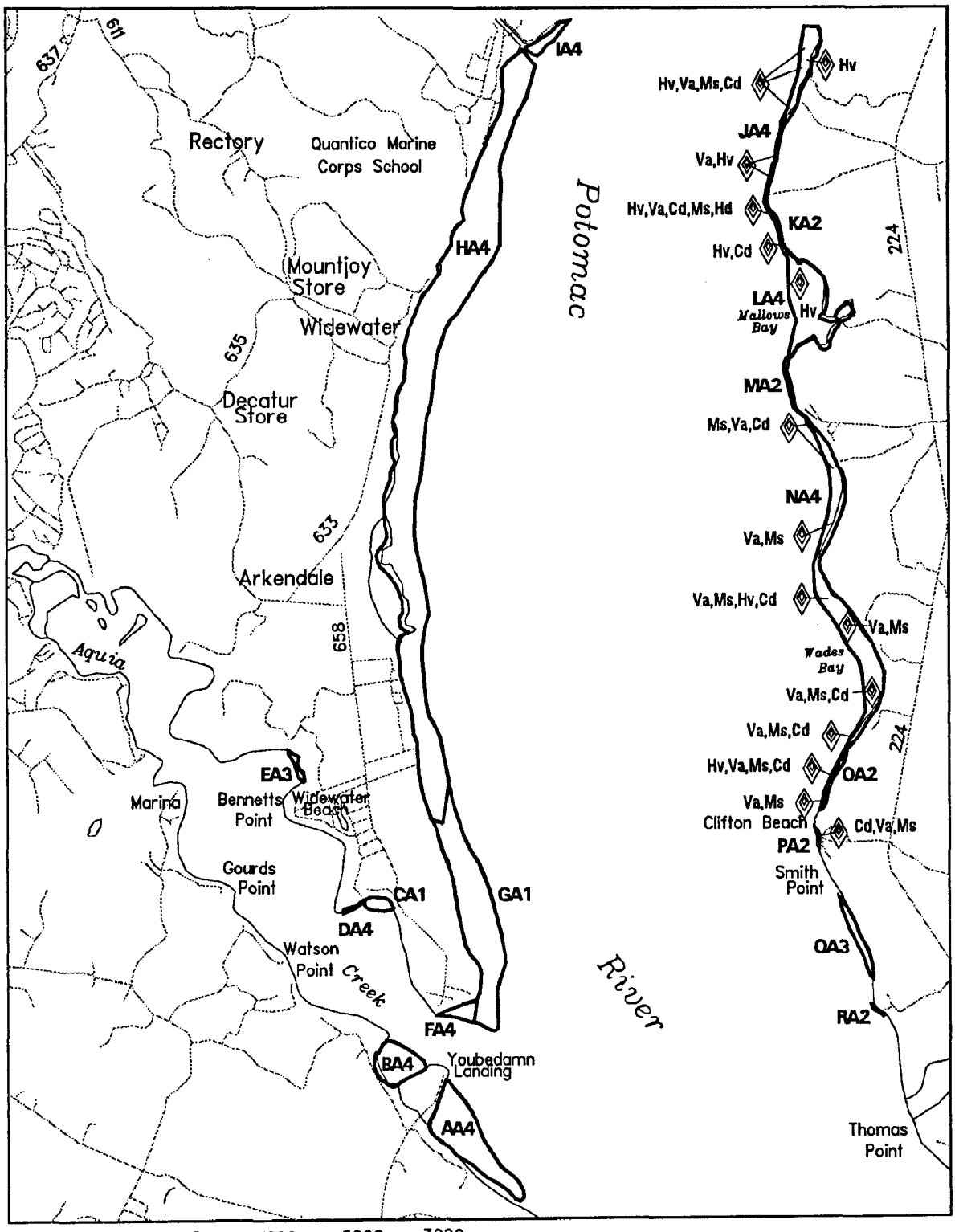
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 09-08-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Widewater, VA.-MD. (055)



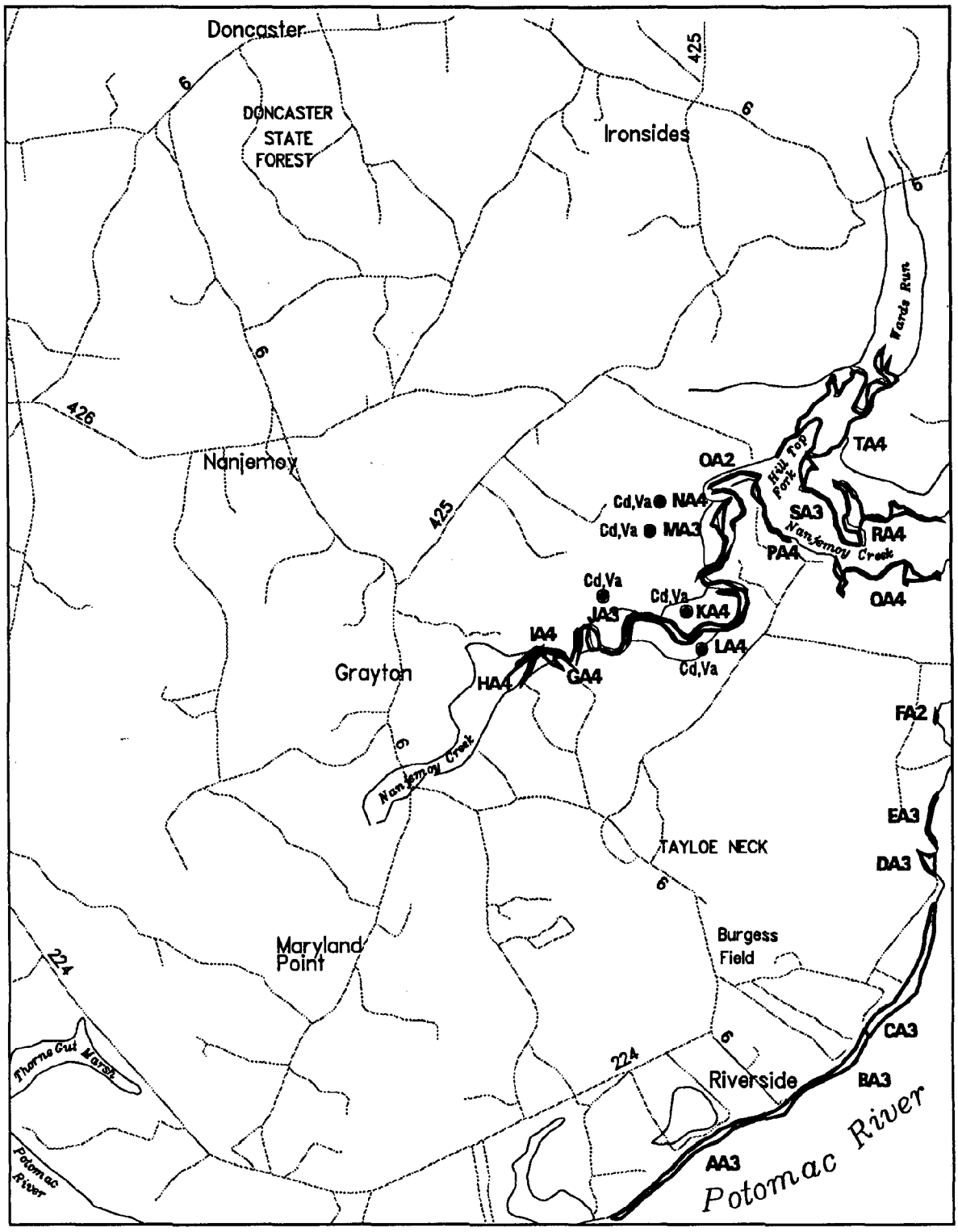
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-23-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Nanjemoy, MD. (056)



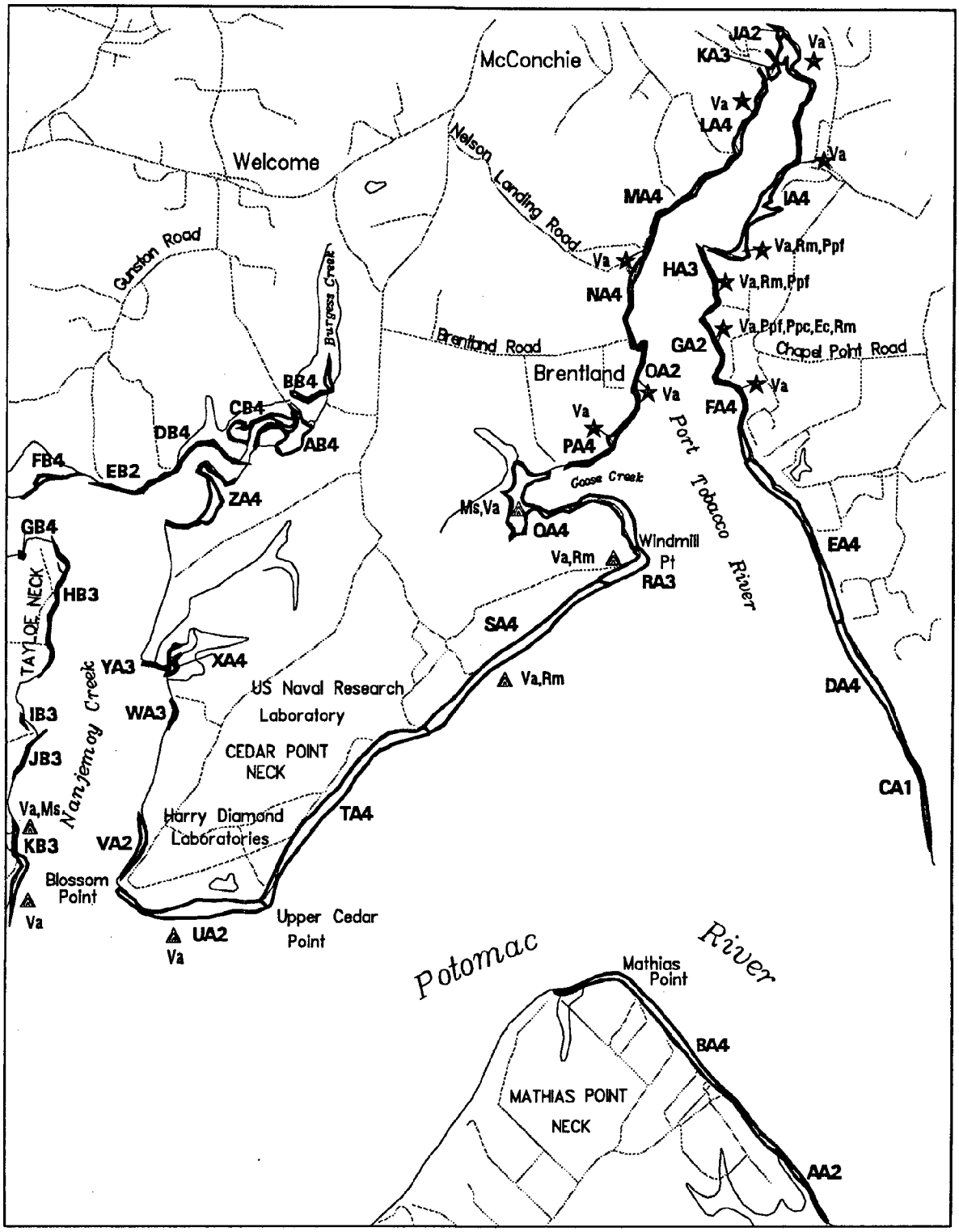
Scale (meters): 0 1000 2000 3000

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-23-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Mathias Point, MD.-VA. (057)



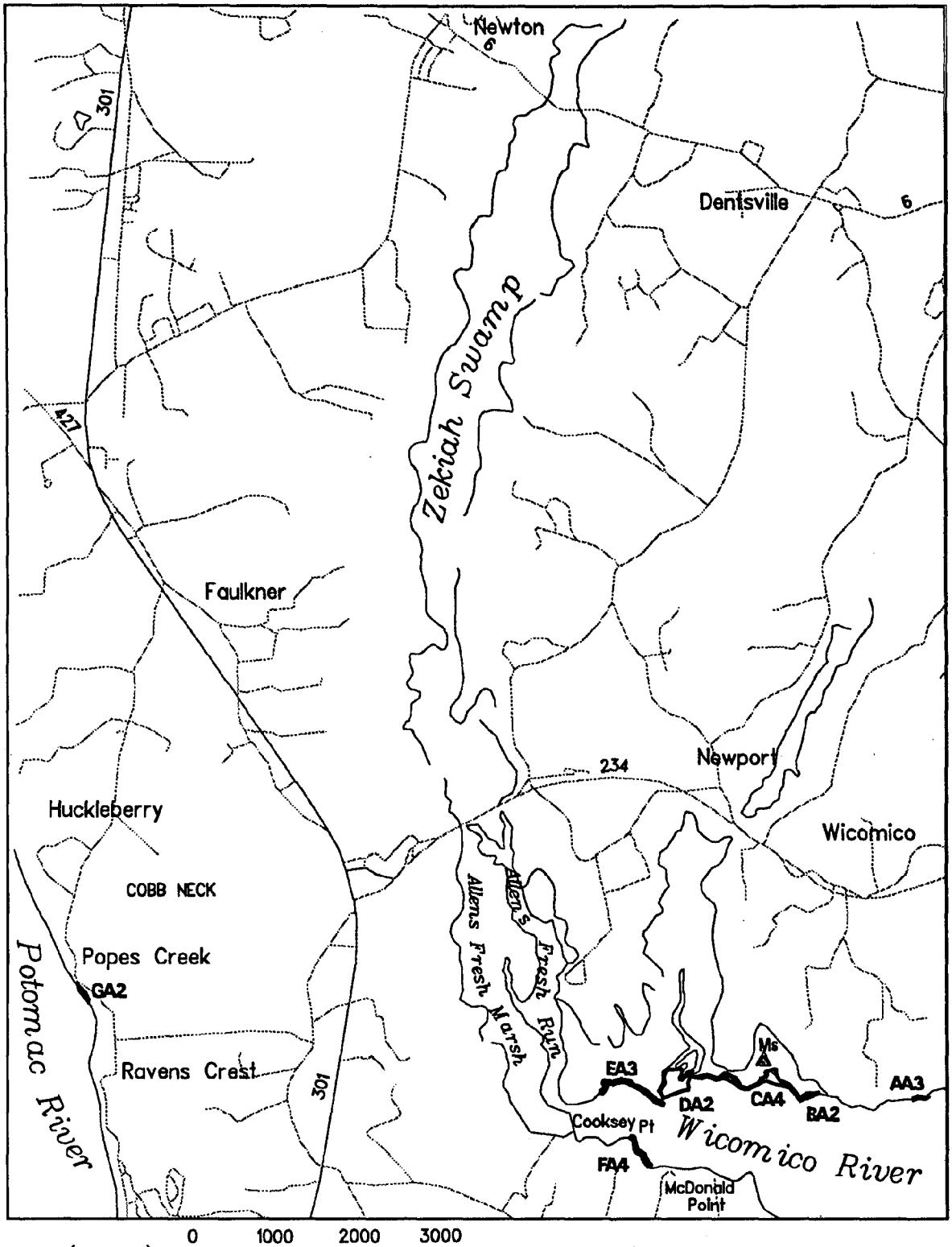
Scale (meters): 0 1000 2000 3000

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-23-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Popes Creek, MD. (058)



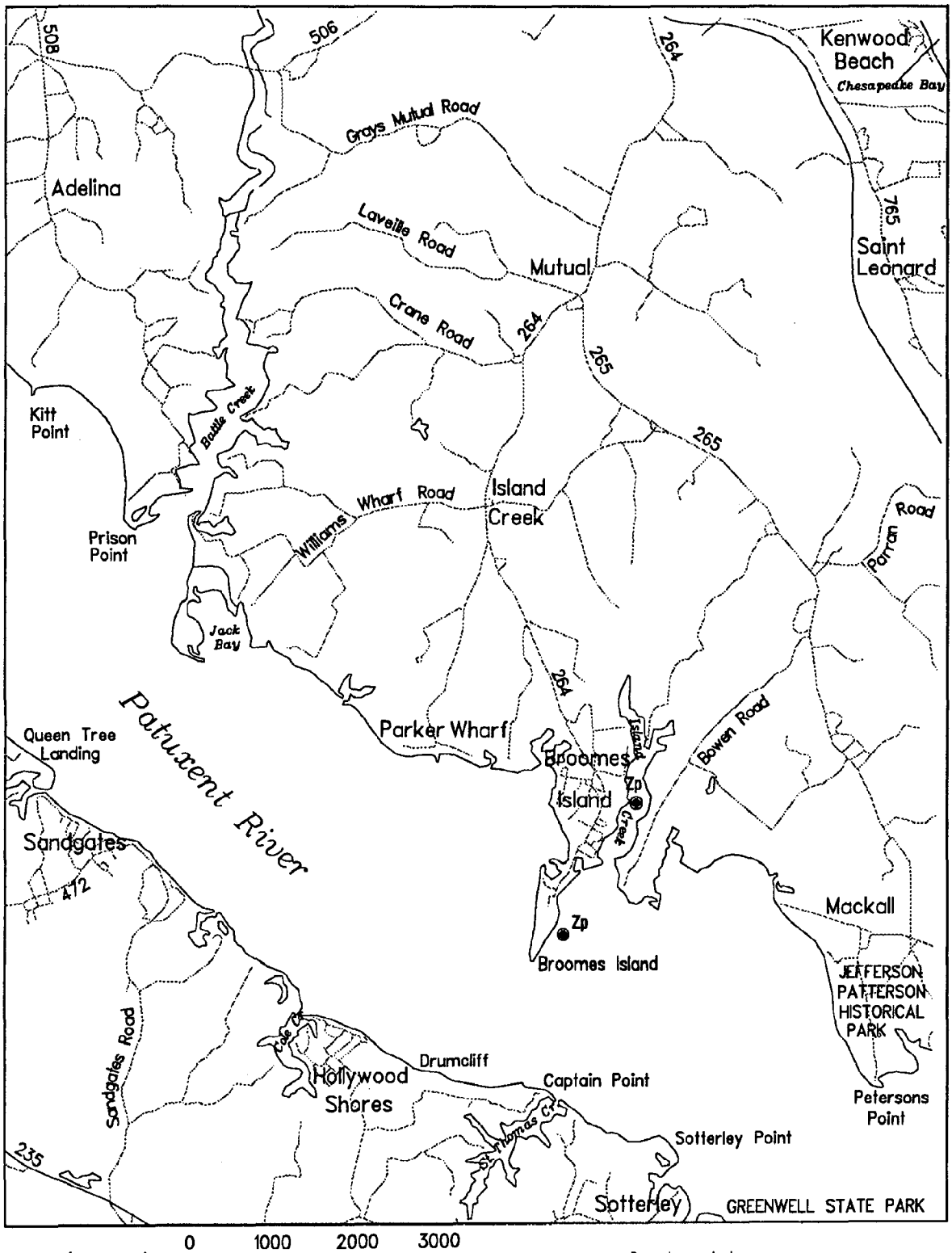
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-11-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Broomes Island, MD. (060)



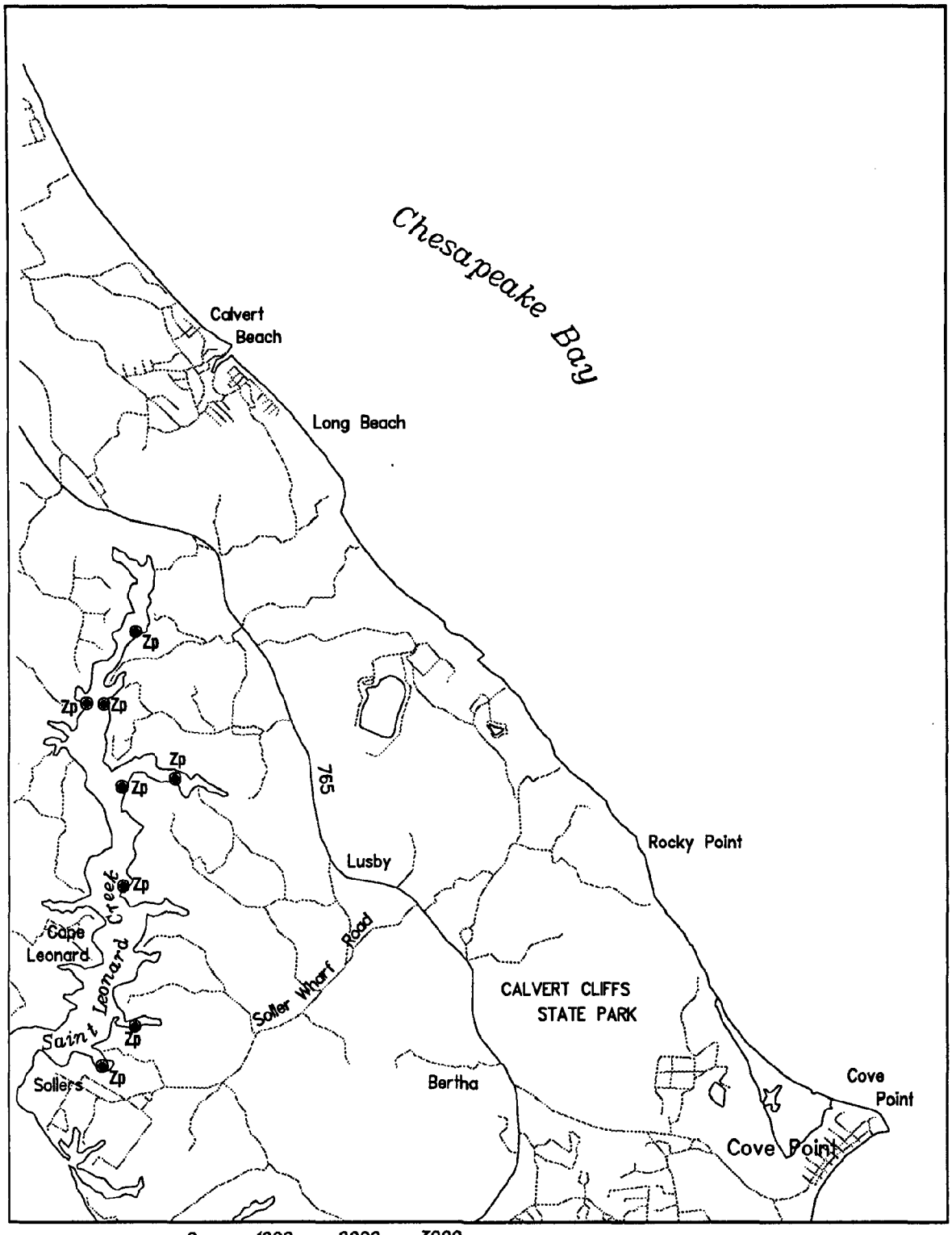
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-11-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Cove Point, MD. (061)



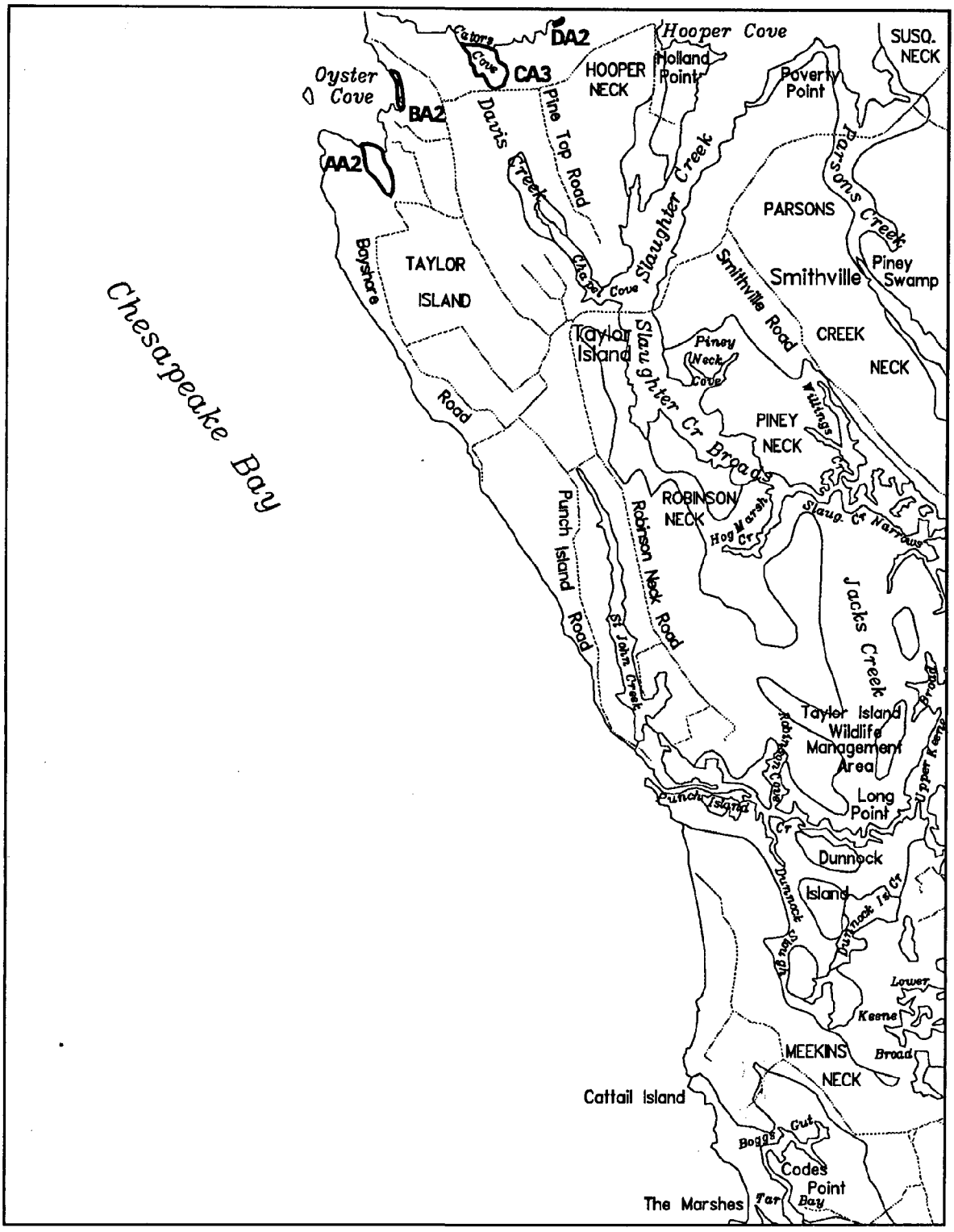
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-11-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Taylors Island, MD. (062)



0 1000 2000 3000

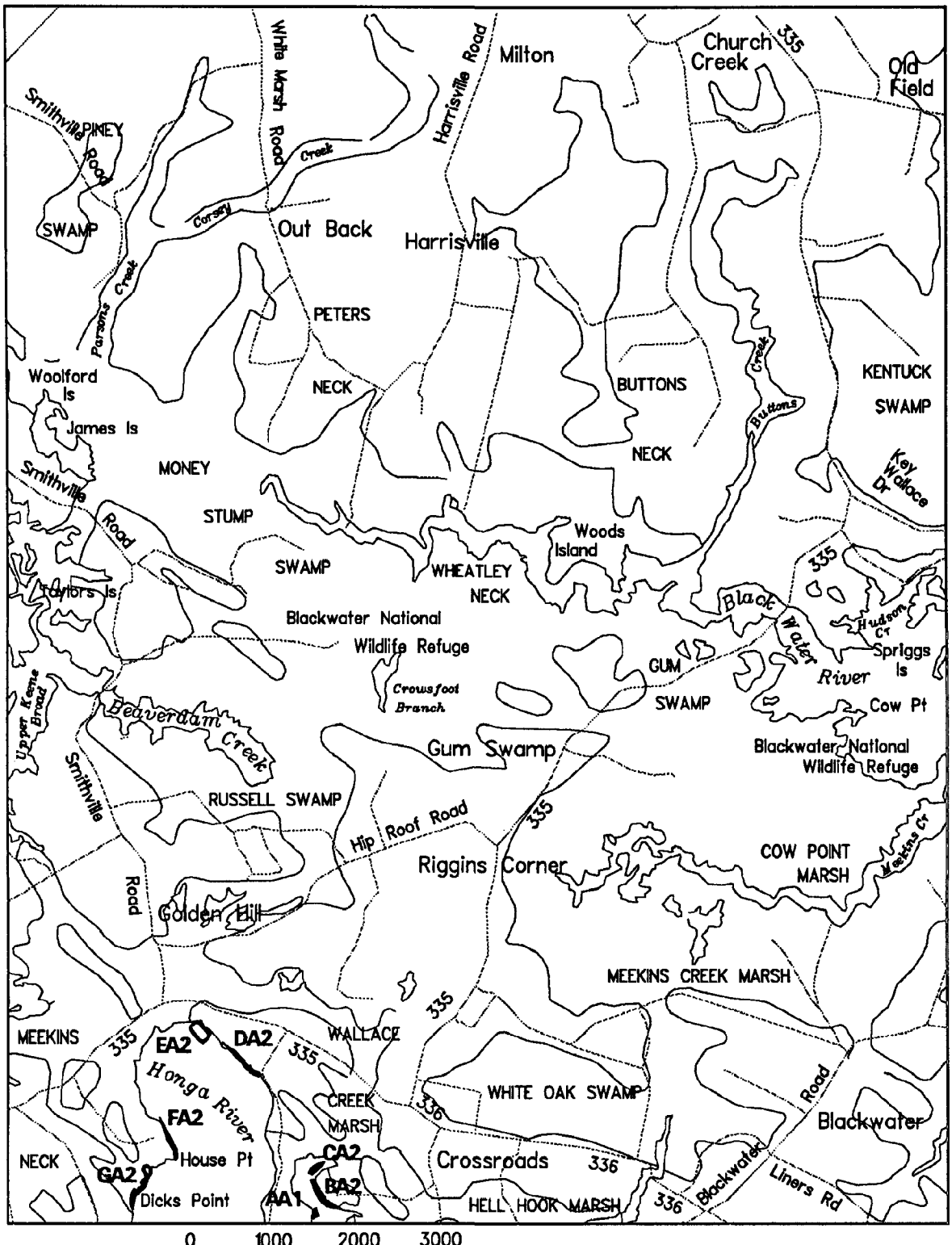
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 07-11-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Golden Hill, MD. (063)



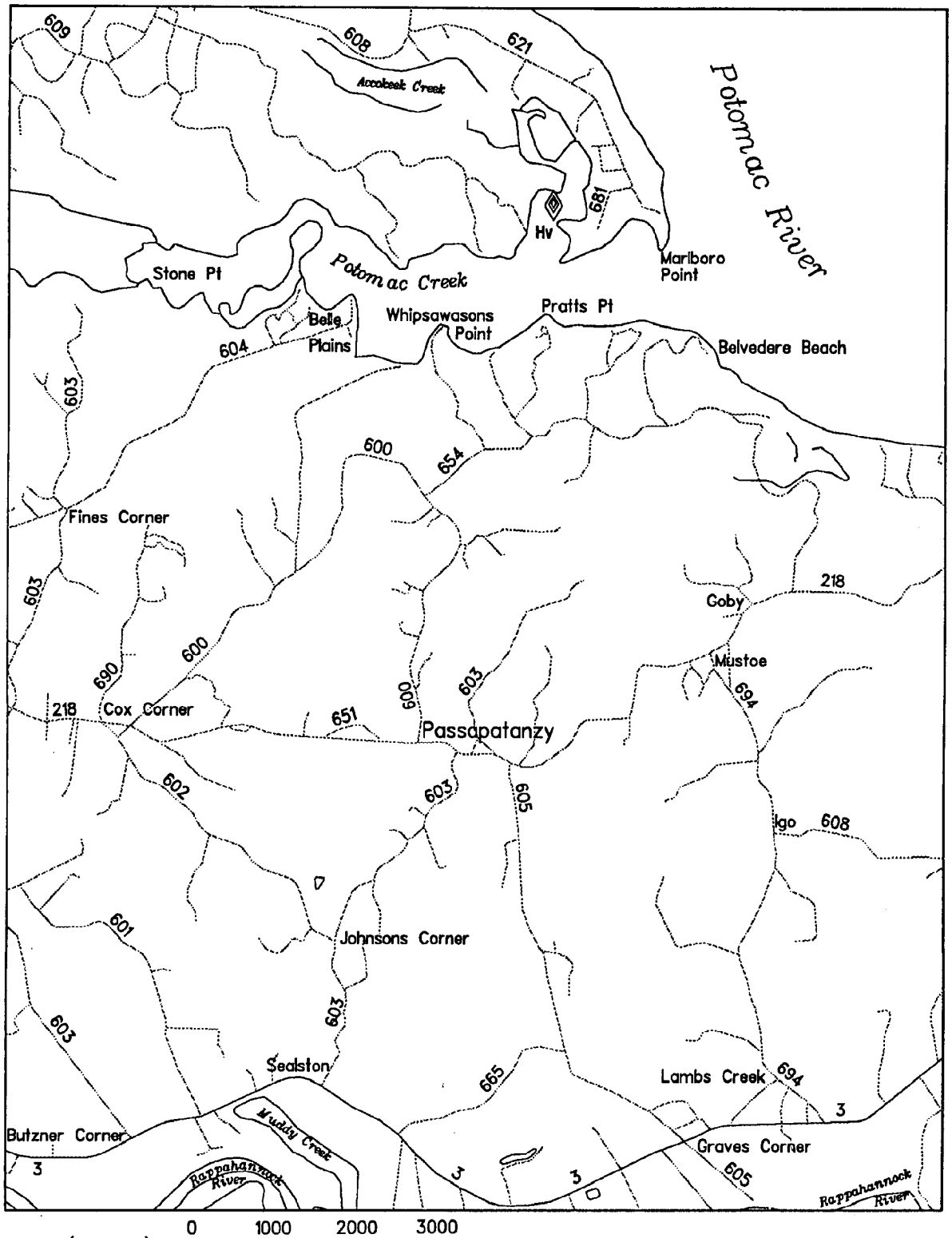
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-25-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Passapatanzy, MD.-VA. (064)



0 1000 2000 3000

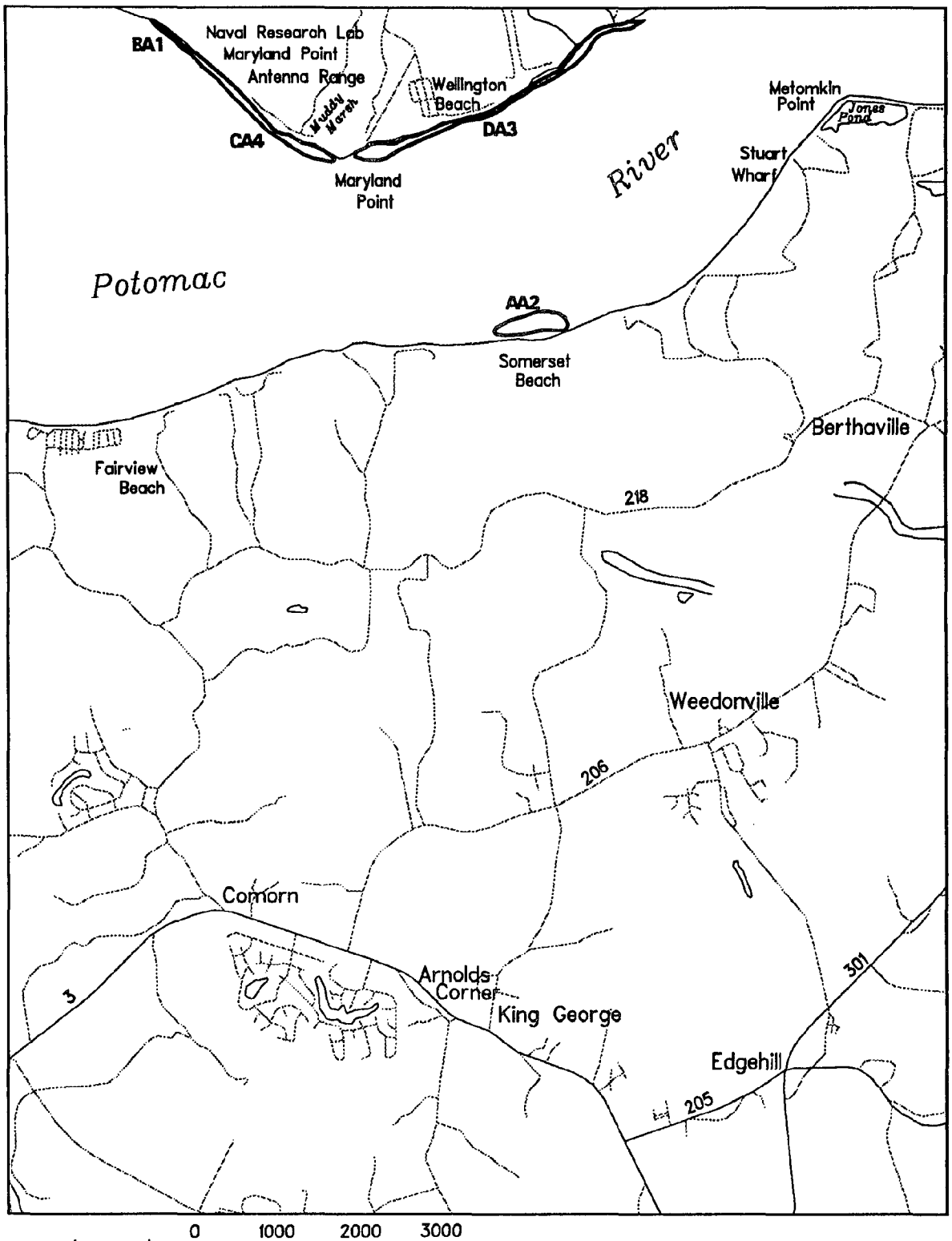
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-23-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
King George, VA.-MD. (065)



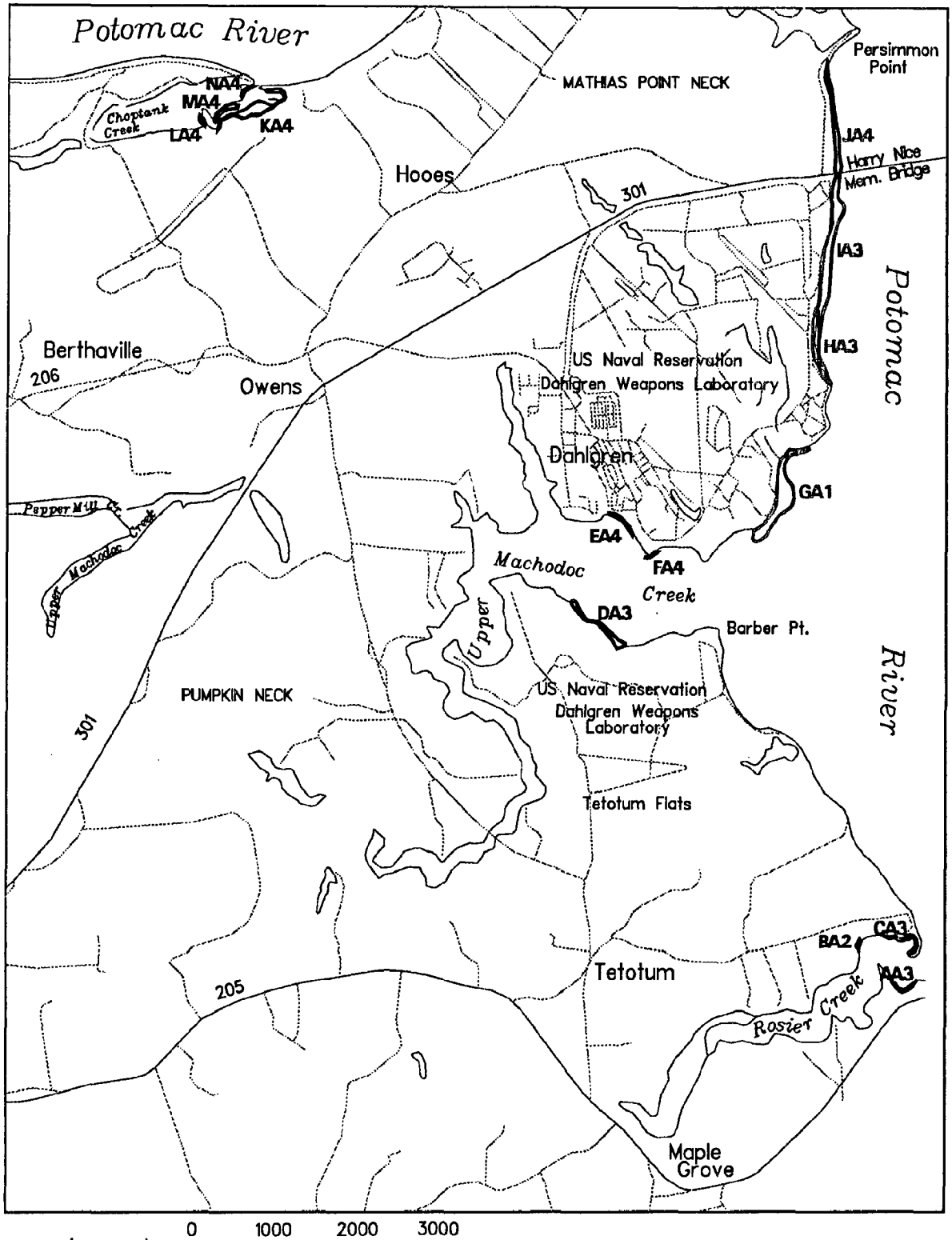
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-23-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Dahlgren, VA.-MD. (066)



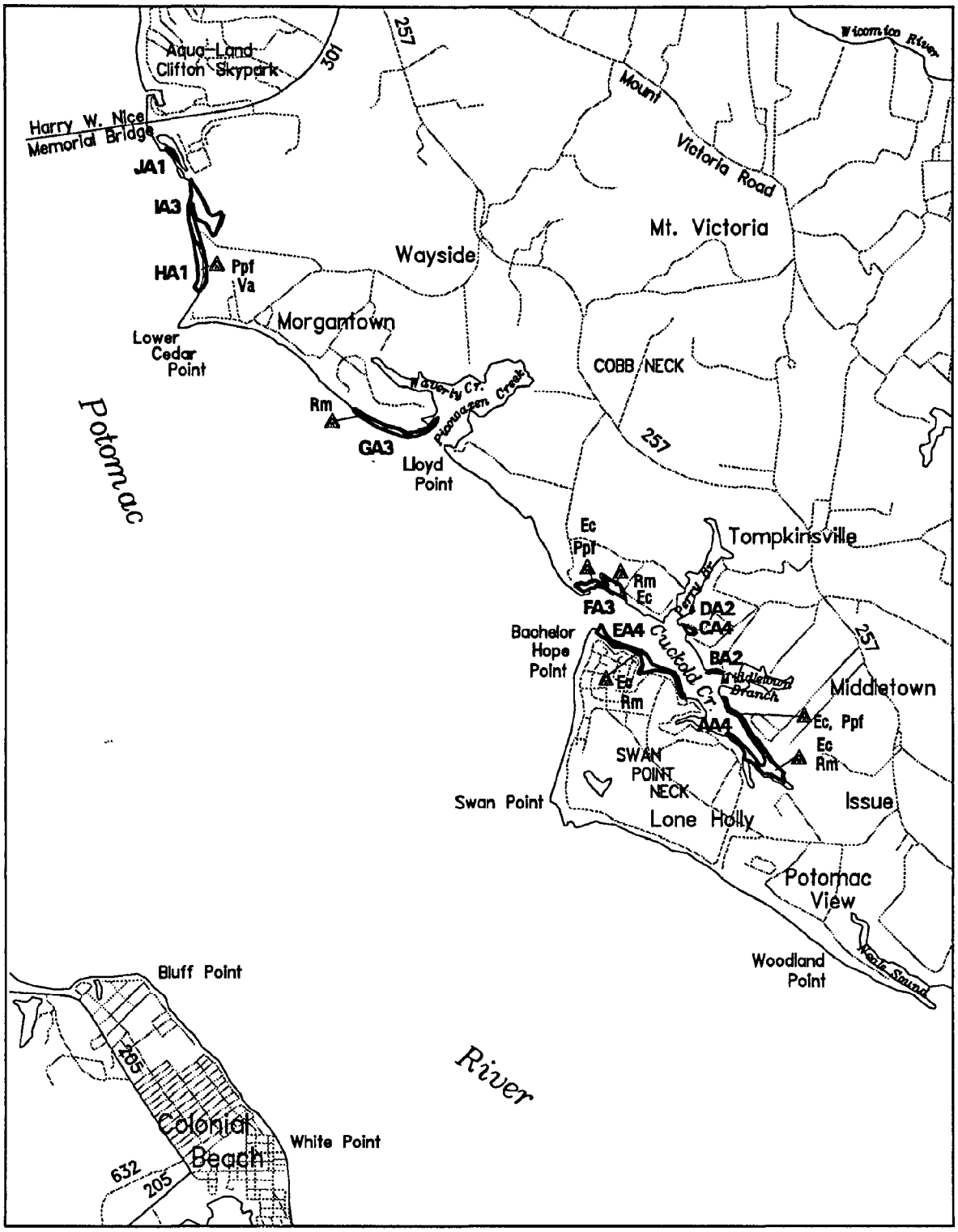
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-11-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Colonial Beach North, VA.-MD. (067)



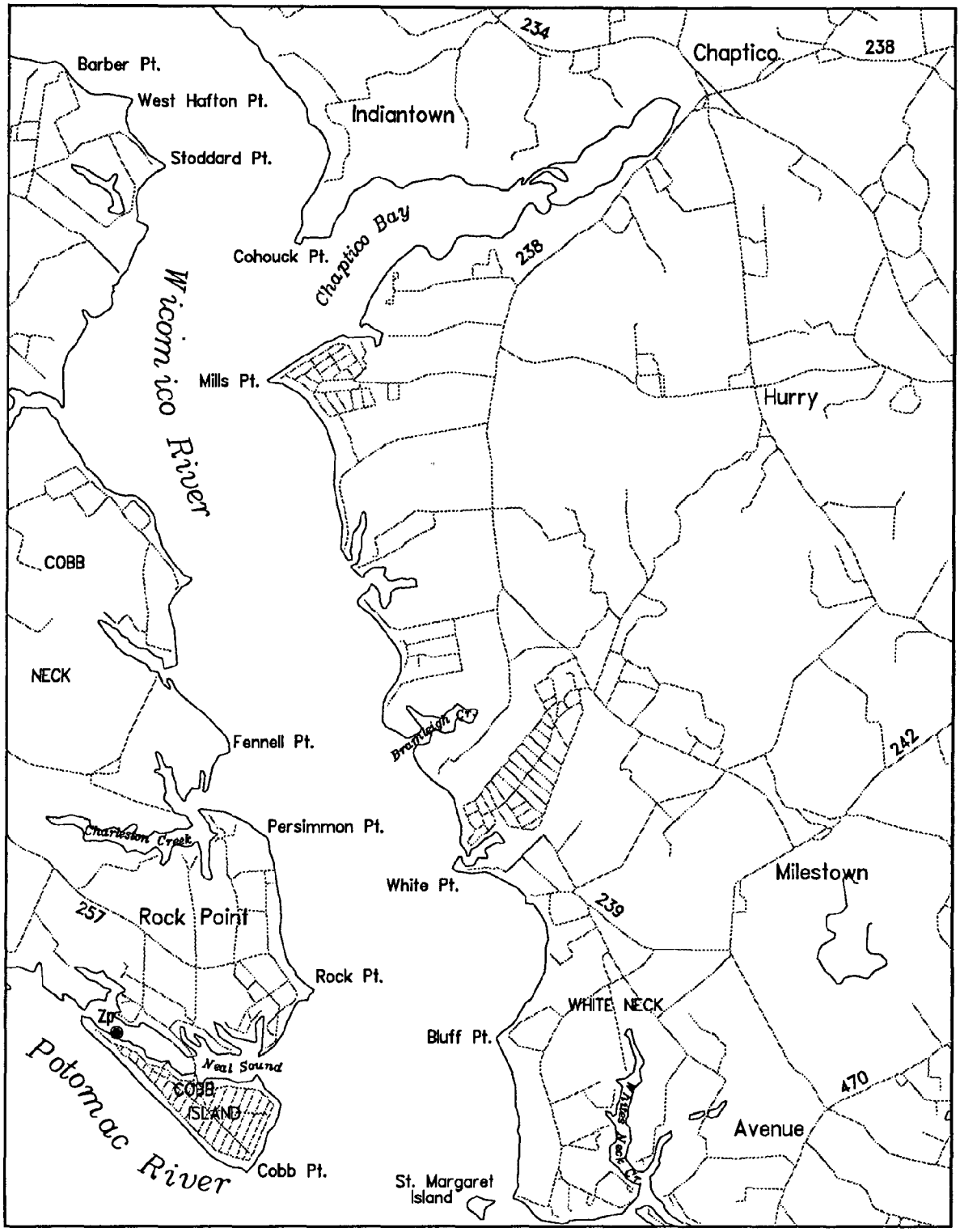
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-11-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Rock Point, MD. (068)



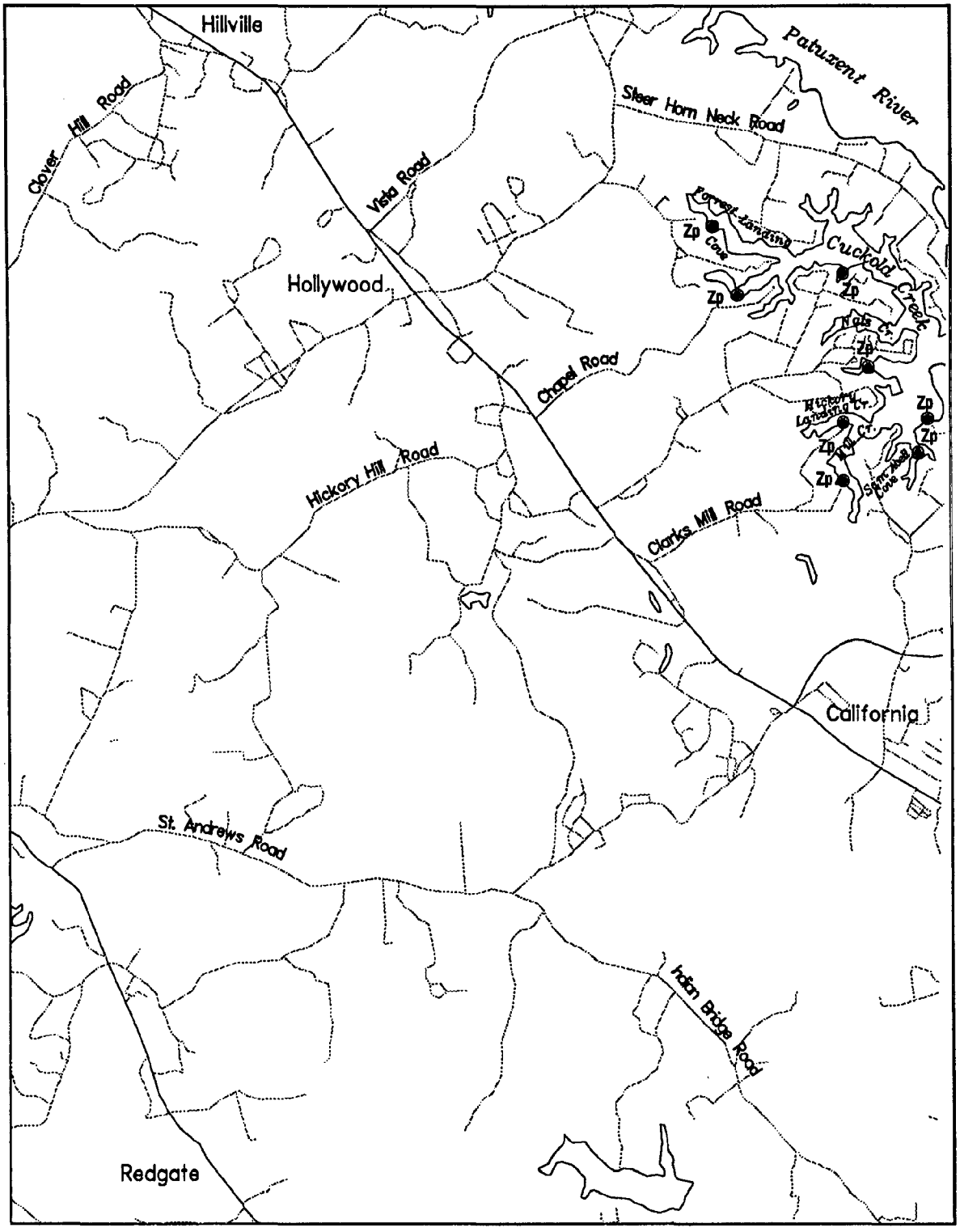
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-11-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Hollywood, MD. (070)



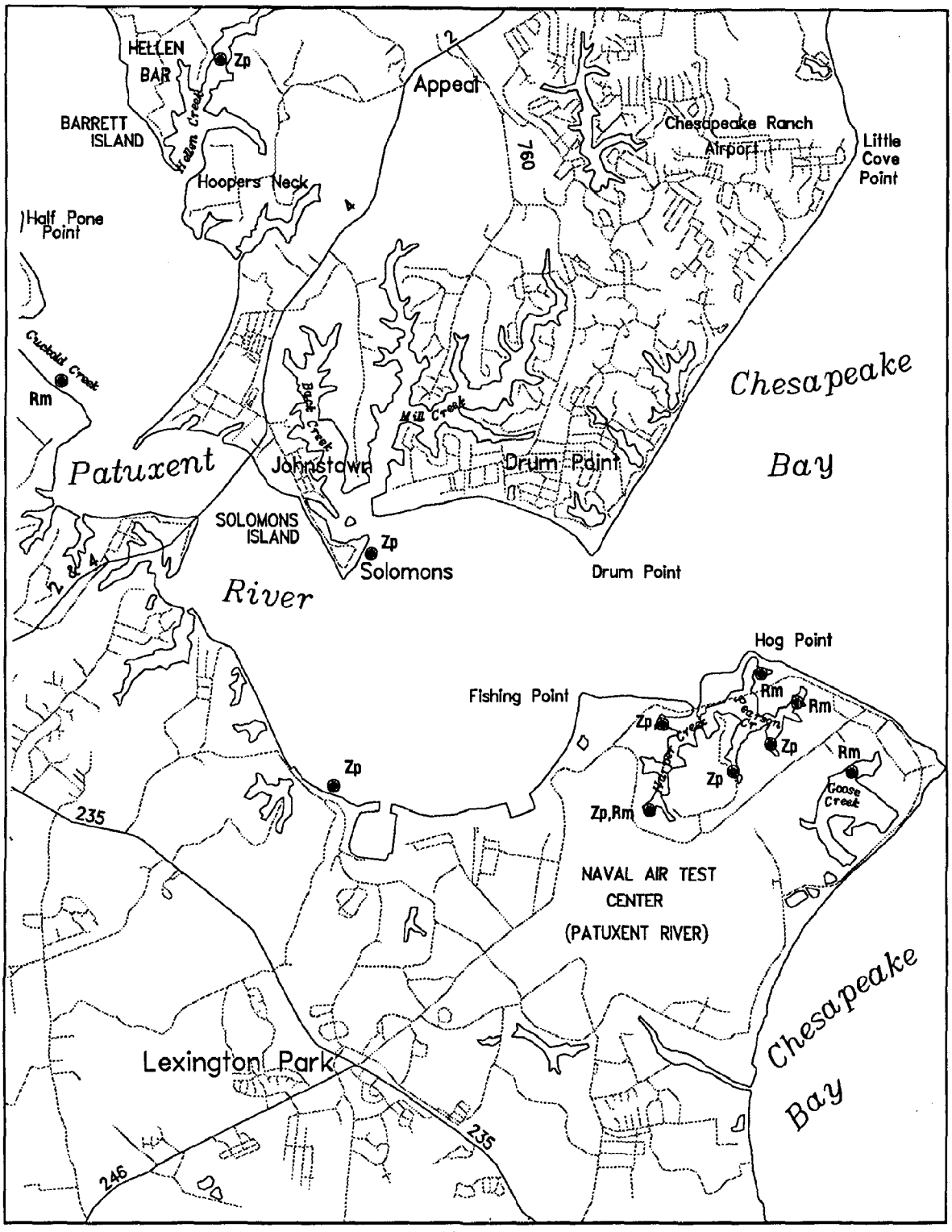
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-11-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Solomons Island, MD. (071)



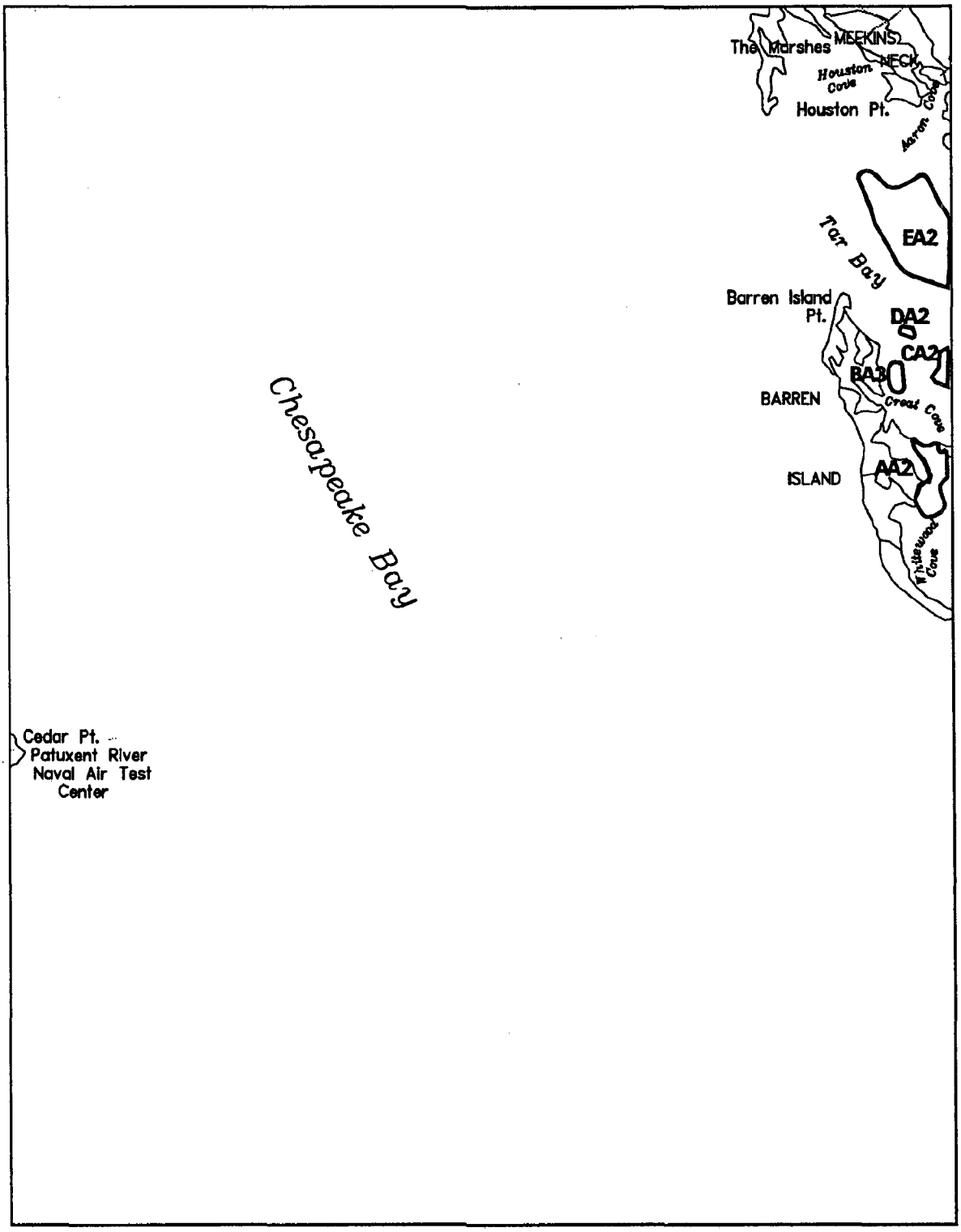
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-11-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Barren Island, MD. (072)



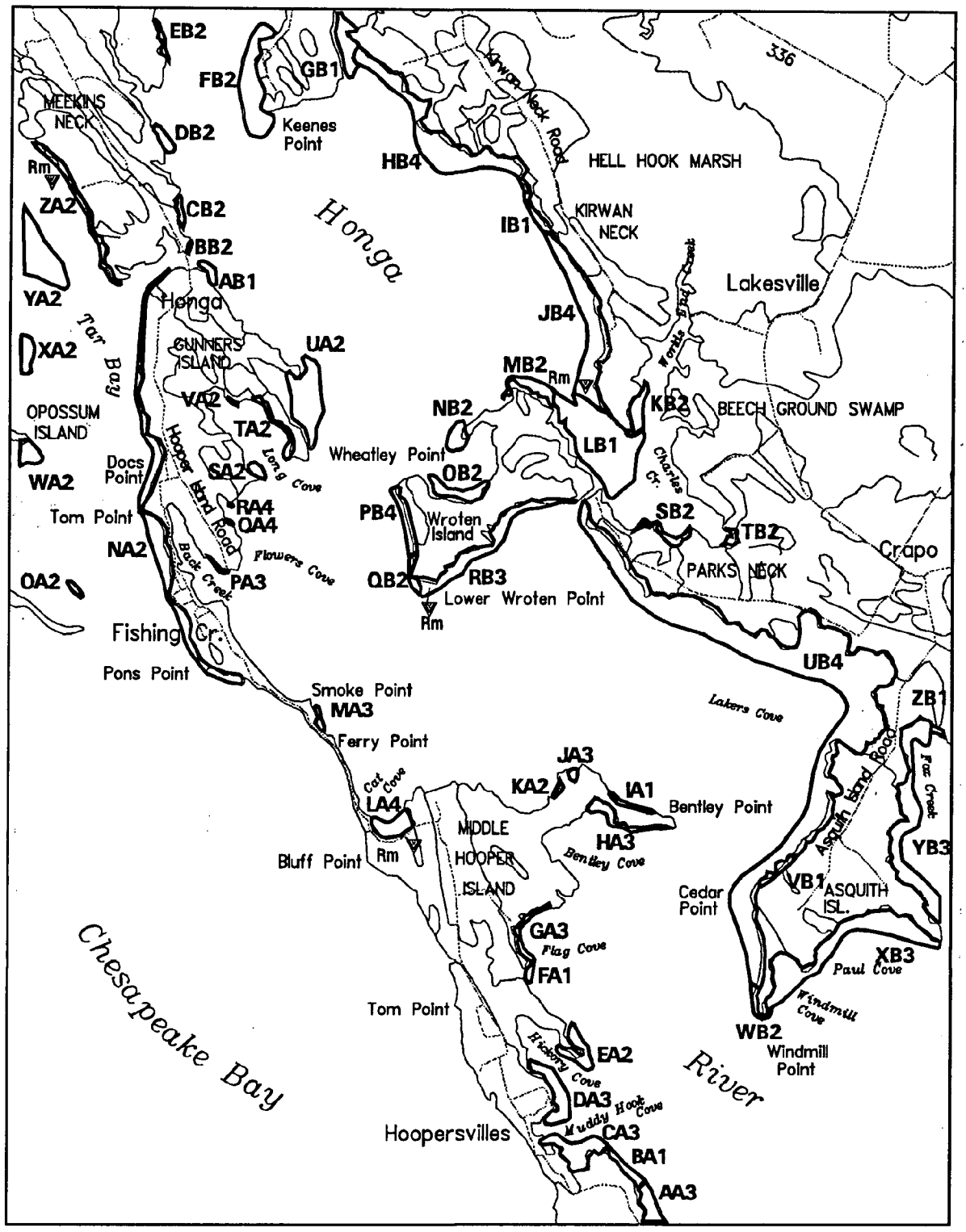
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 07-11-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Honga, MD. (073)



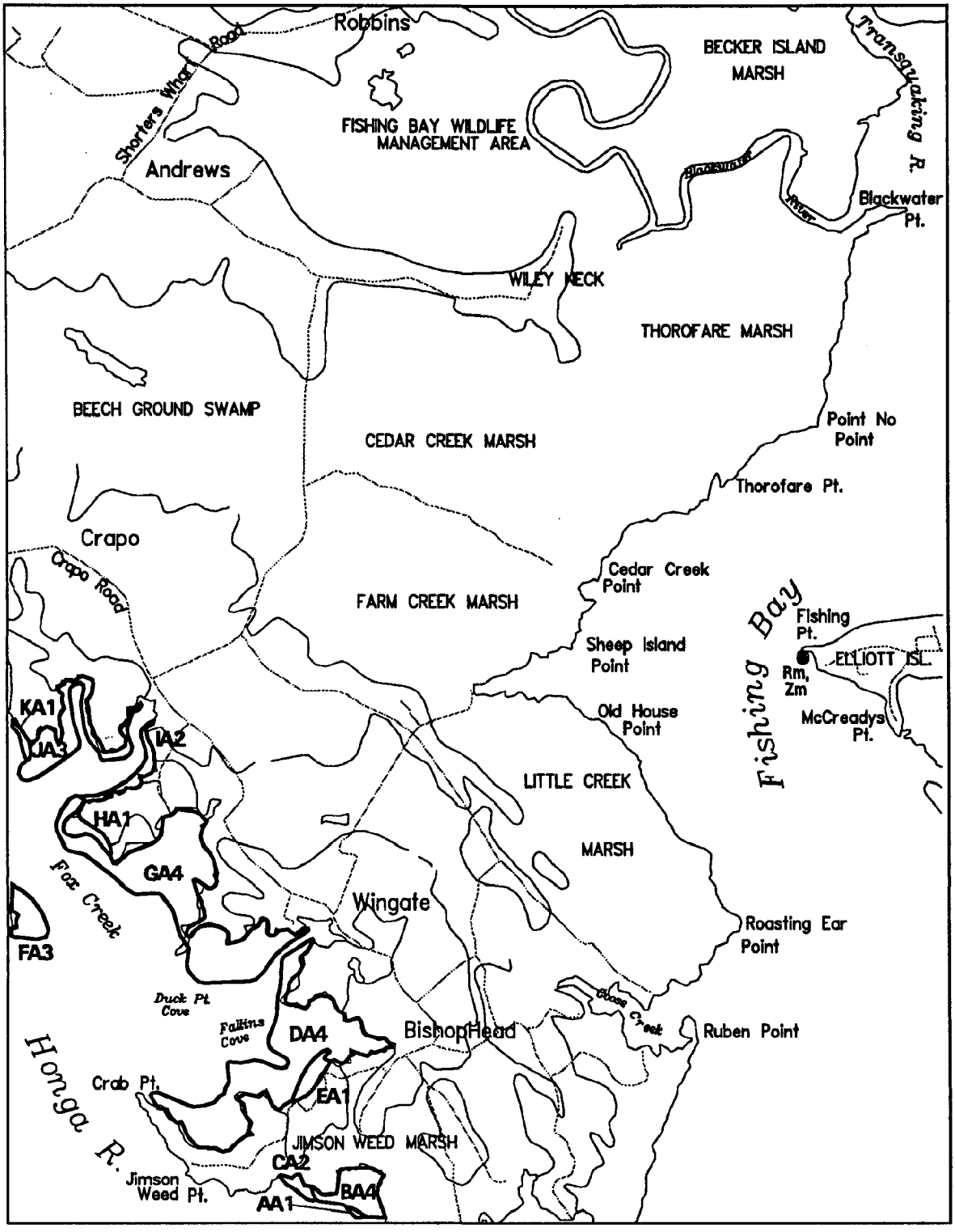
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-25-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Wingate, MD. (074)



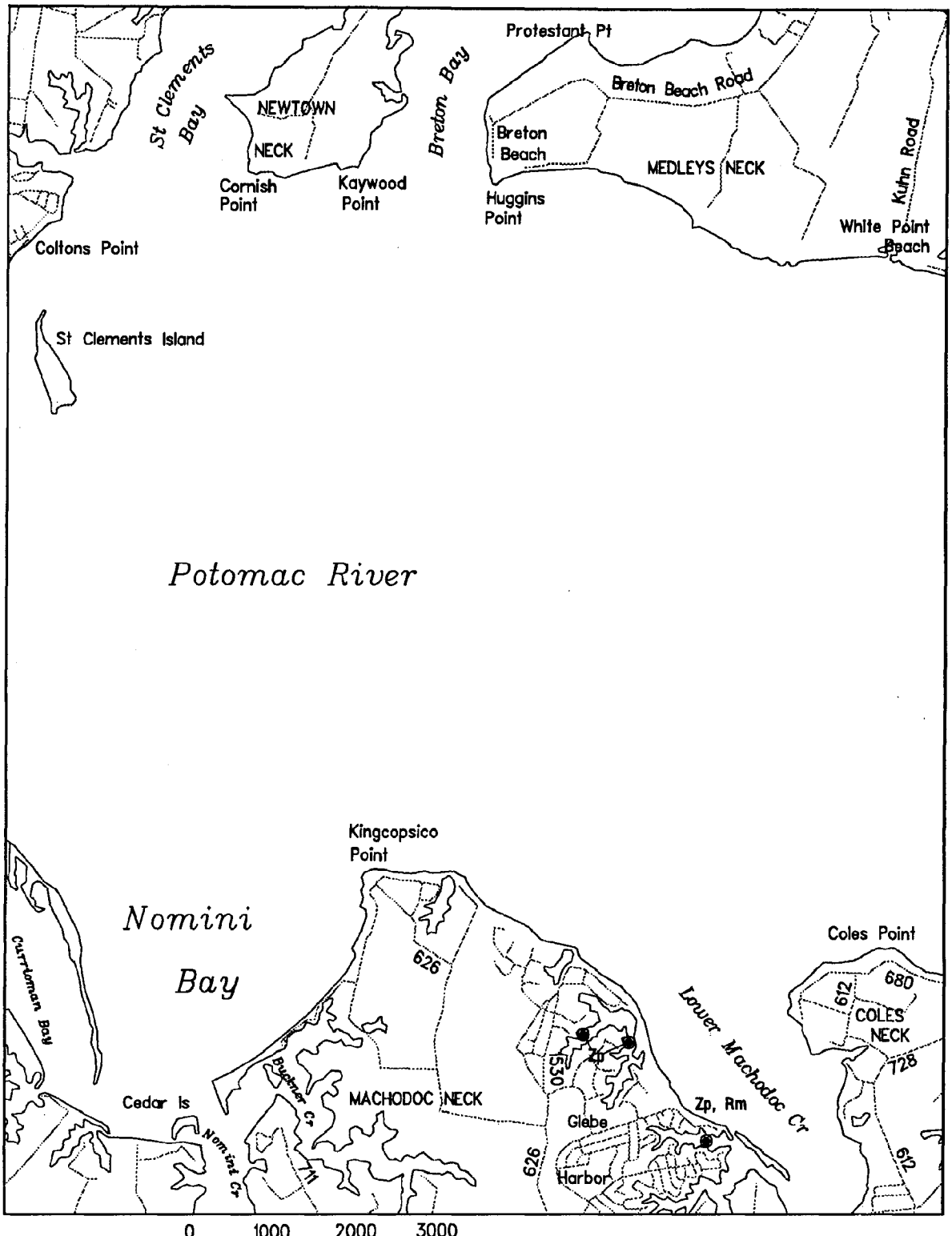
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-10-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
St. Clements Island, VA.-MD. (078)



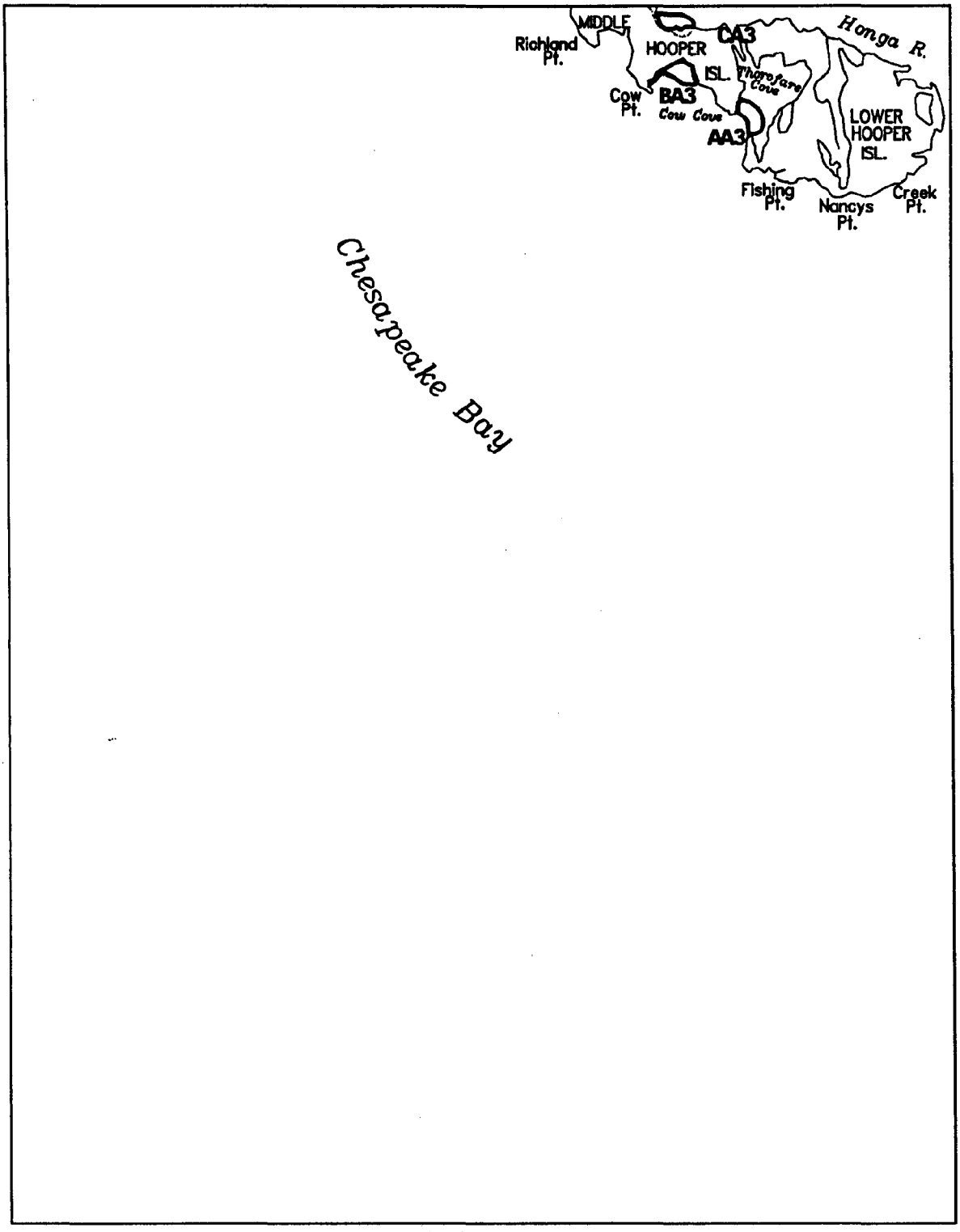
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 07-15-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Richland Point, MD. (082)



0 1000 2000 3000

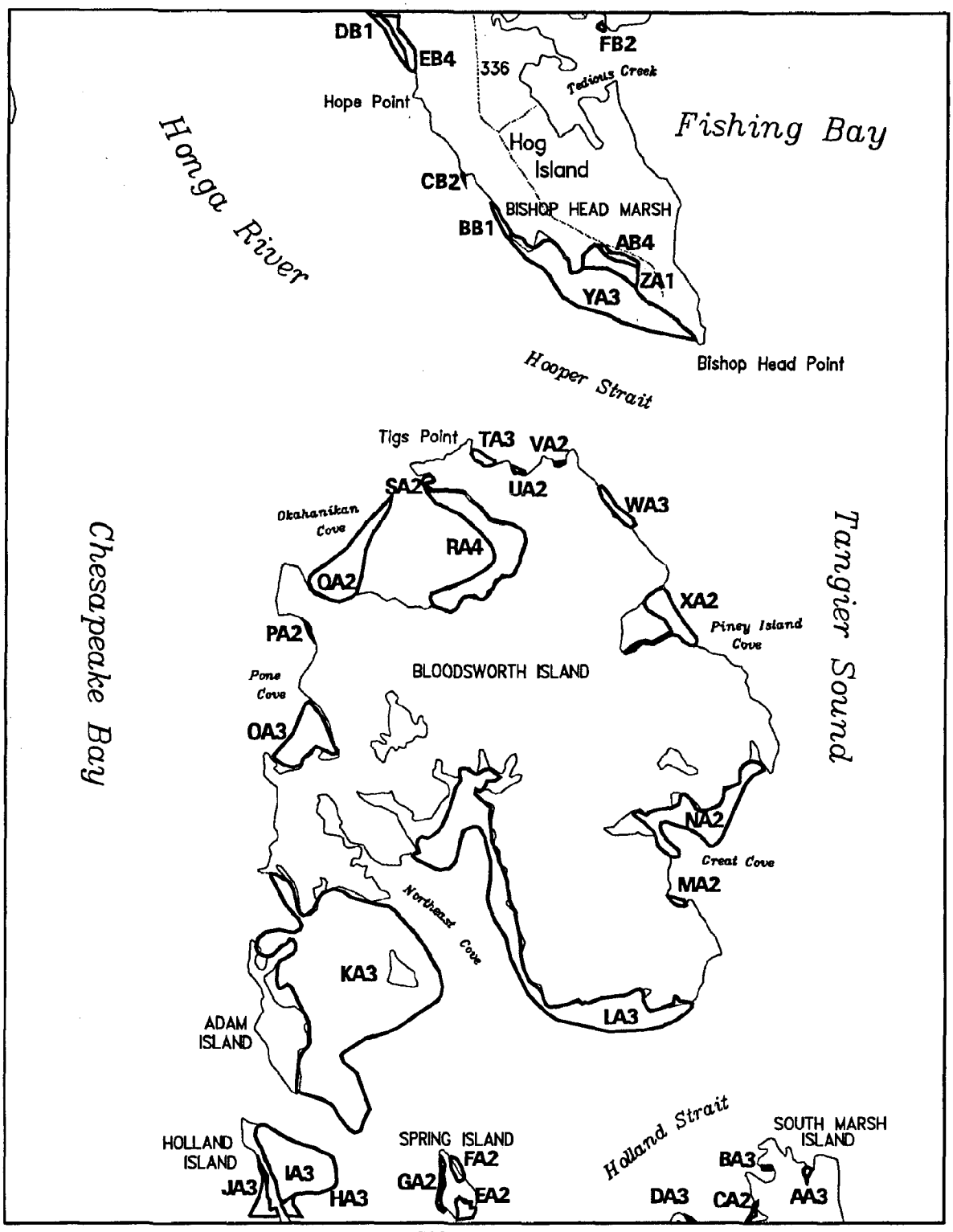
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 07-11-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Bloodsworth Island, MD. (083)



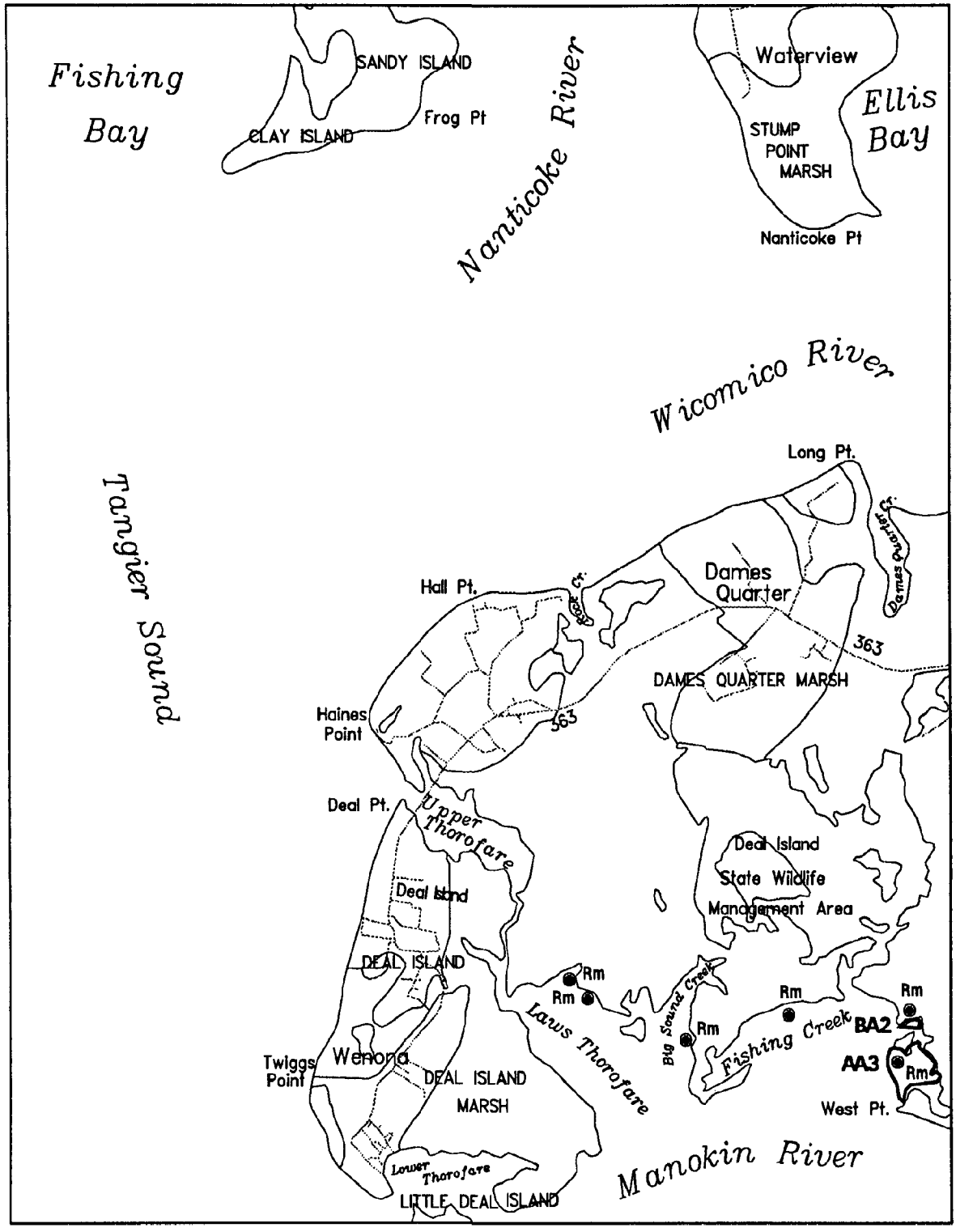
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-14-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Deal Island, MD. (084)



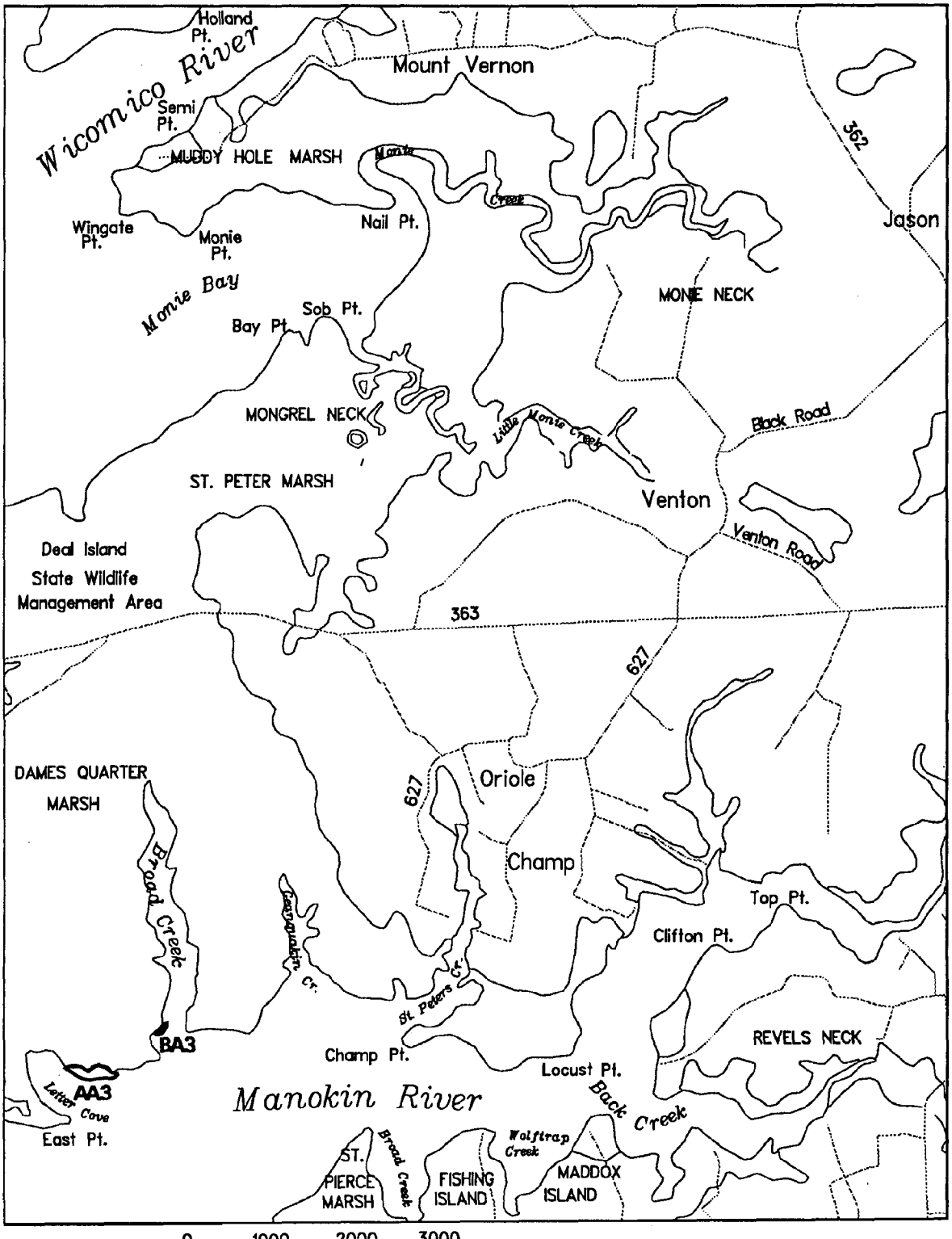
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-25-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Monie, MD. (085)



0 1000 2000 3000

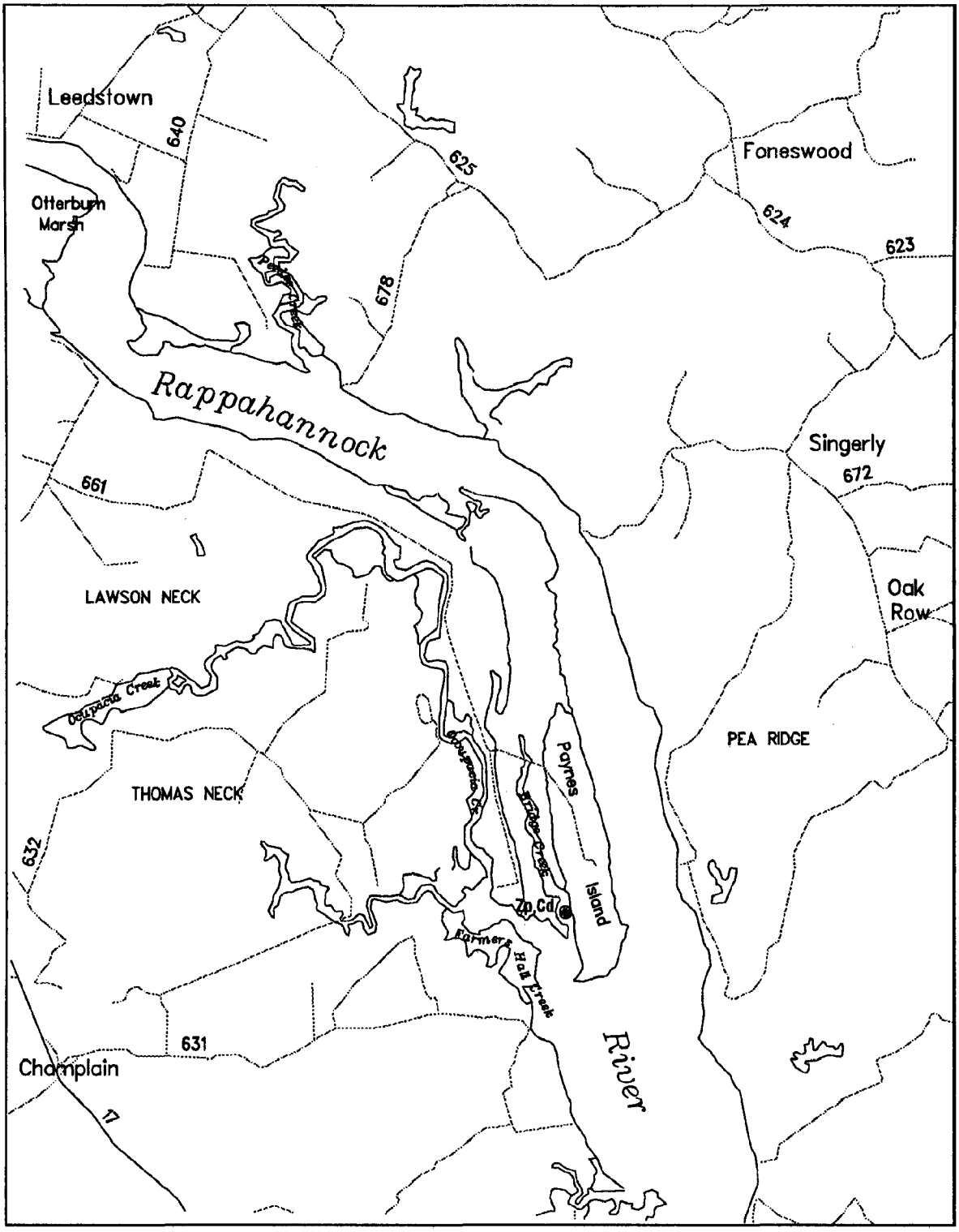
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-25-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Champlain, VA. (086)



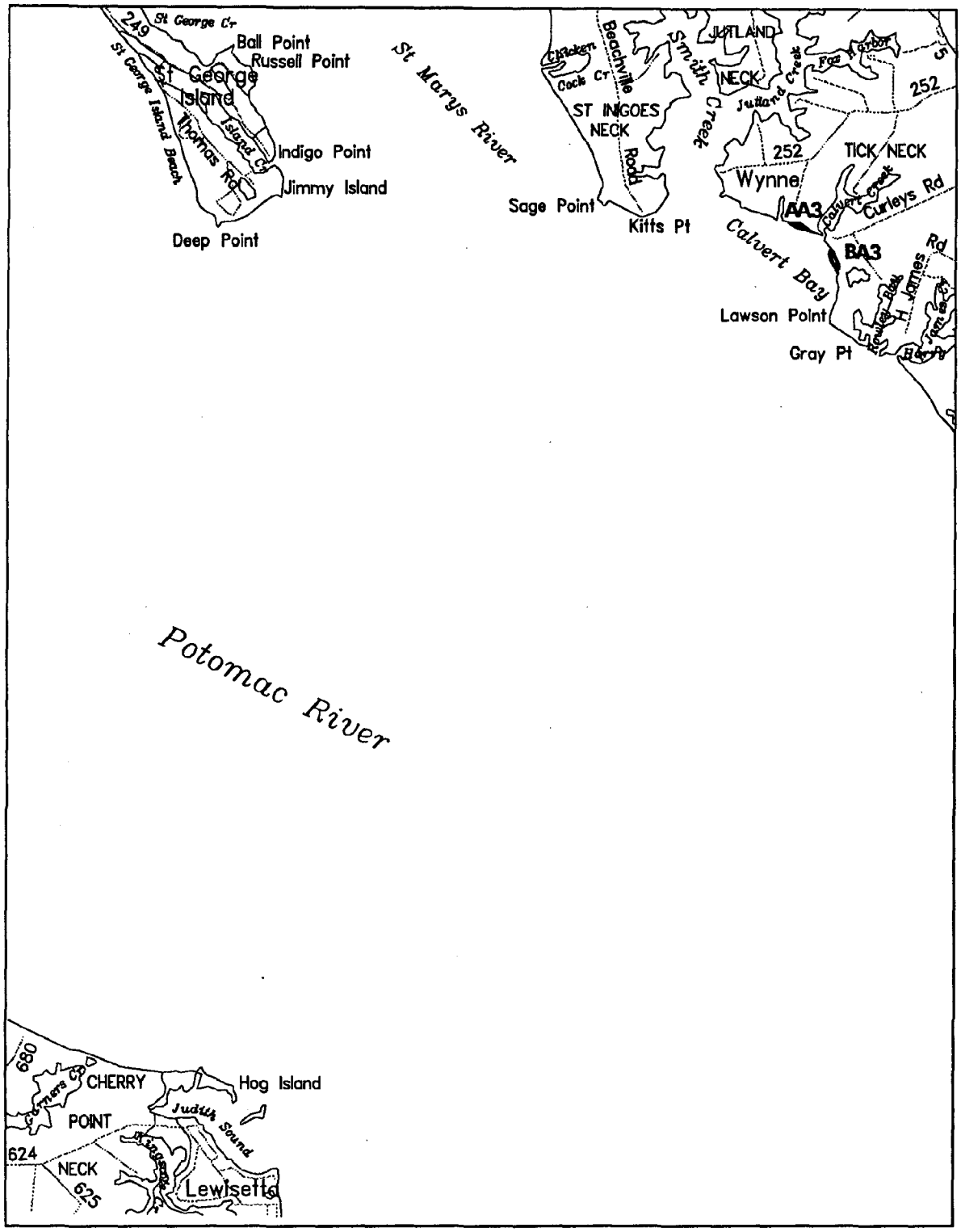
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 07-15-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
St. George Island, MD.-VA. (089)



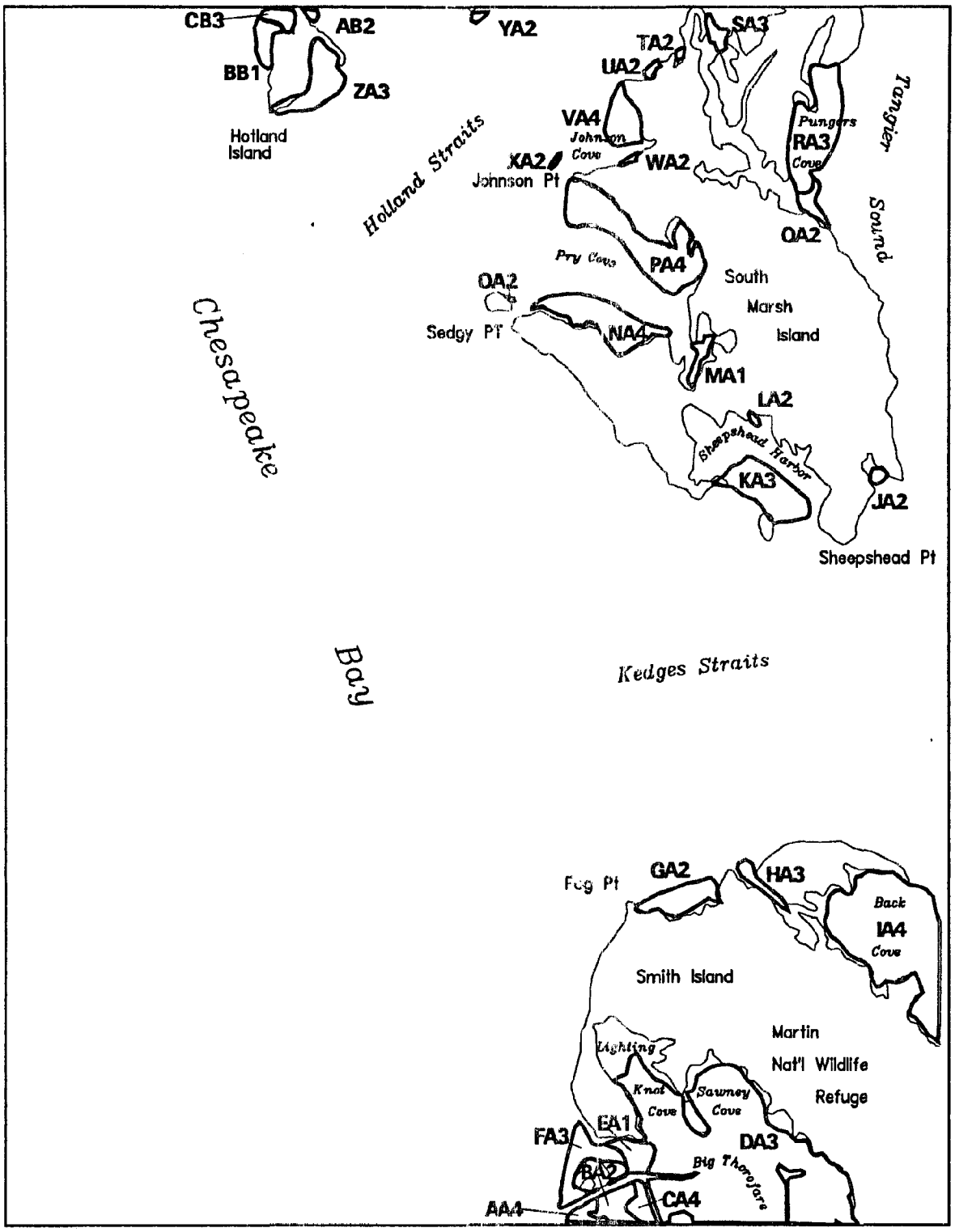
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 07-15-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Kedges Straits, MD. (091)



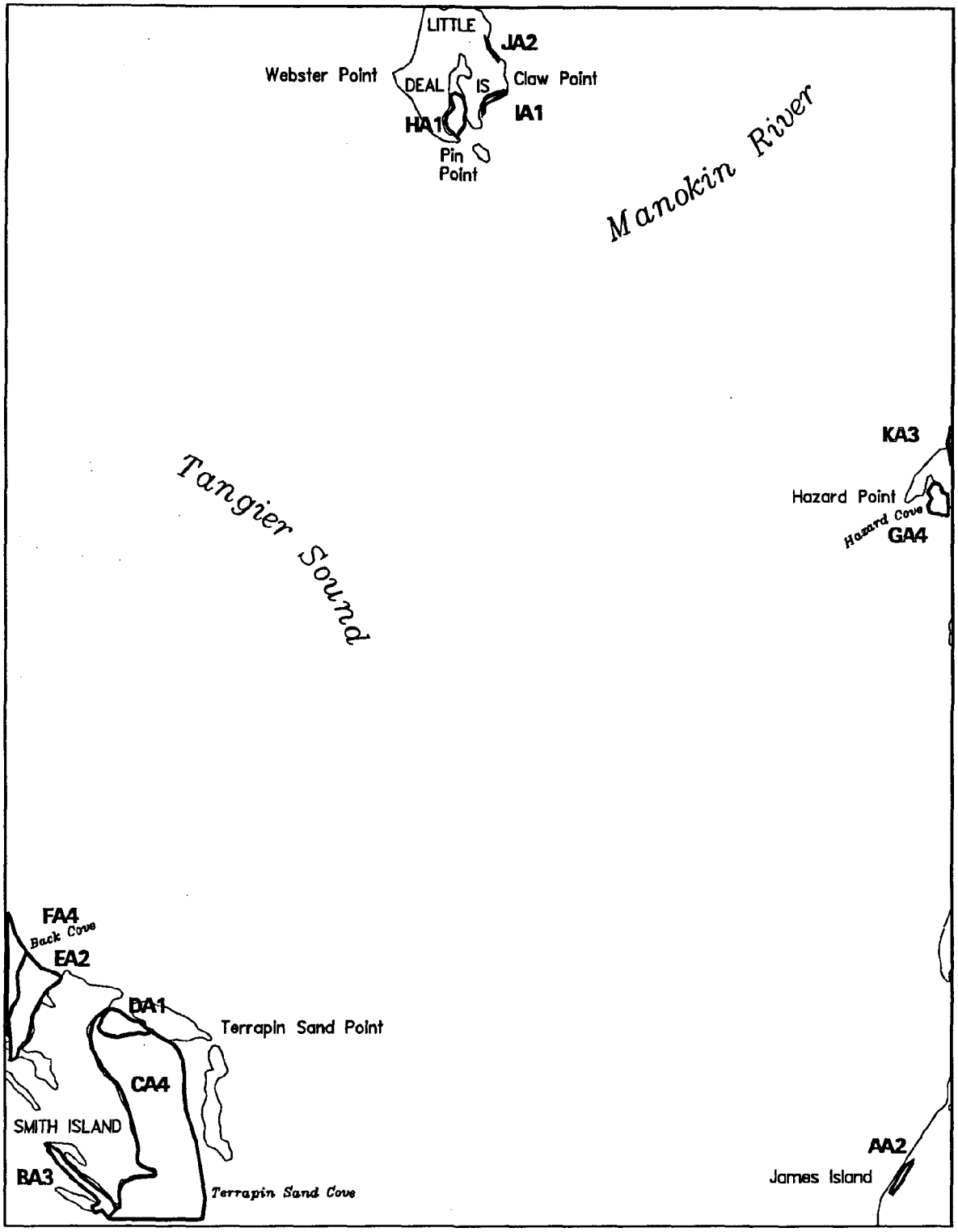
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-14-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Terrapin Sand Point, MD. (092)



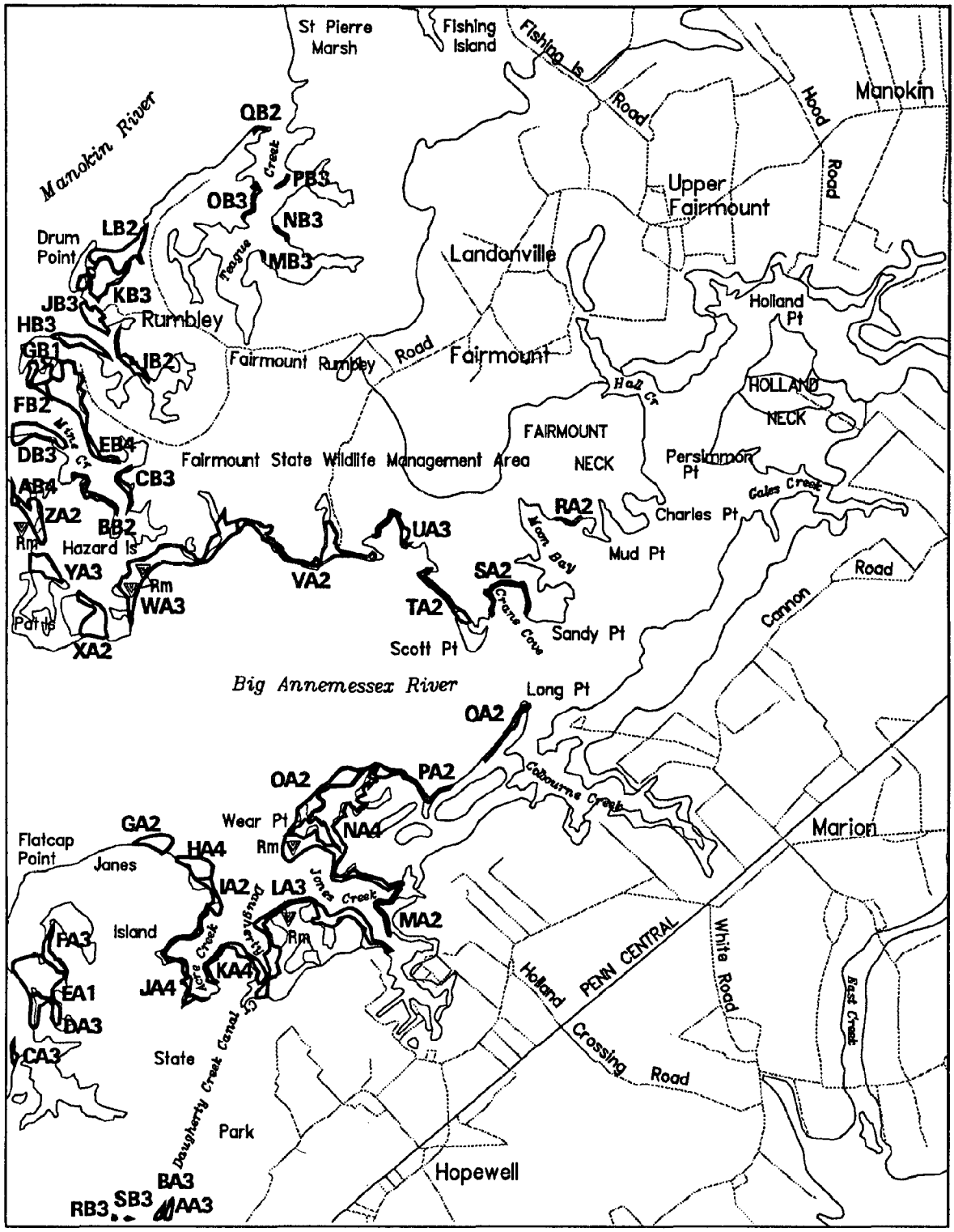
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-14-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Marion, MD. (093)



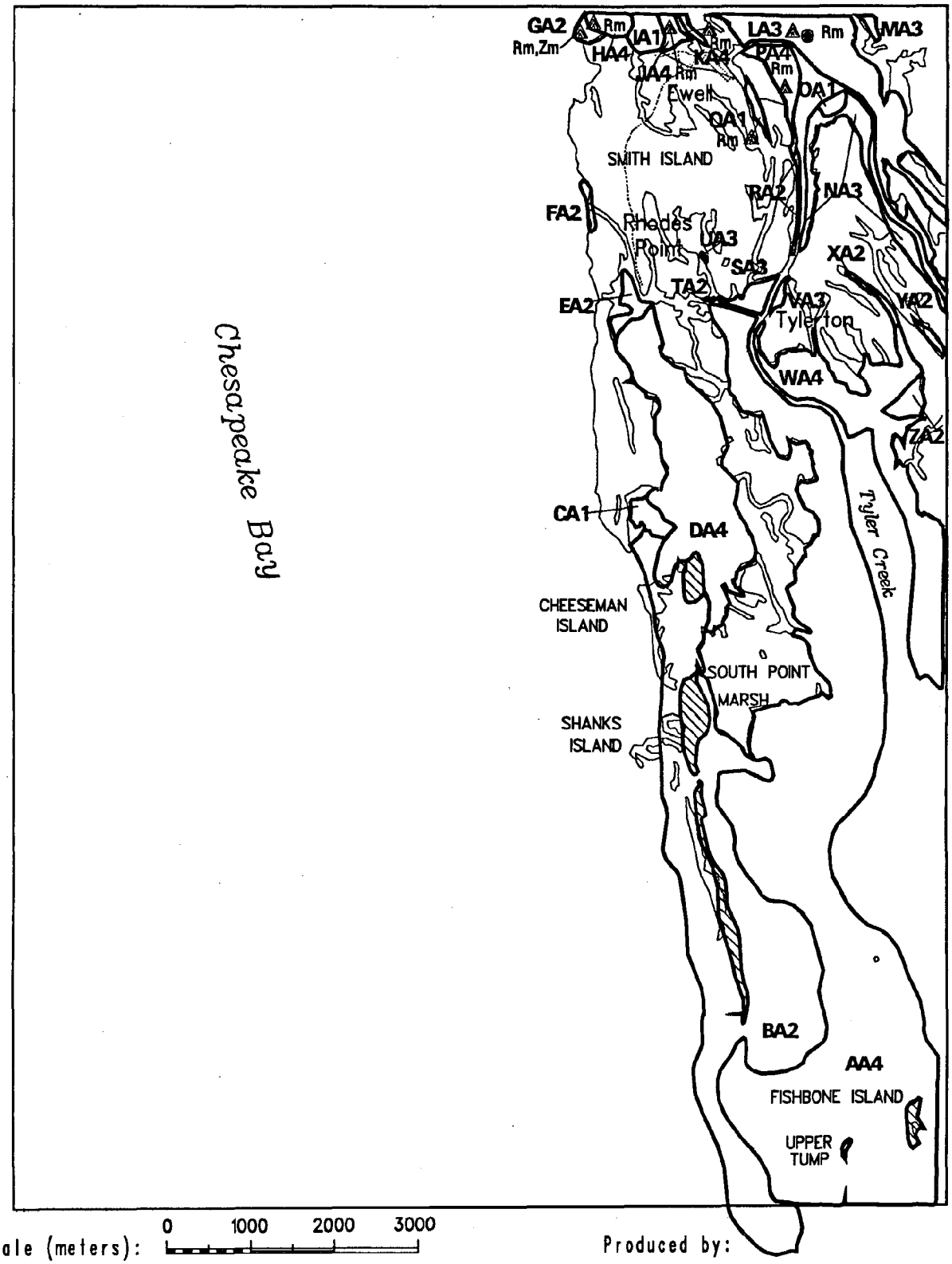
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-14-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Ewell, MD.-VA. (099)



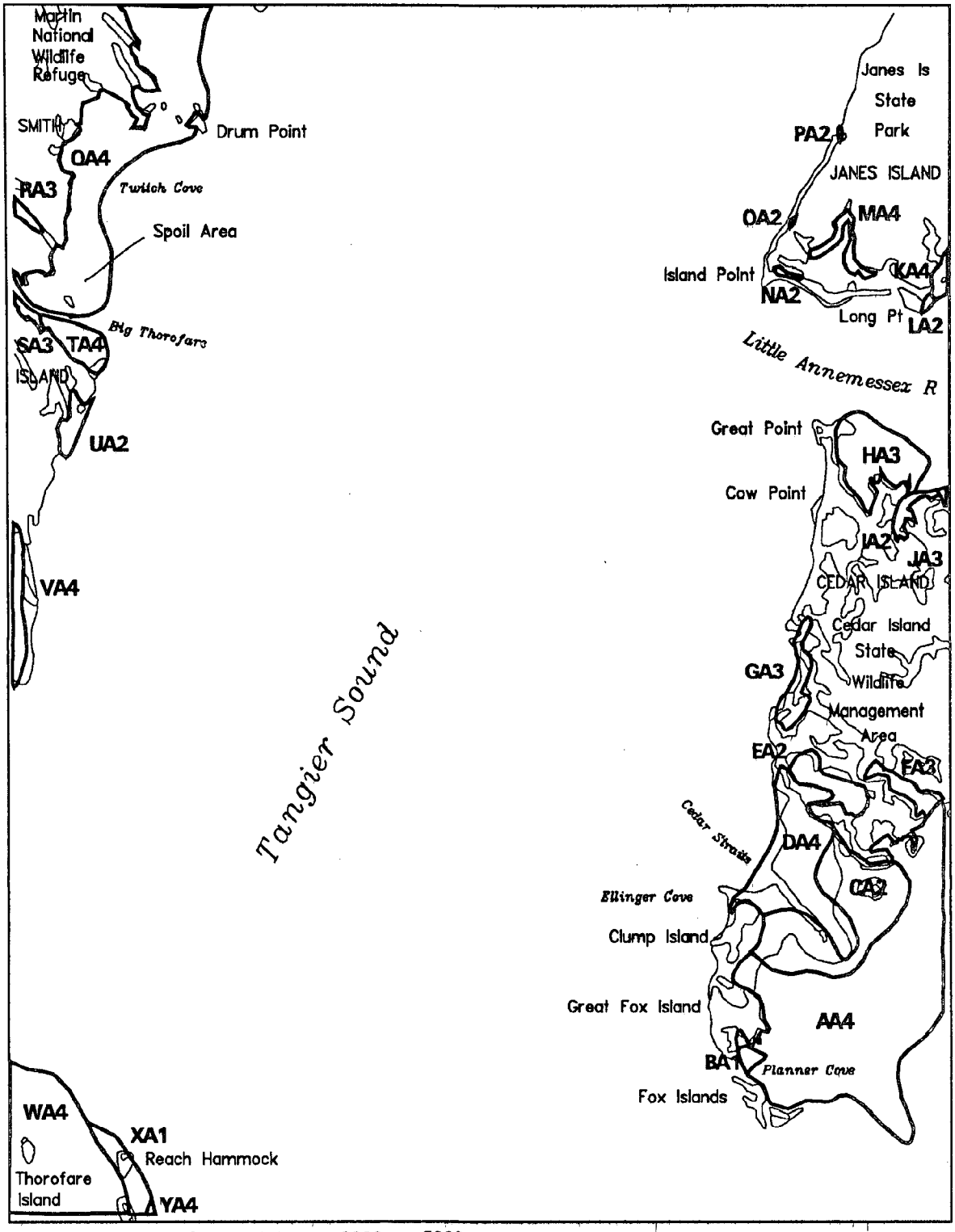
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-14-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Great Fox Island, MD.-VA. (100)



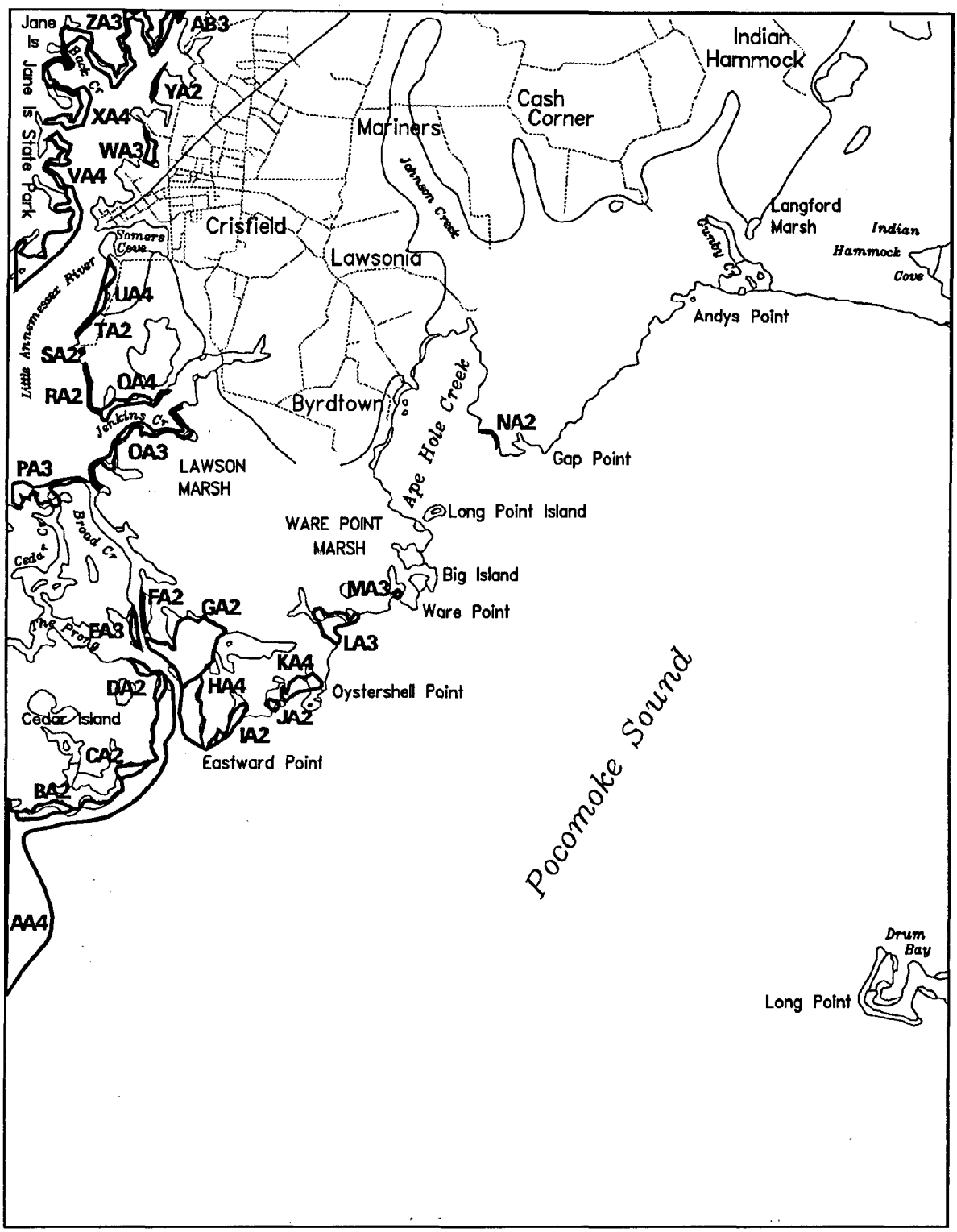
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-14-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Crisfield, MD.-VA. (101)



0 1000 2000 3000

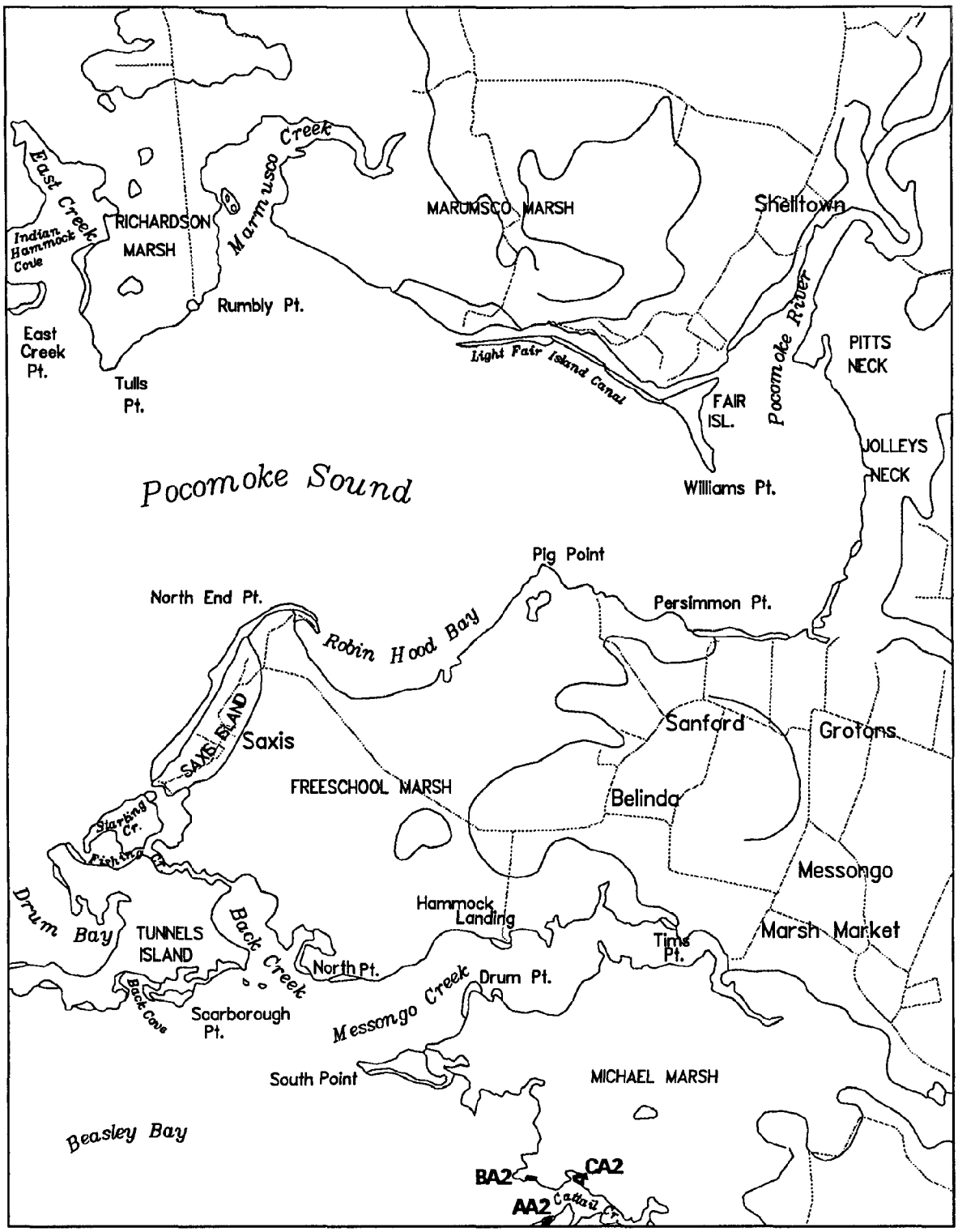
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-14-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Saxis, VA.-MD. (102)



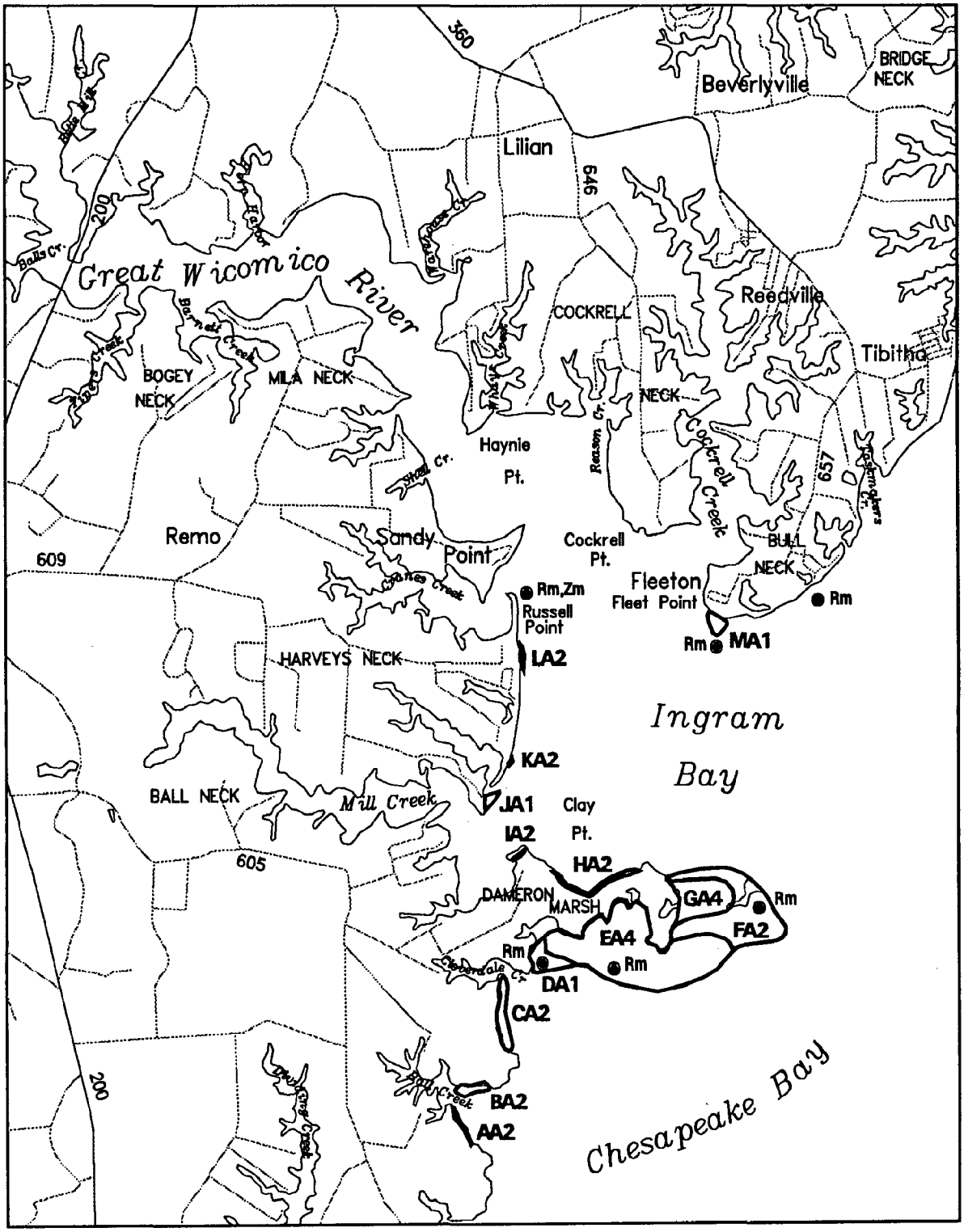
Scale (meters): 0 1000 2000 3000

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 05-16-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Reedville, VA. (106)



0 1000 2000 3000

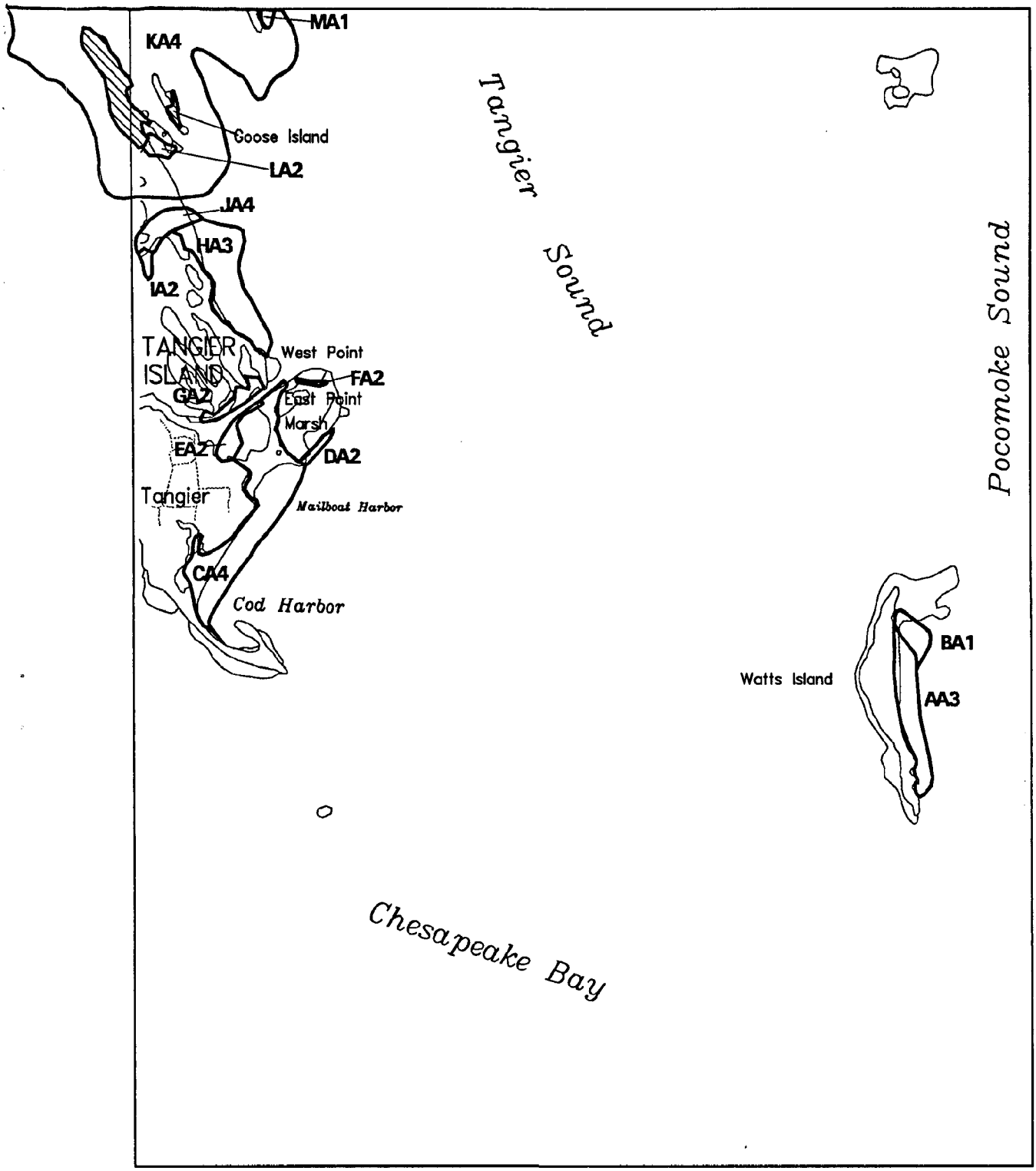
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 05-15-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Tangier Island, VA. (107)



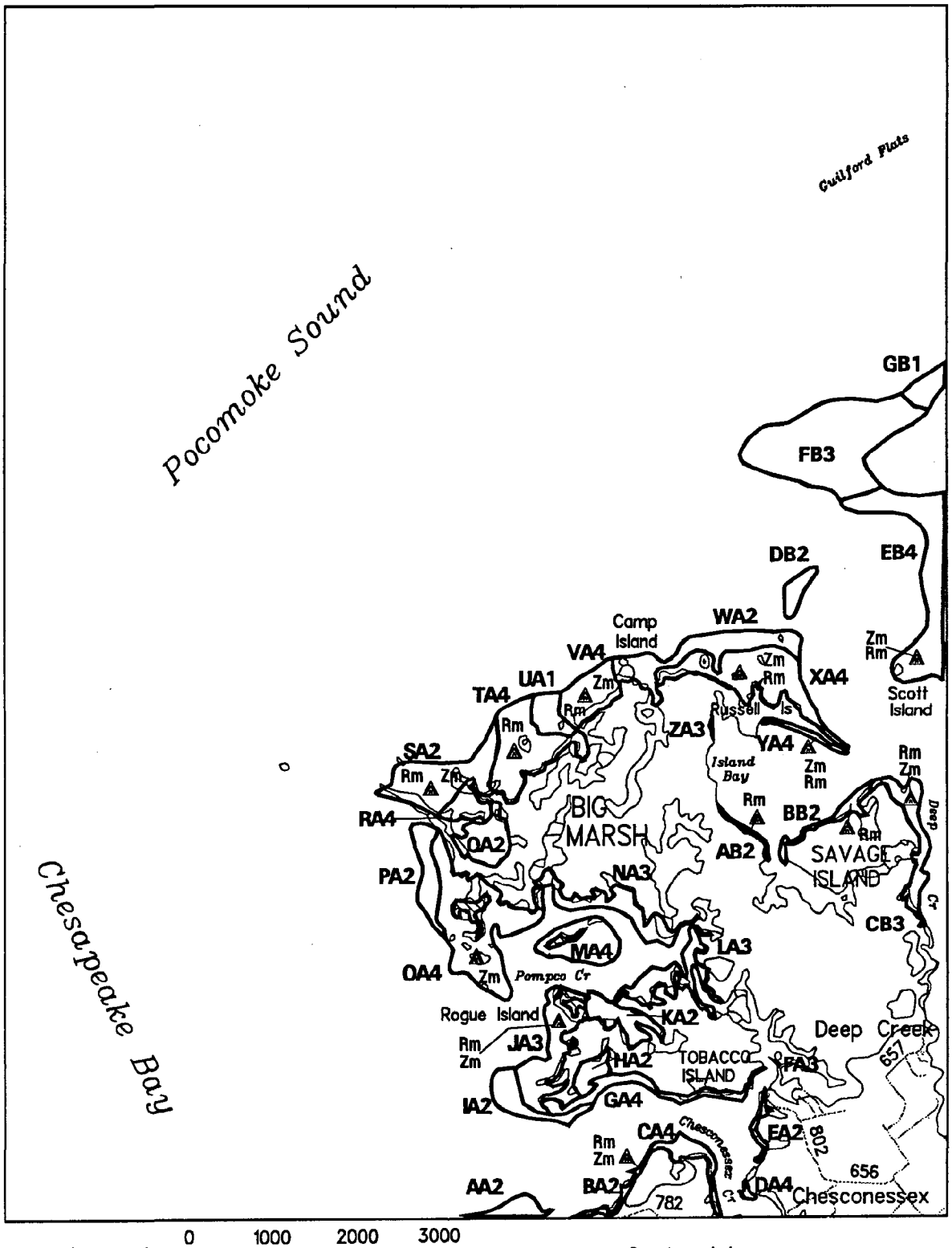
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-14-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Chesconessex, VA. (108)



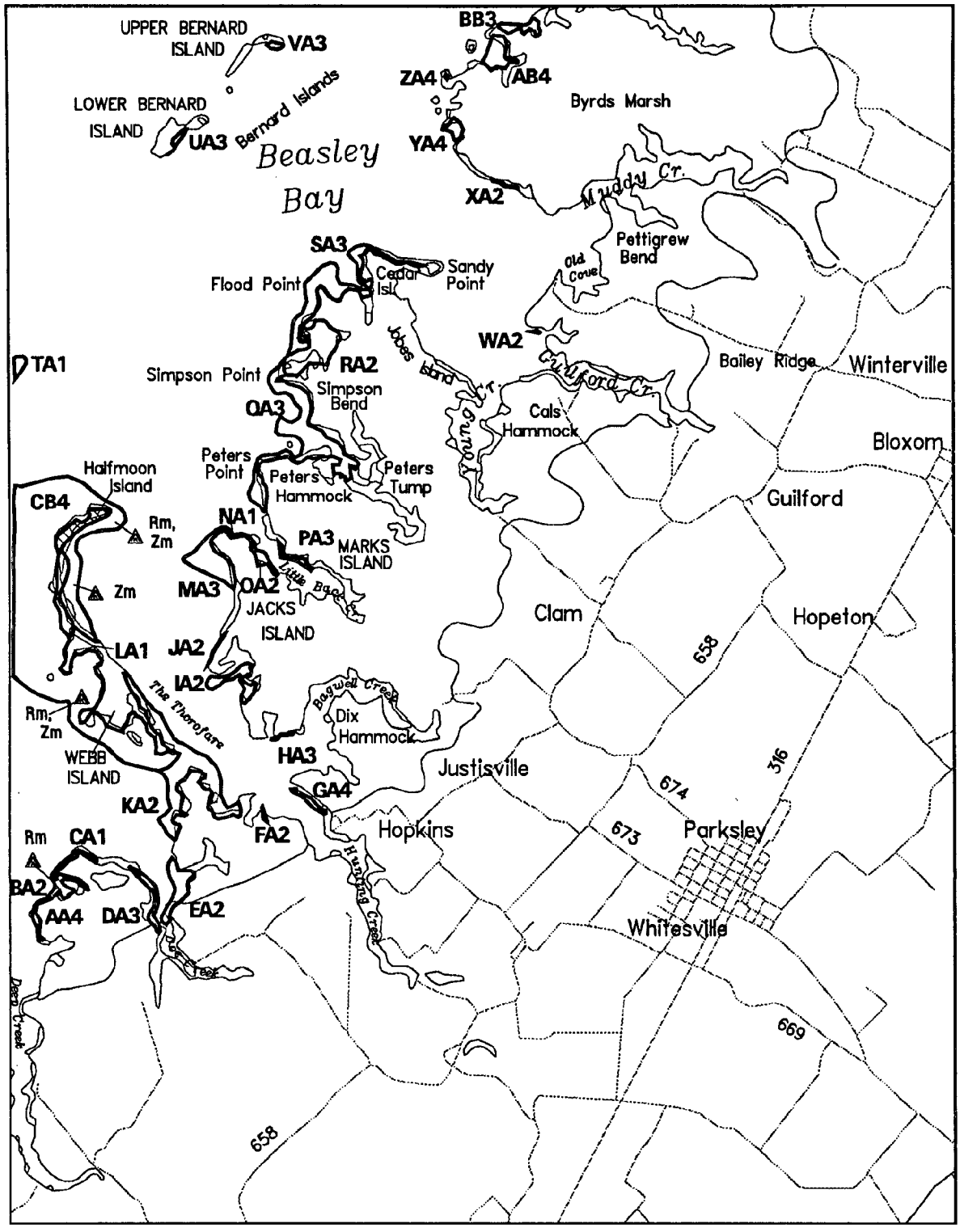
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-07-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Parksley, VA. (109)



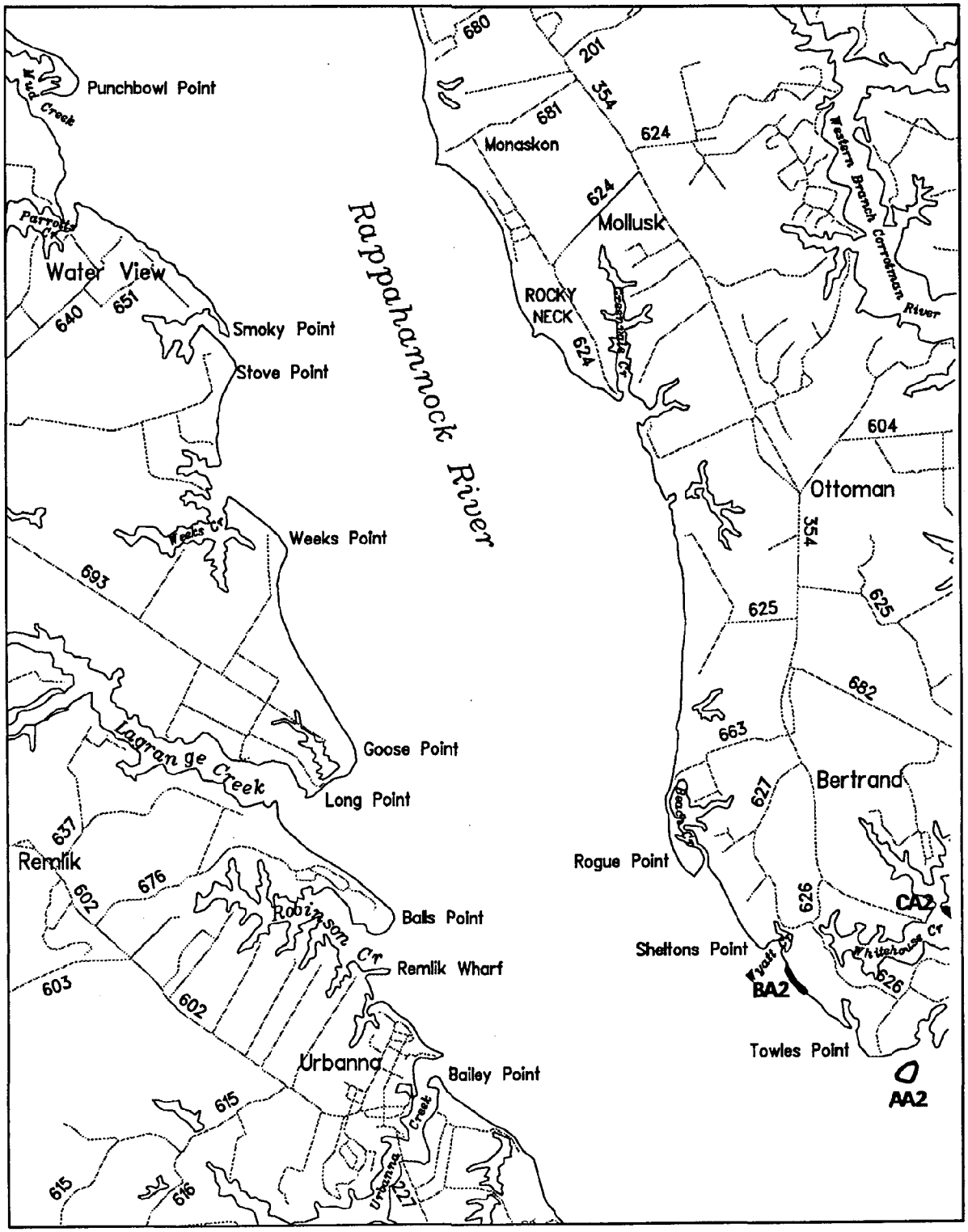
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 05-16-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Urbanna, VA. (110)



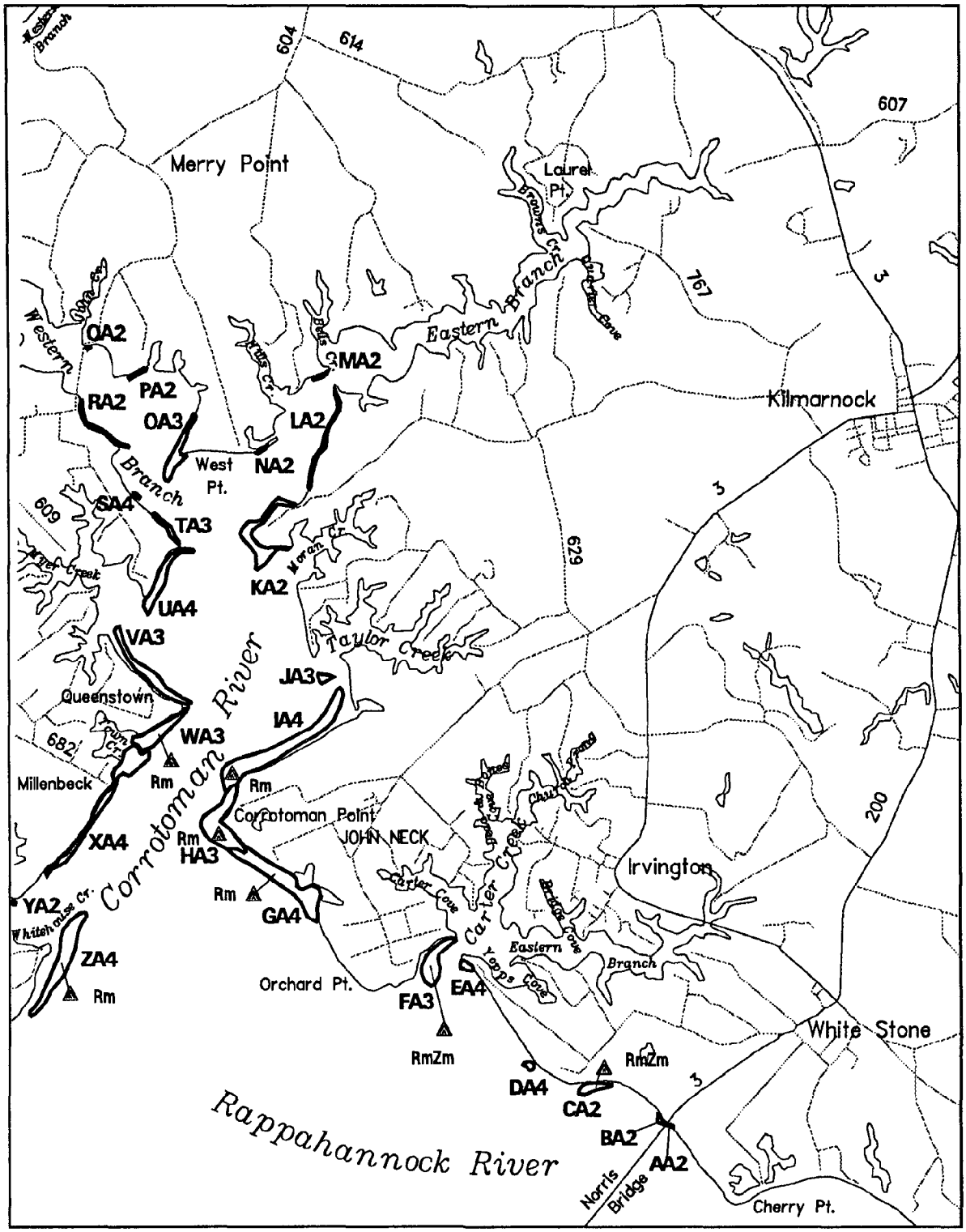
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

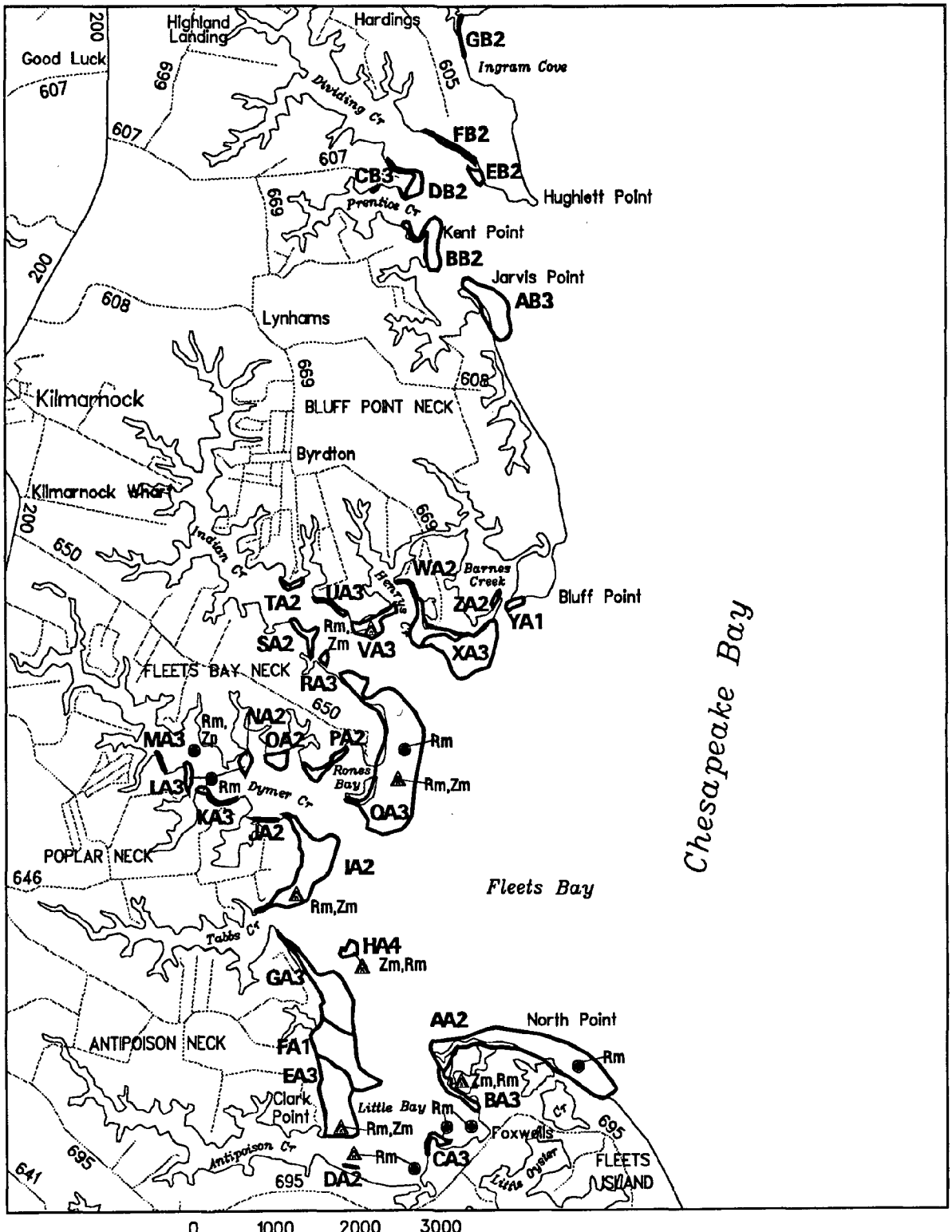
Date Flown: 05-15-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Irvington, VA. (111)



SUBMERGED AQUATIC VEGETATION 1991
Fleets Bay, VA. (112)



0 1000 2000 3000

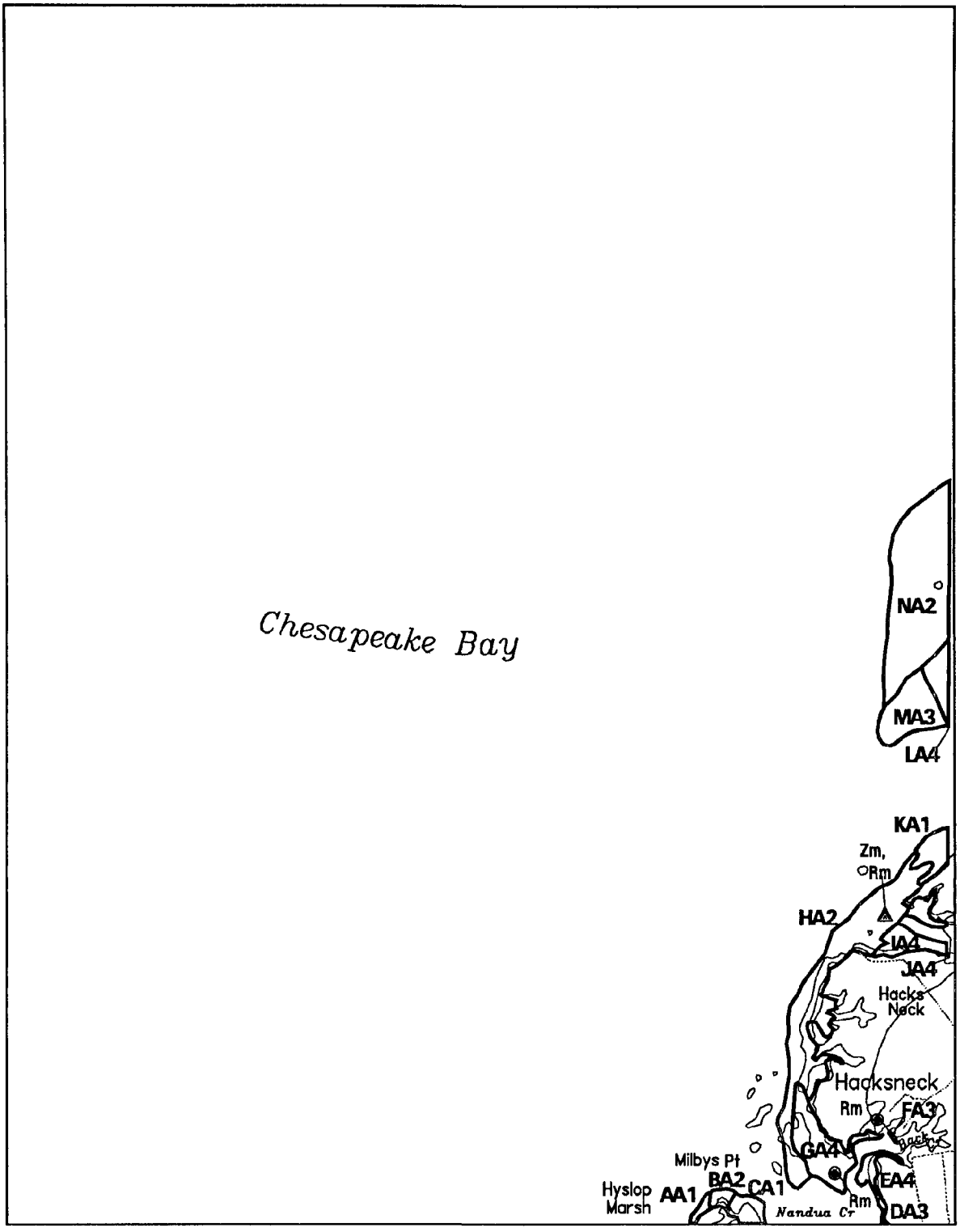
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 05-15-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Nandua Creek, VA. (113)



0 1000 2000 3000

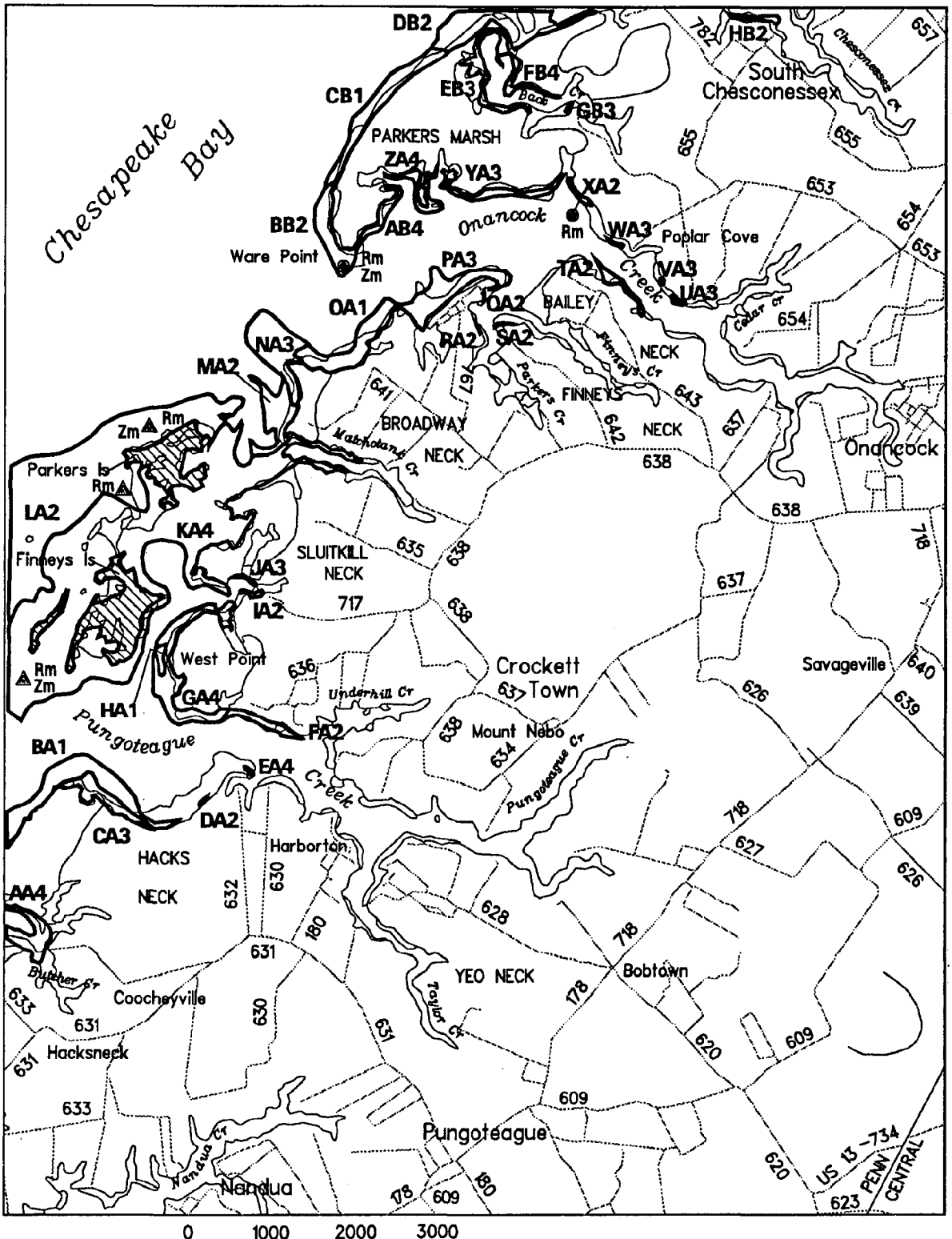
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-07-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Pungoteague, VA. (114)



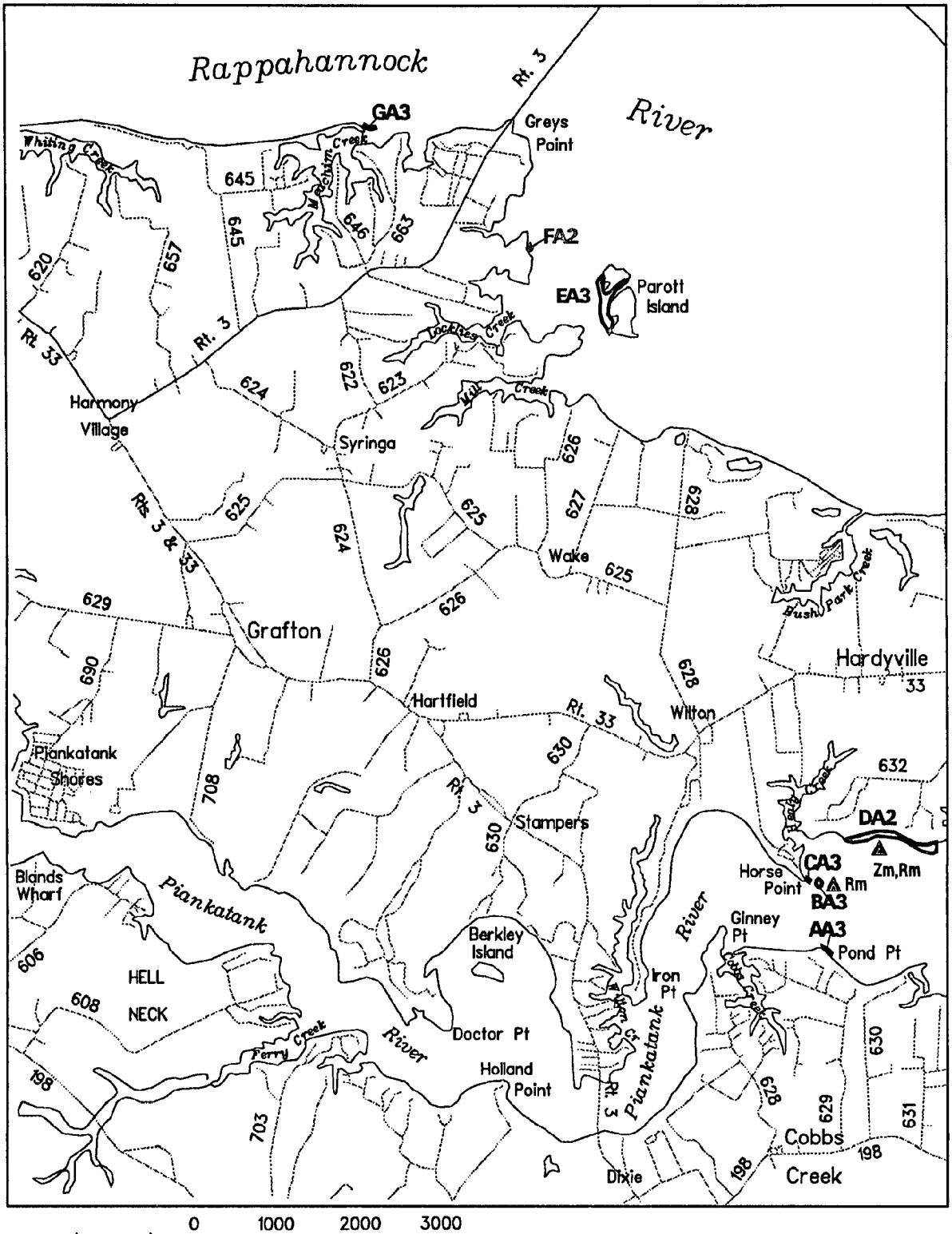
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-07-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Wilton, VA. (117)



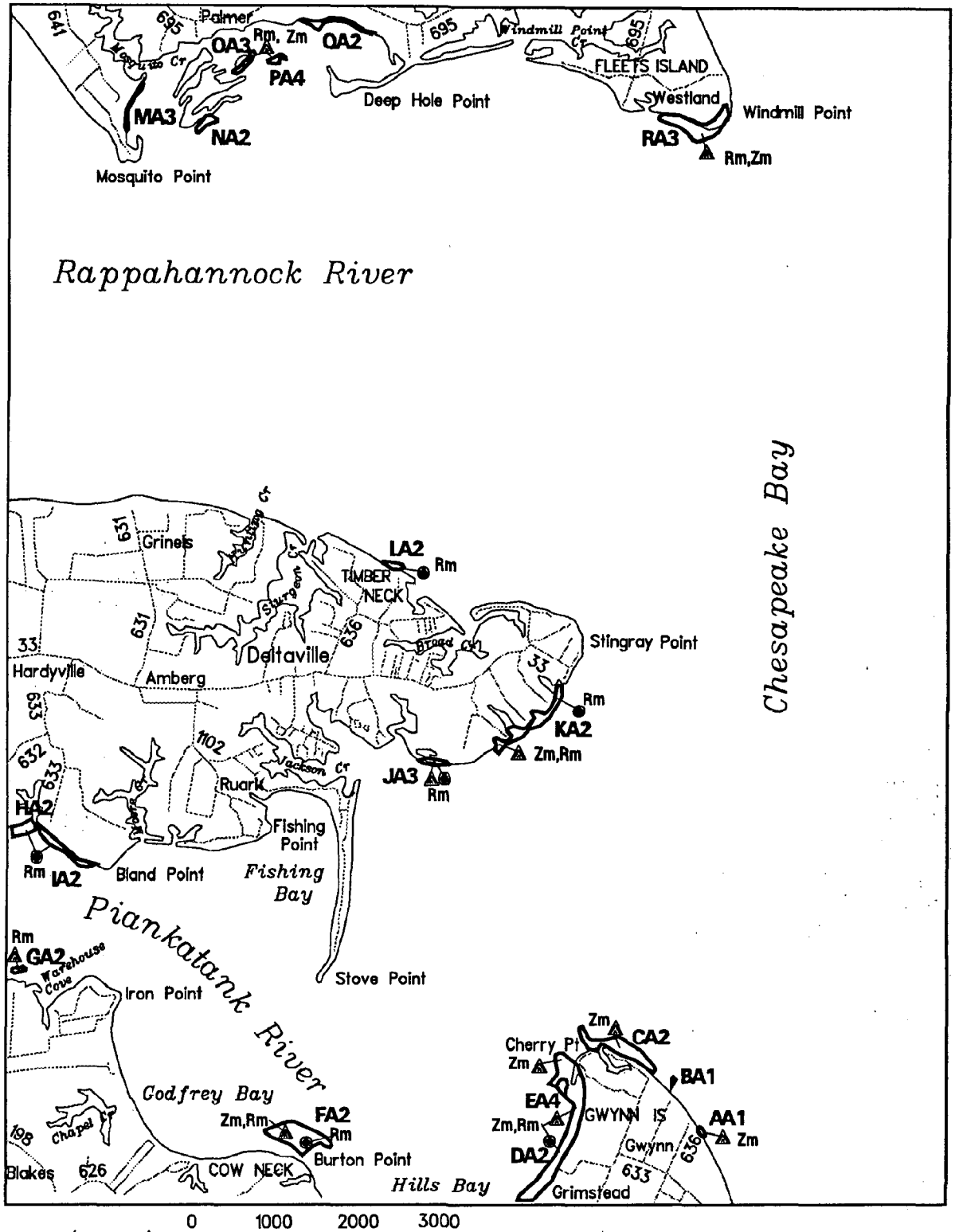
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 05-16-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Deltaville, VA. (118)



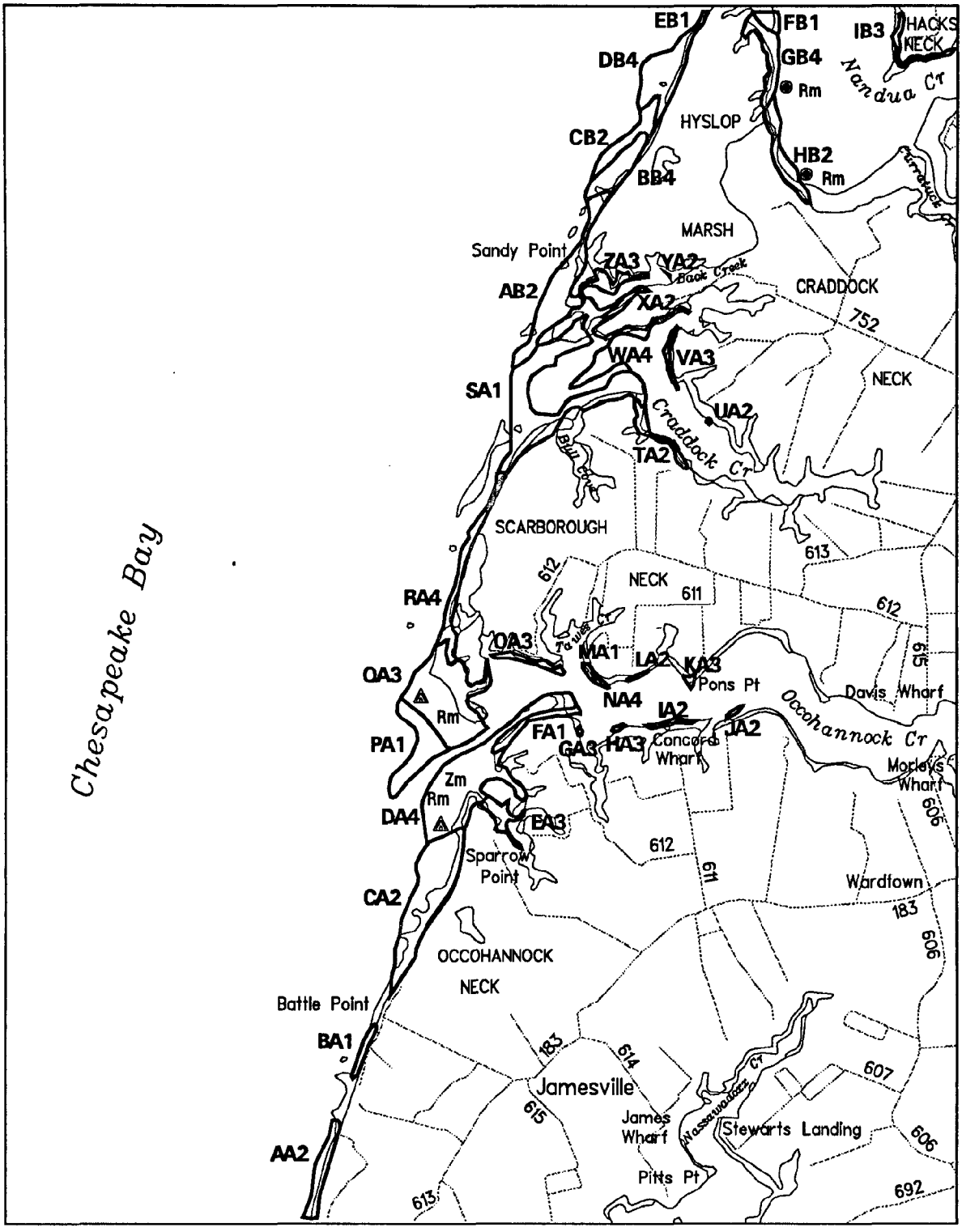
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 05-15-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Jamesville, VA. (119)



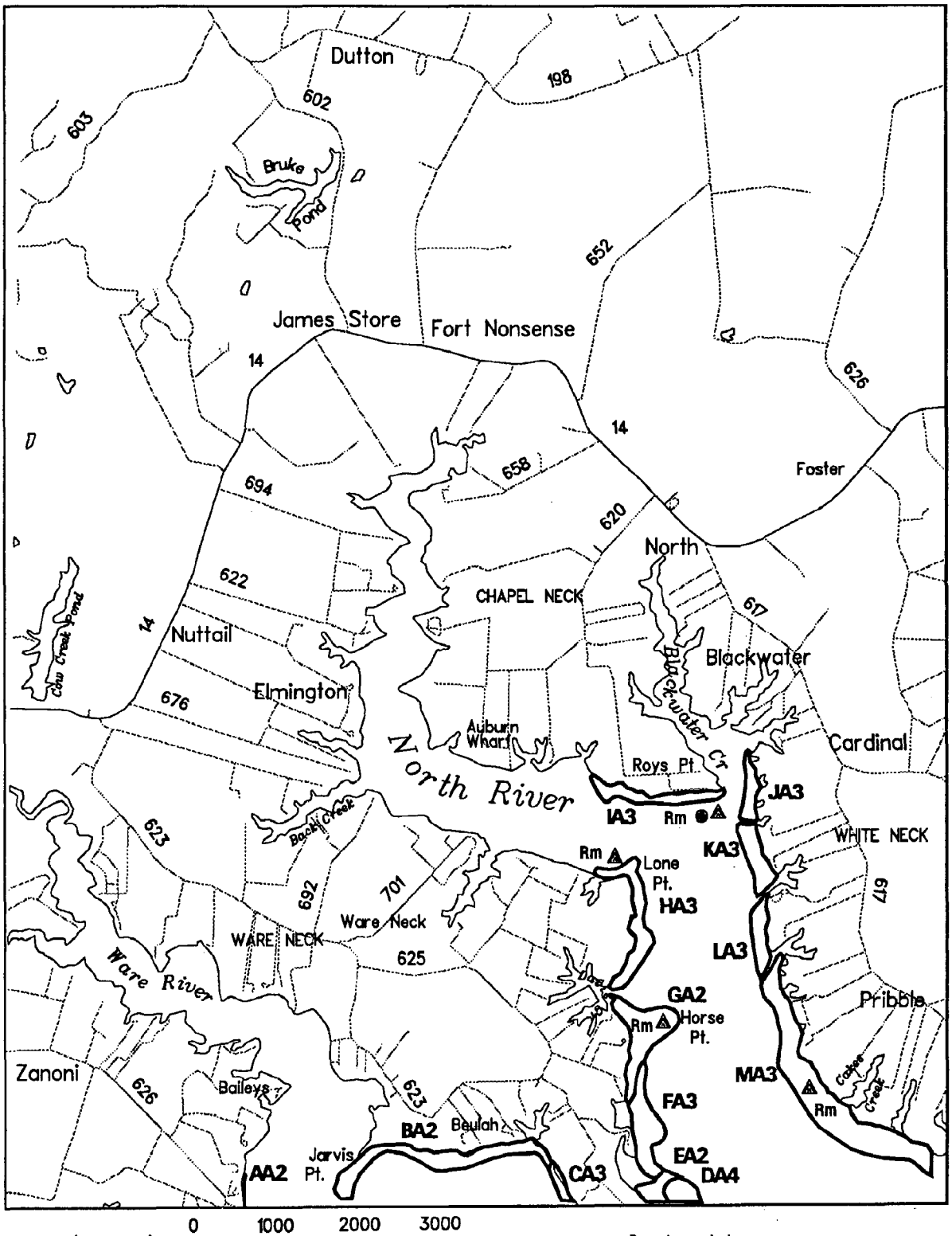
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-07-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Ware Neck, VA. (122)



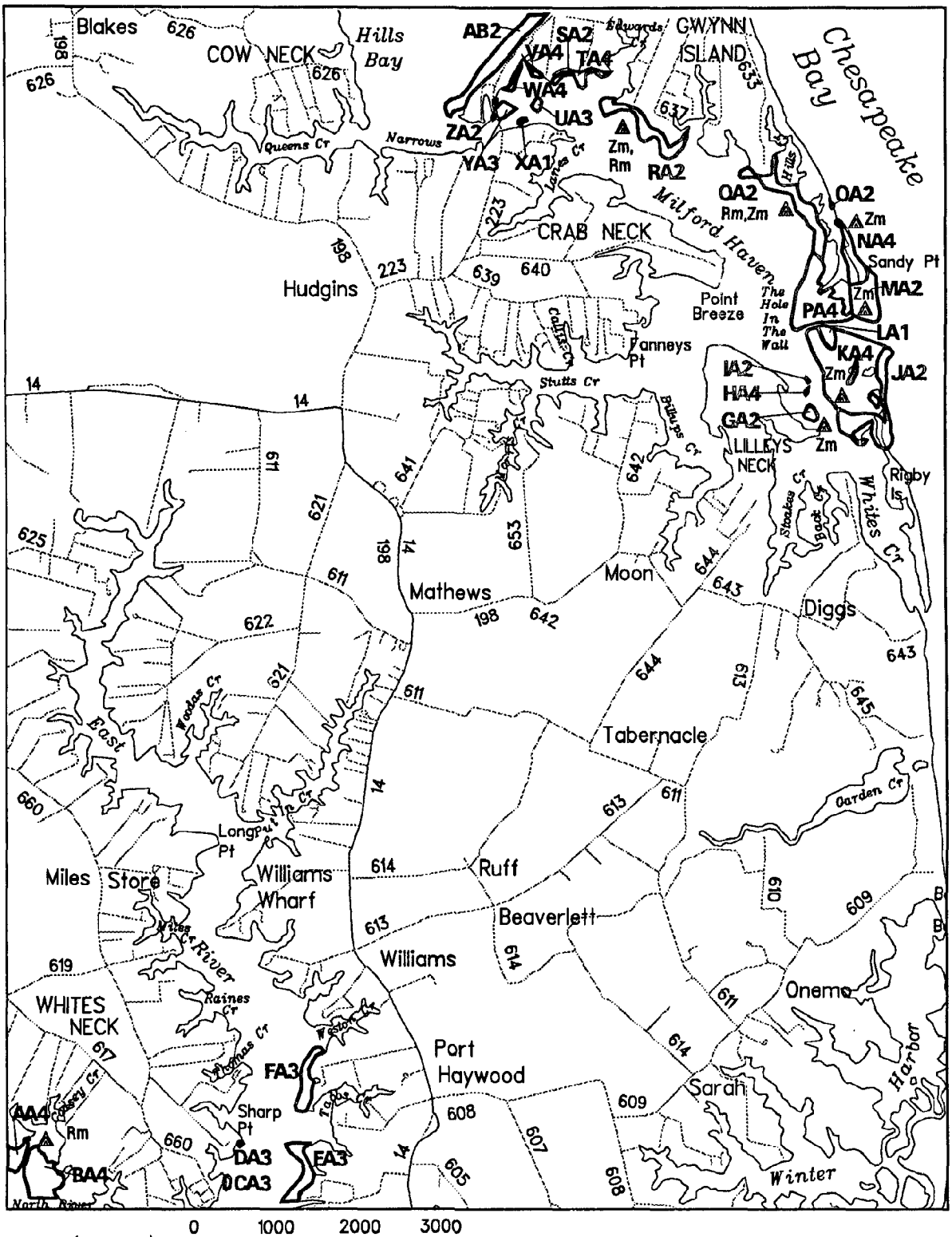
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 05-16-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Mathews, VA. (123)



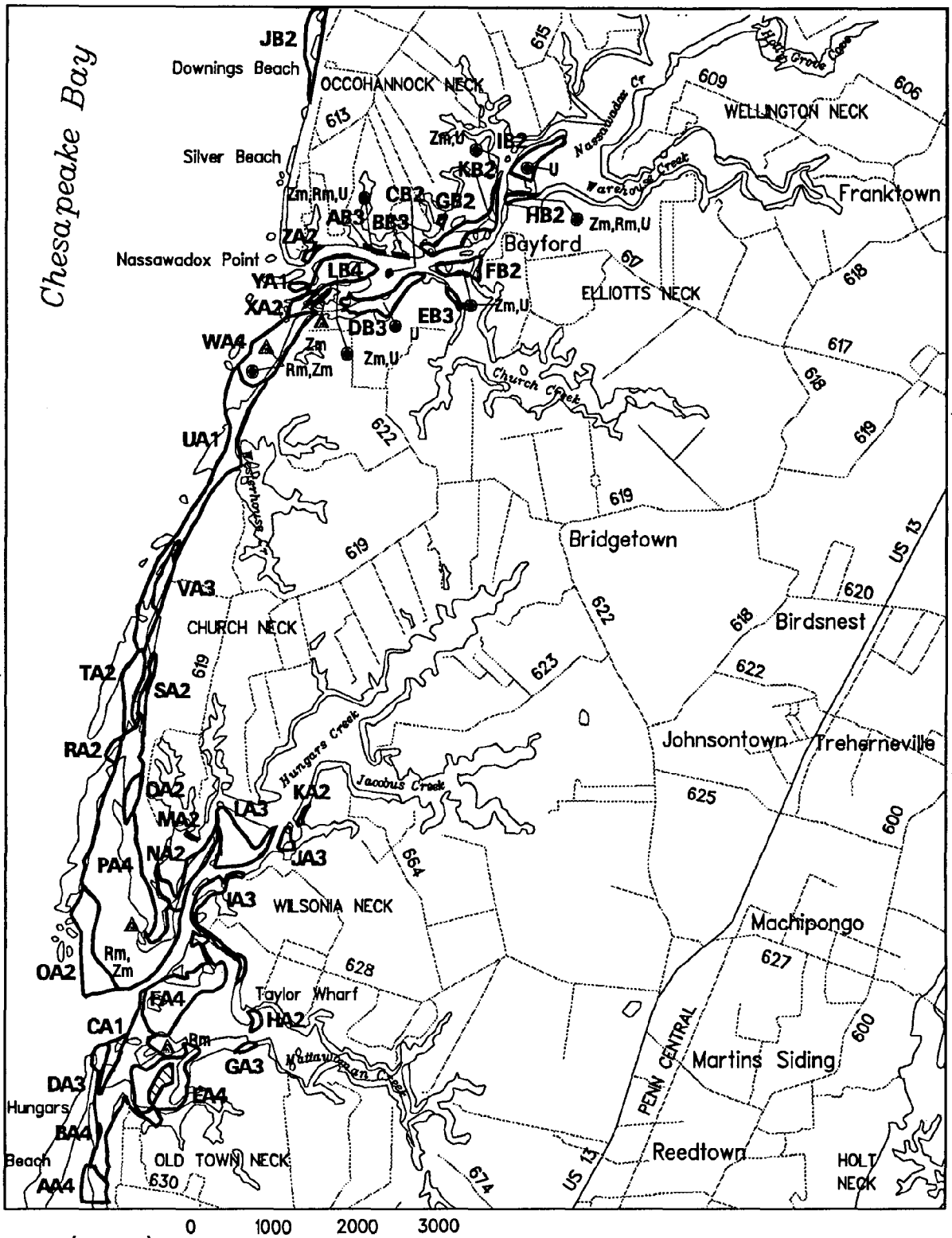
Scale (meters): 0 1000 2000 3000

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 05-16-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Franktown, VA. (124)



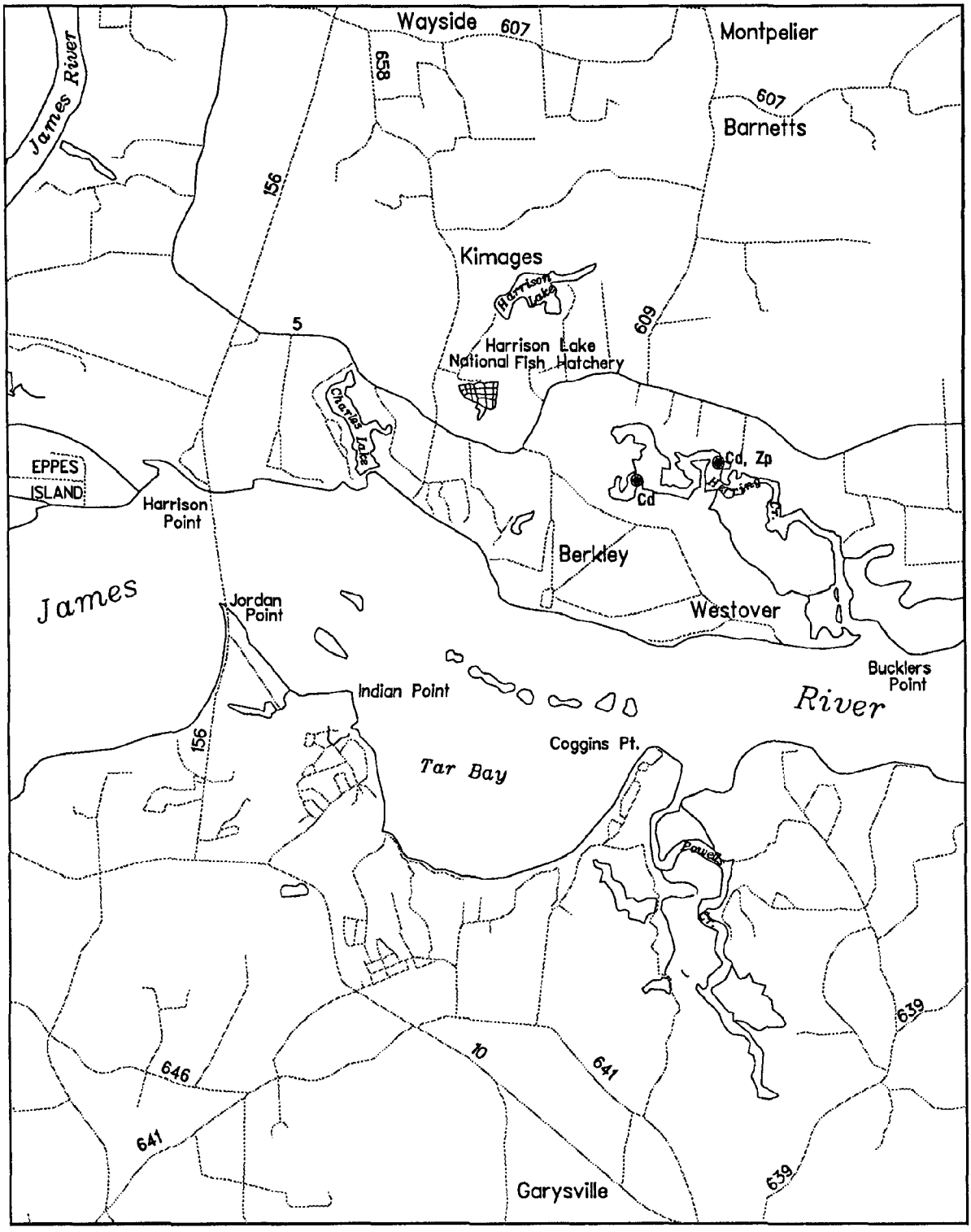
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-07-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Westover, VA. (125)



0 1000 2000 3000

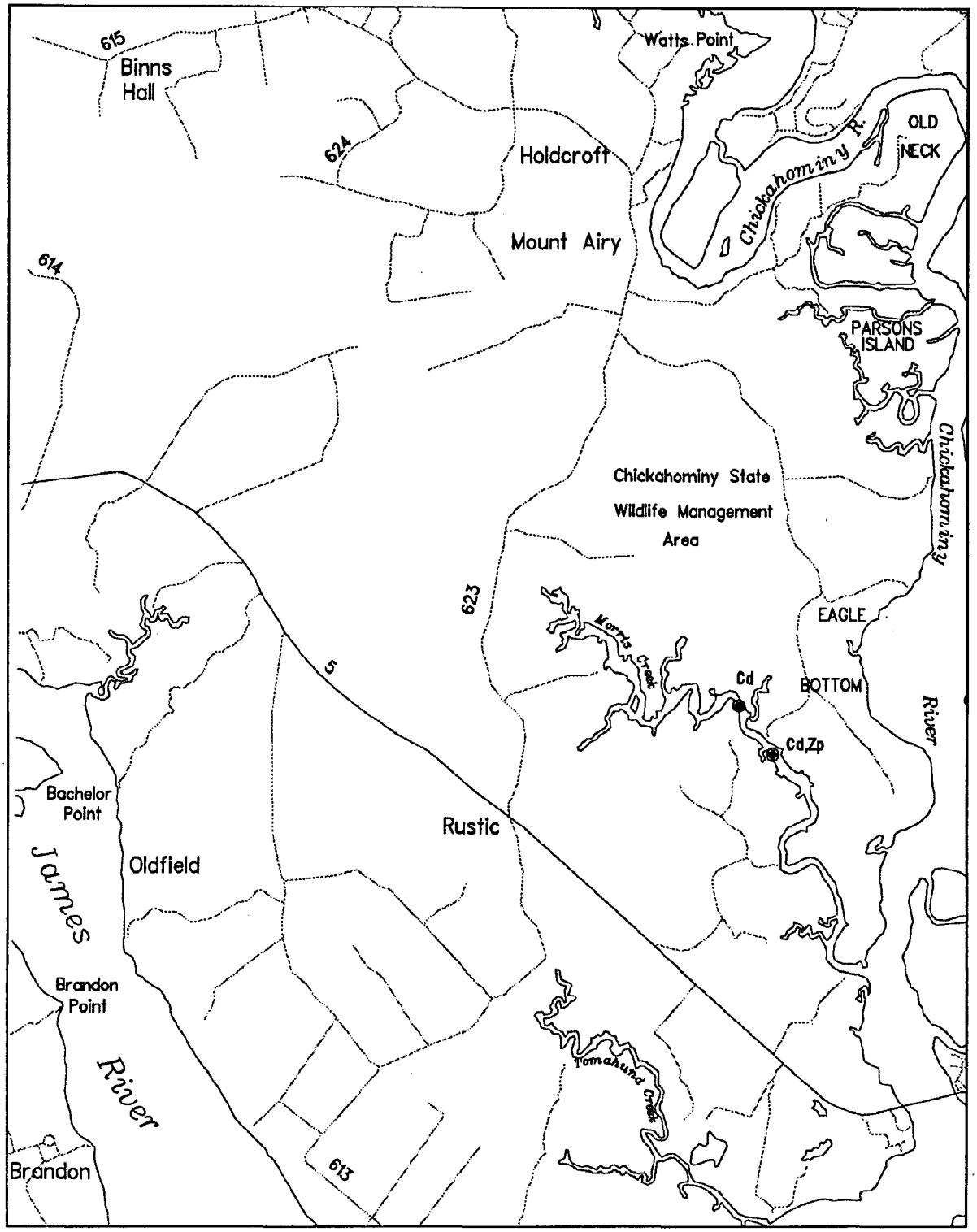
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: (not flown)

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Brandon, VA. (127)



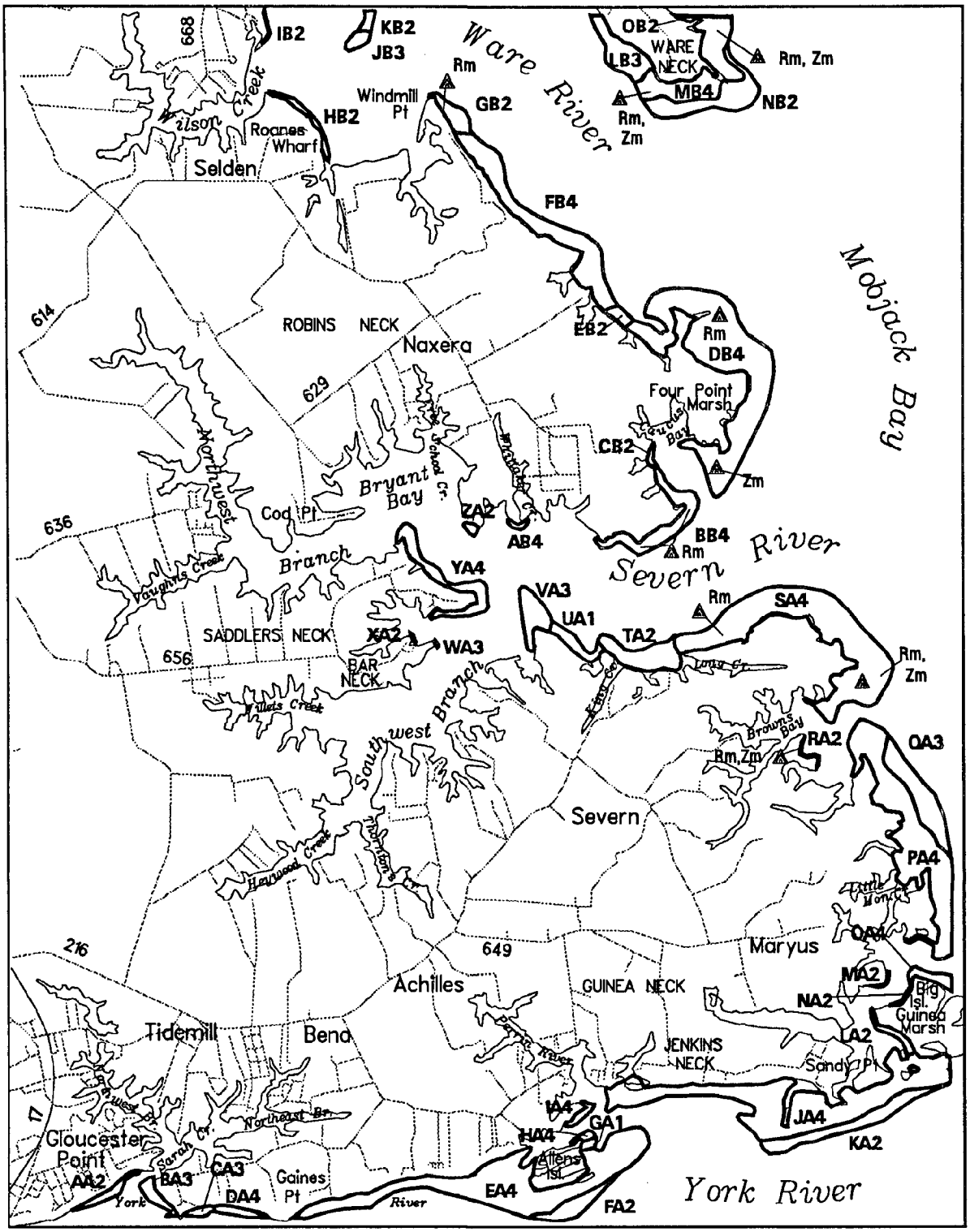
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: (not flown)

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Achilles, VA. (131)



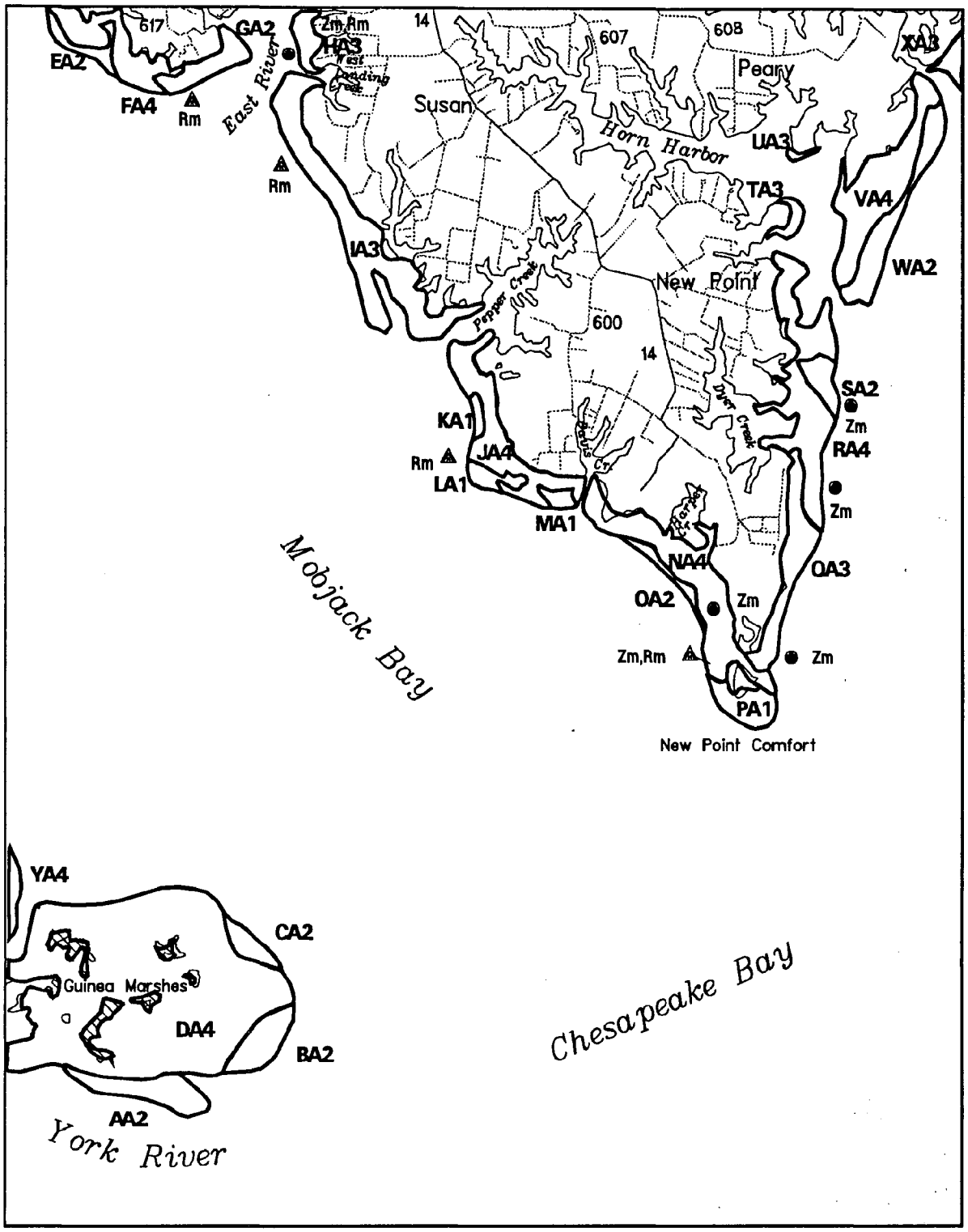
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 05-16-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
New Point Comfort, VA. (132)



0 1000 2000 3000

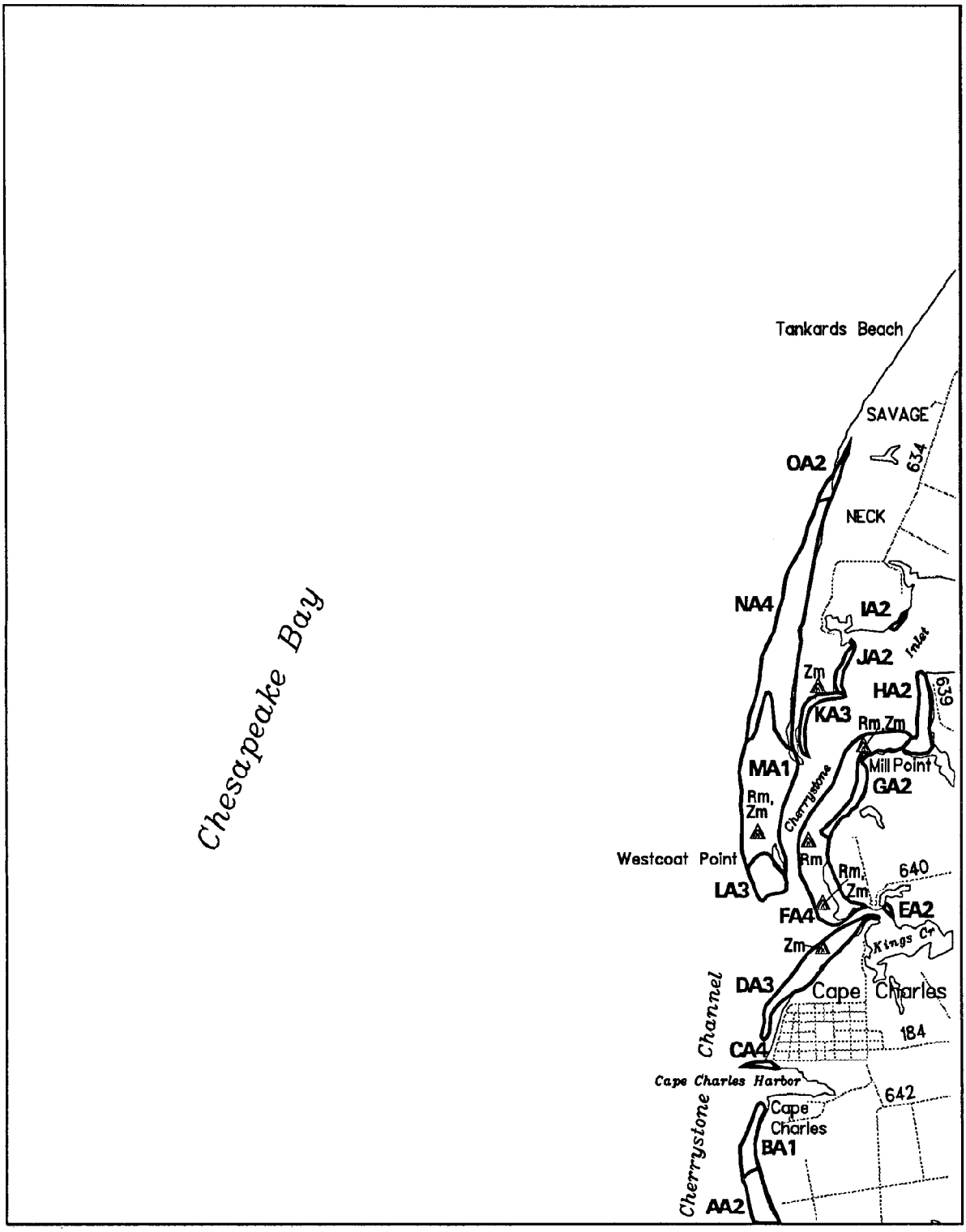
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-07-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Cape Charles, VA. (133)



0 1000 2000 3000

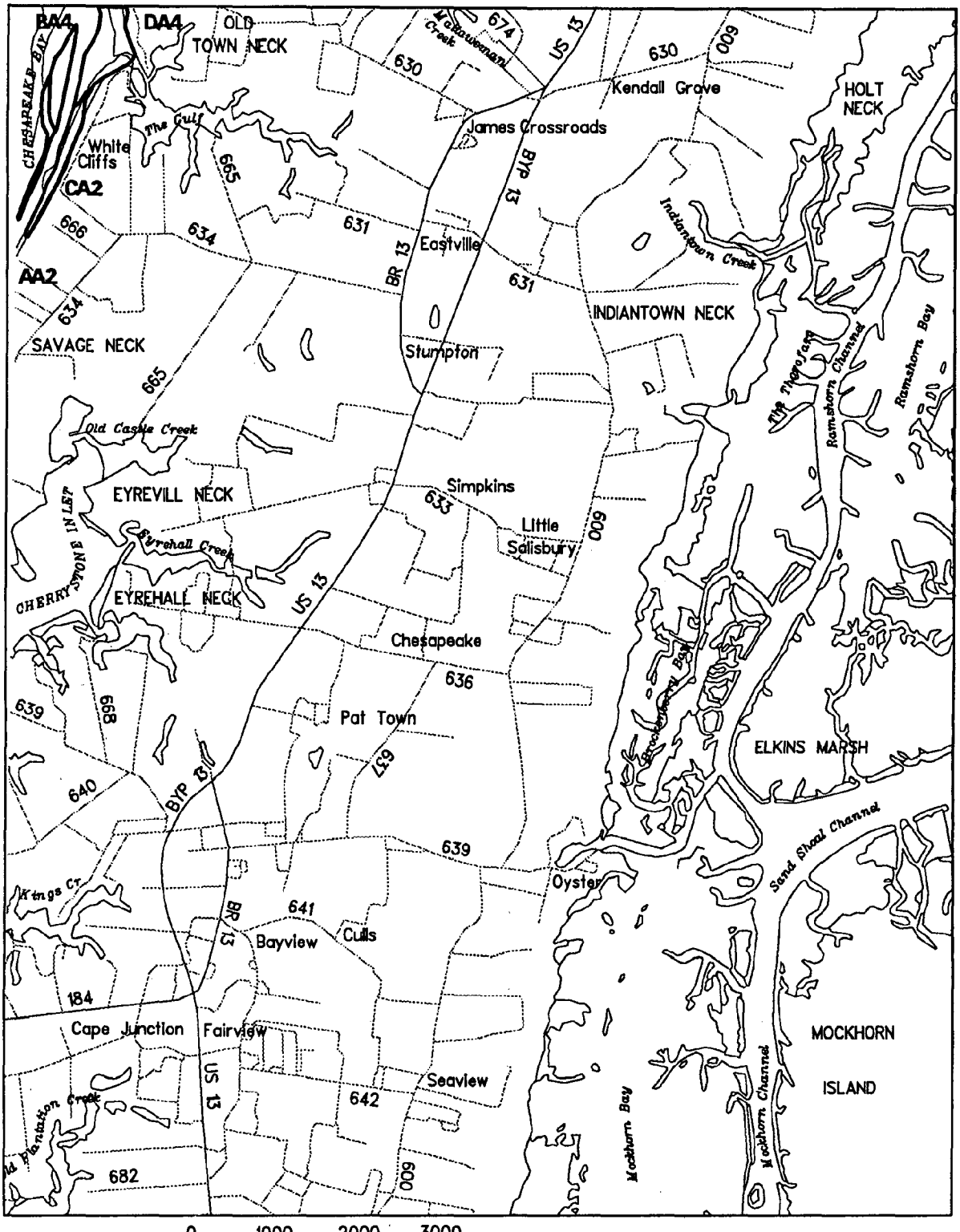
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-07-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Cheriton, VA. (134)



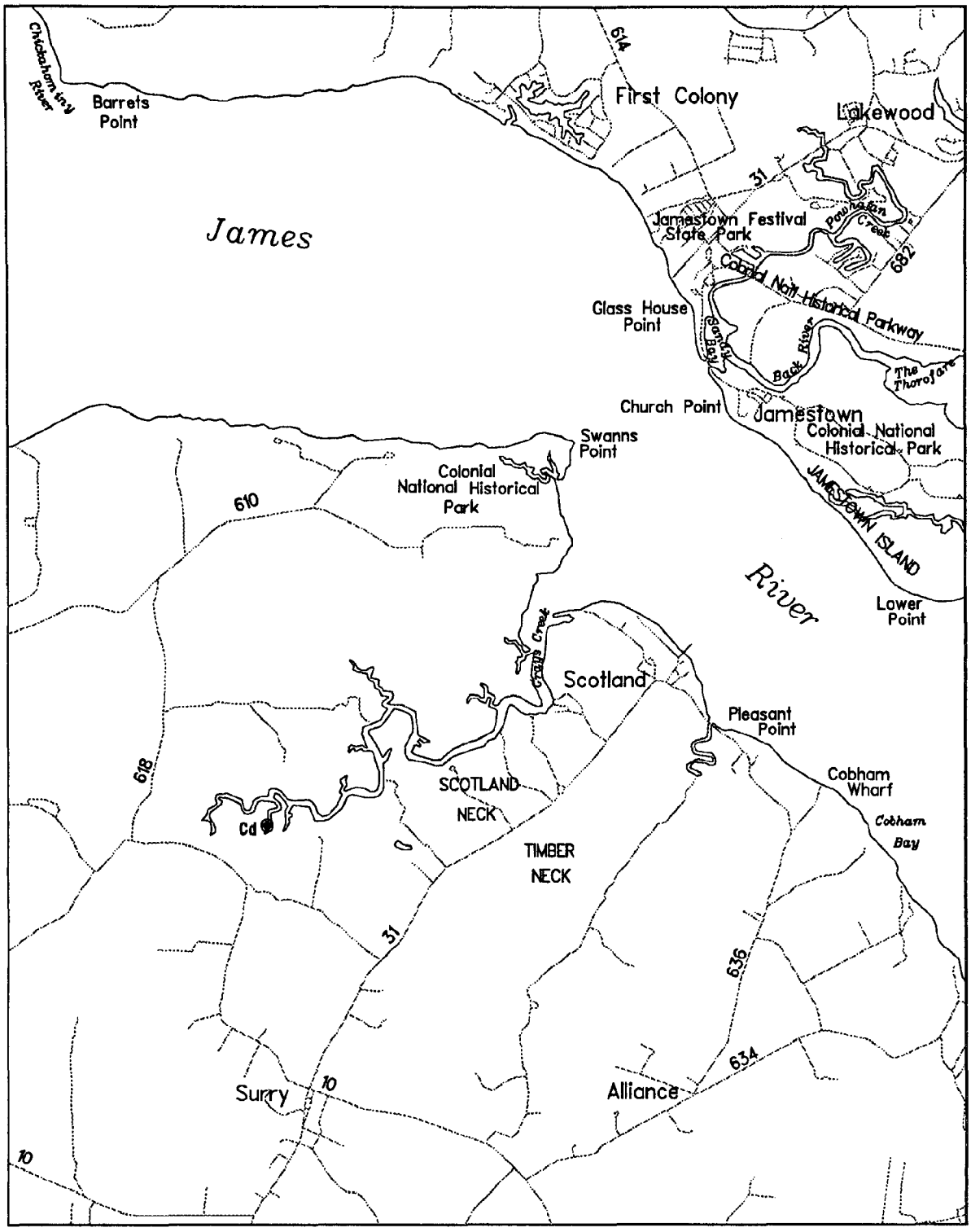
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-07-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Surry, VA. (137)



0 1000 2000 3000

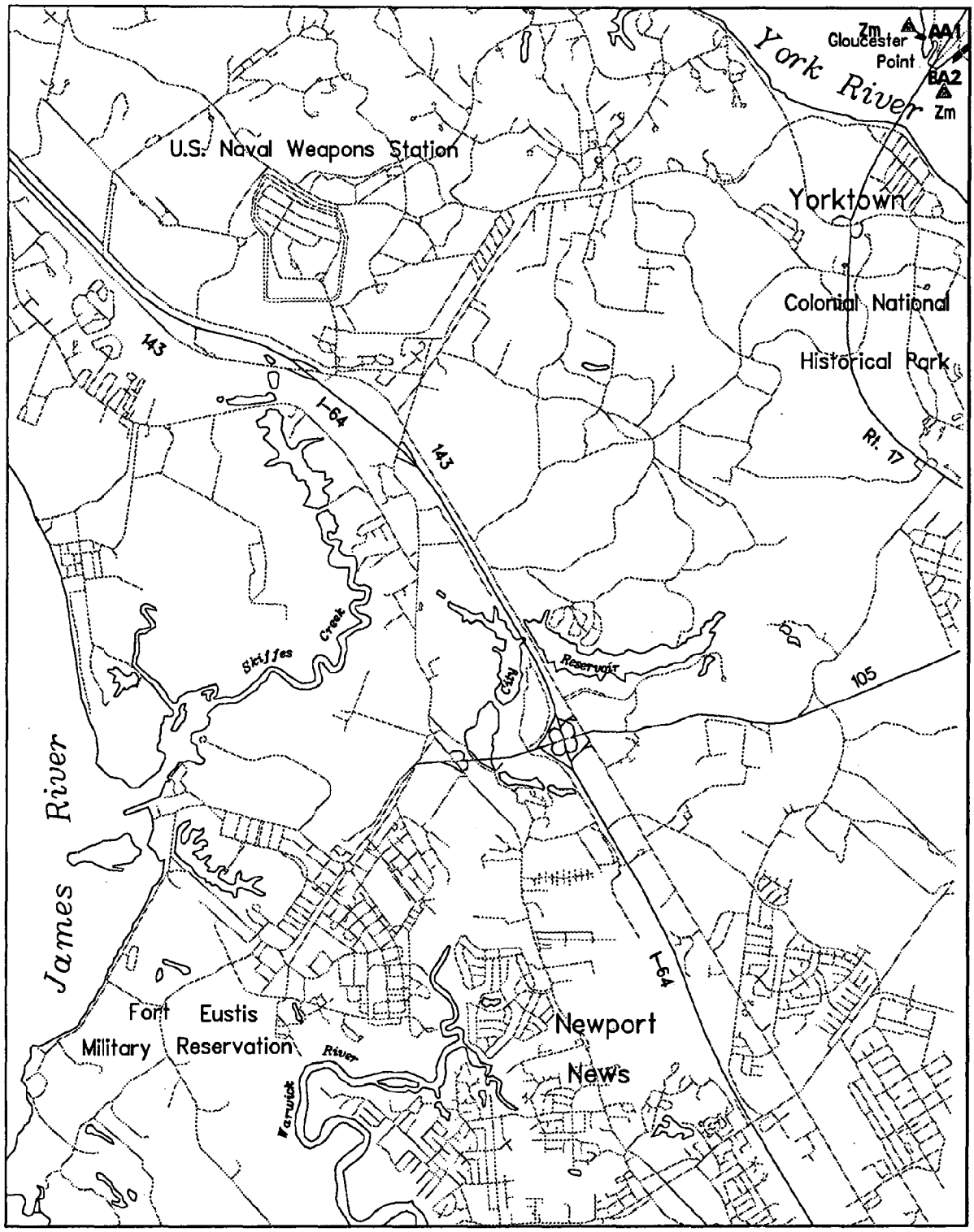
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: (not flown)

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Yorktown, VA. (139)



0 1000 2000 3000

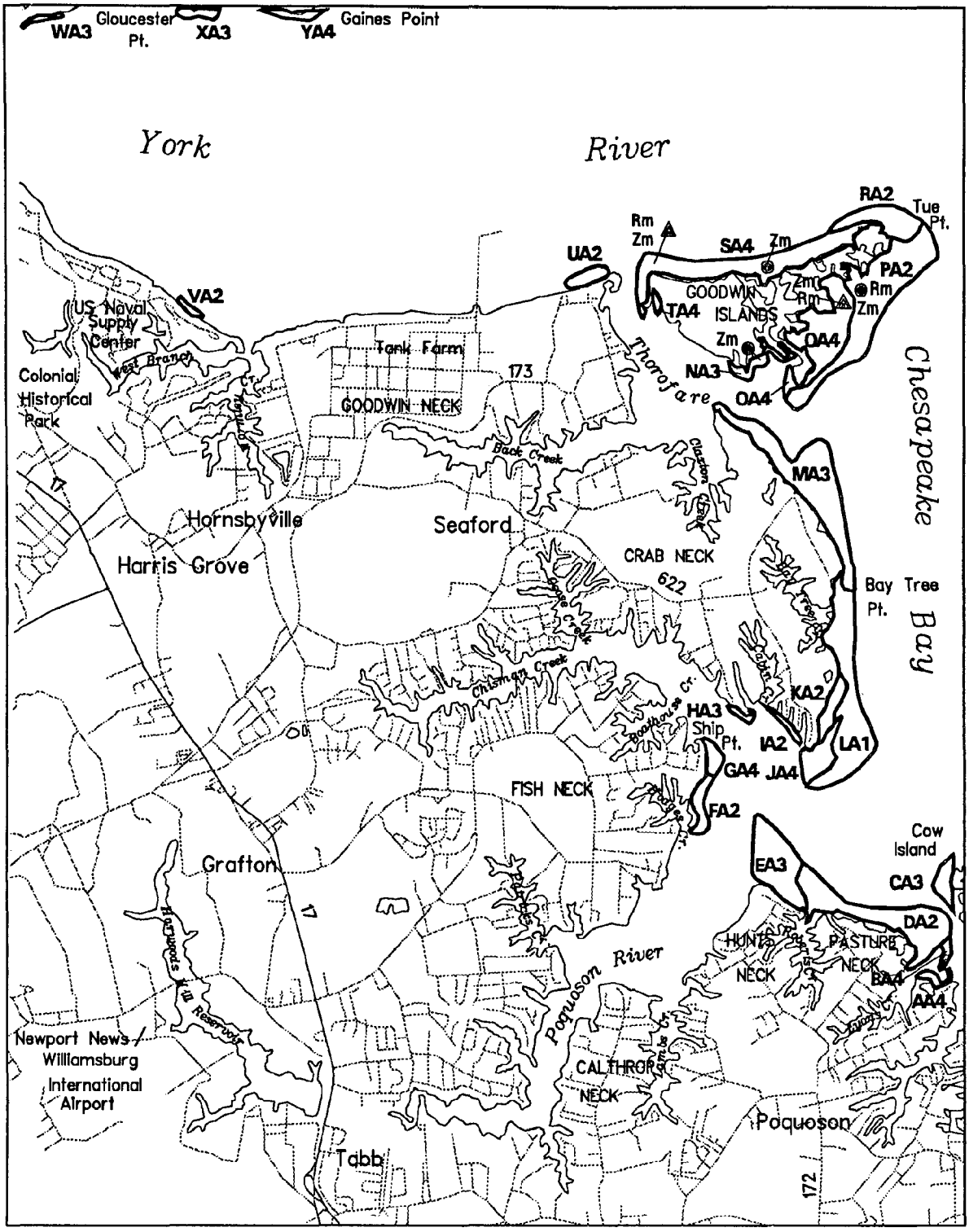
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 05-22-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Poquoson West, VA. (140)



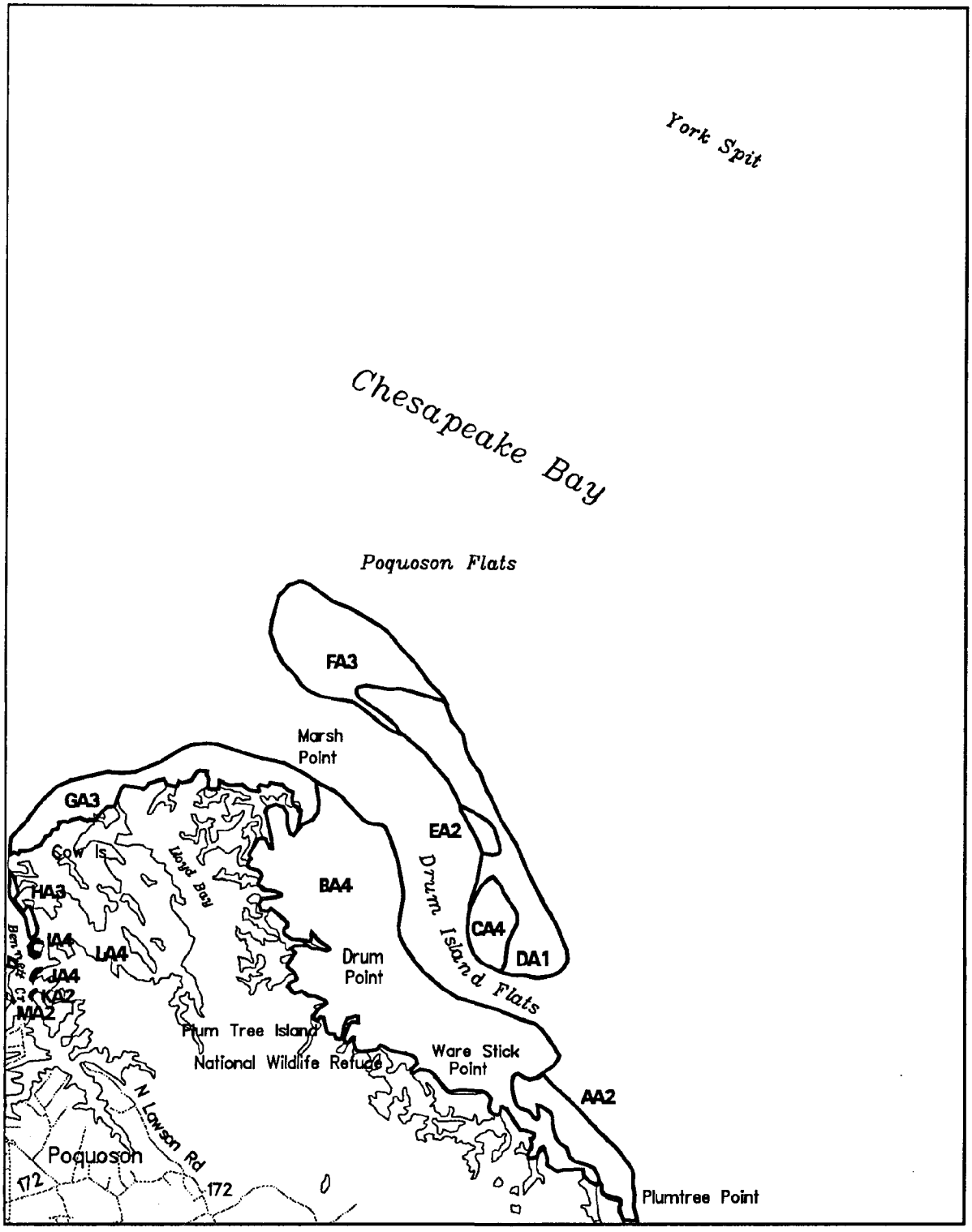
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 05-22-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Poquoson East, VA. (141)



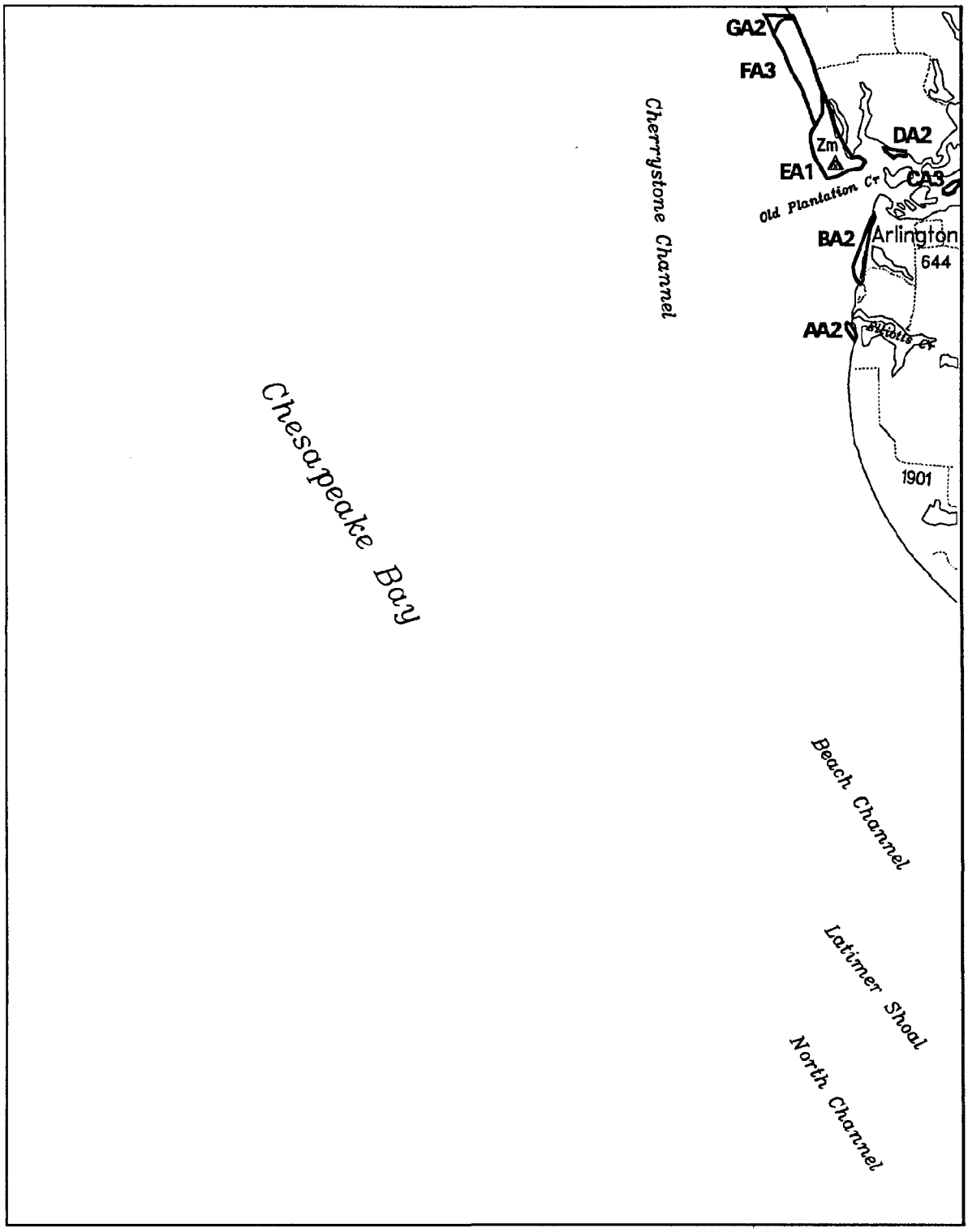
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 05-22-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Elliotts Creek, VA. (142)



0 1000 2000 3000

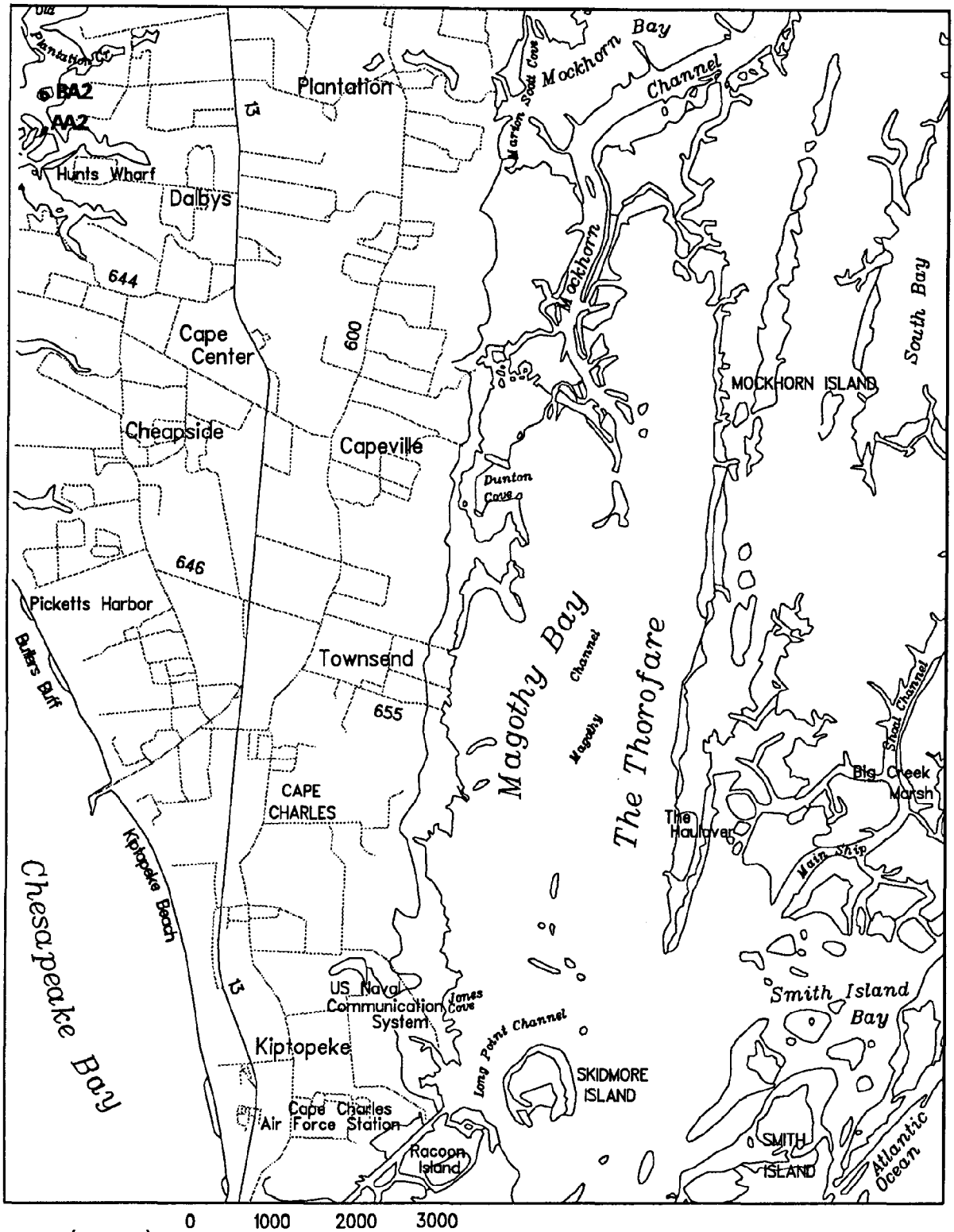
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-07-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Townsend, VA. (143)



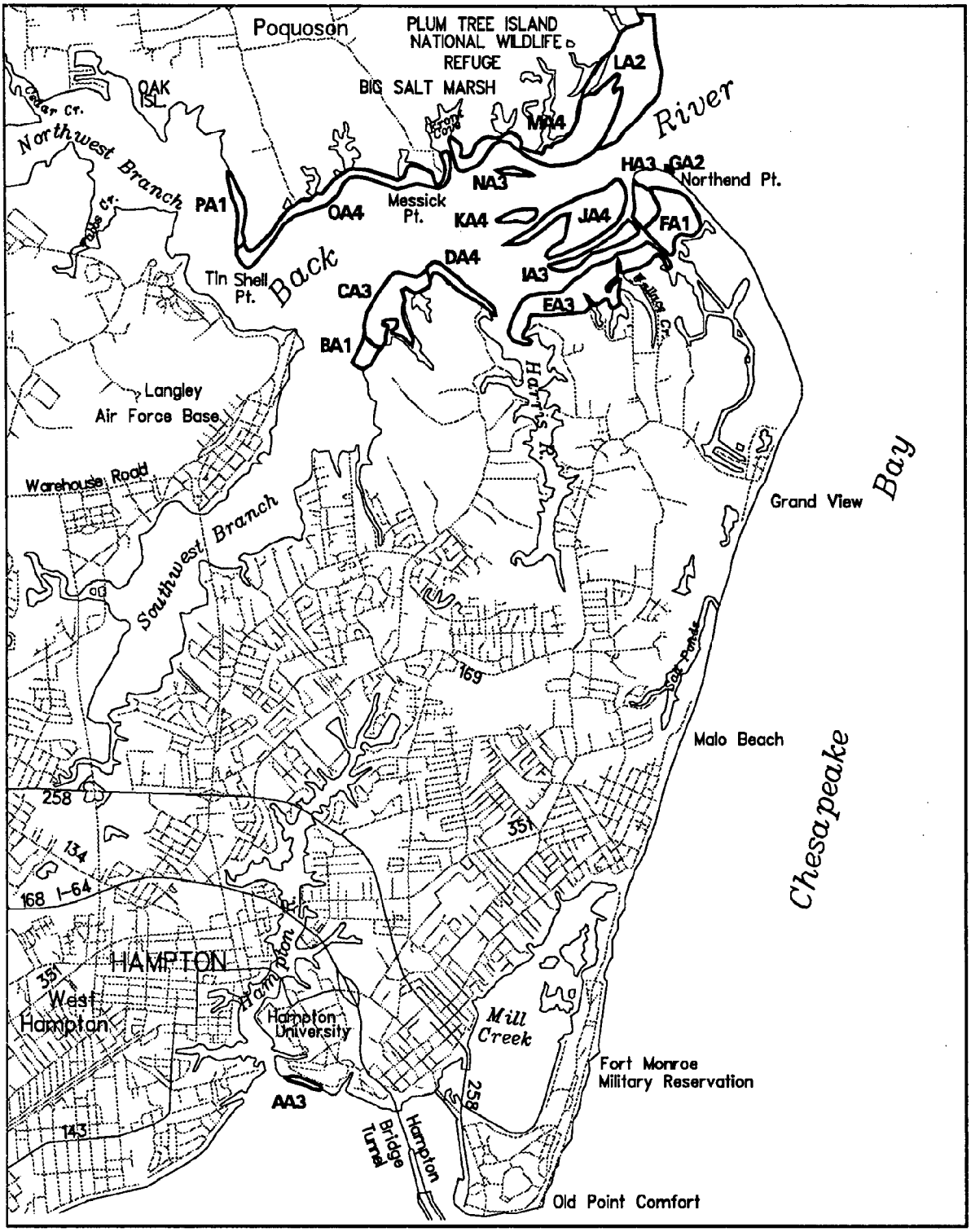
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-07-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Hampton, VA. (147)



0 1000 2000 3000

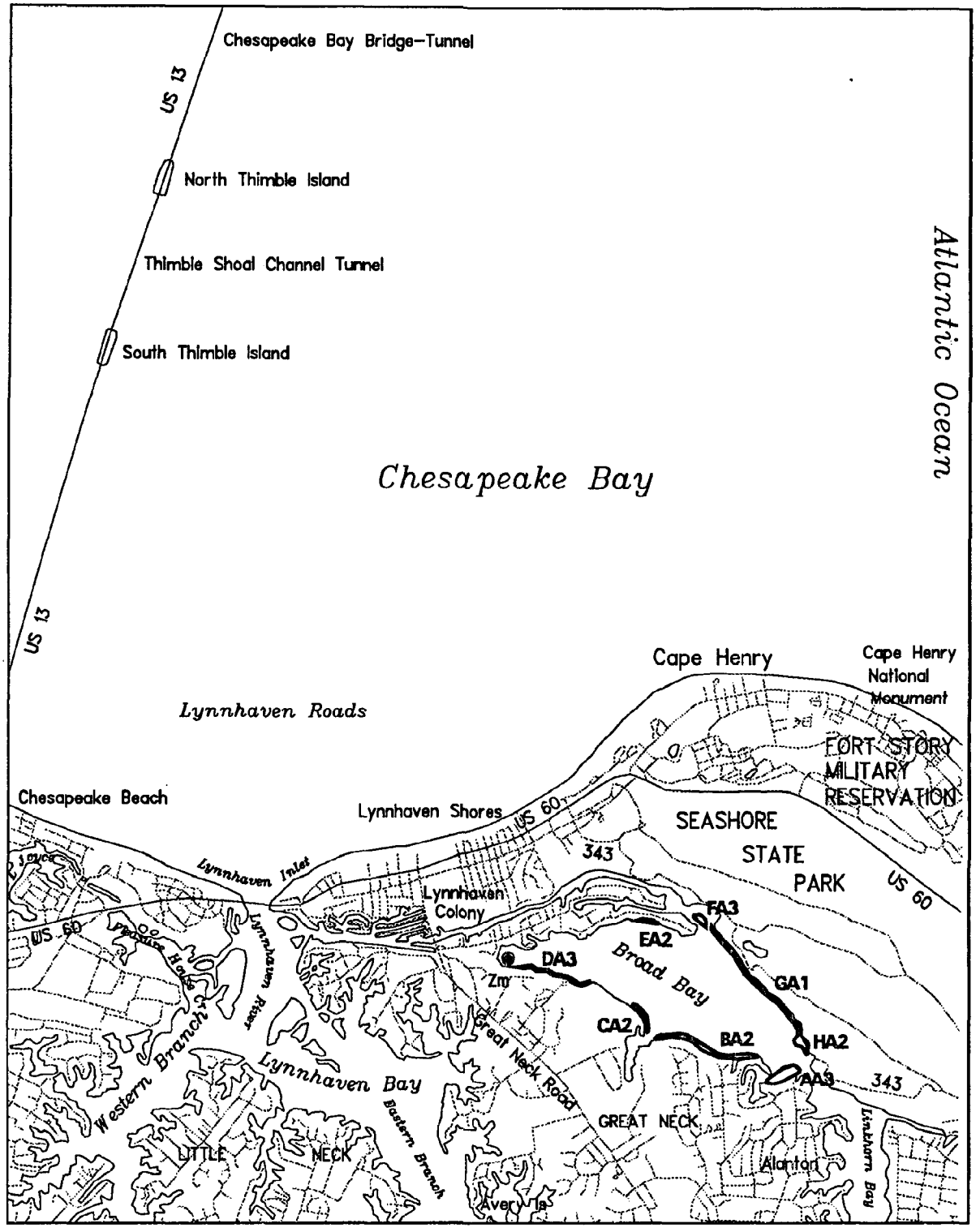
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 05-22-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Cape Henry, VA. (152)



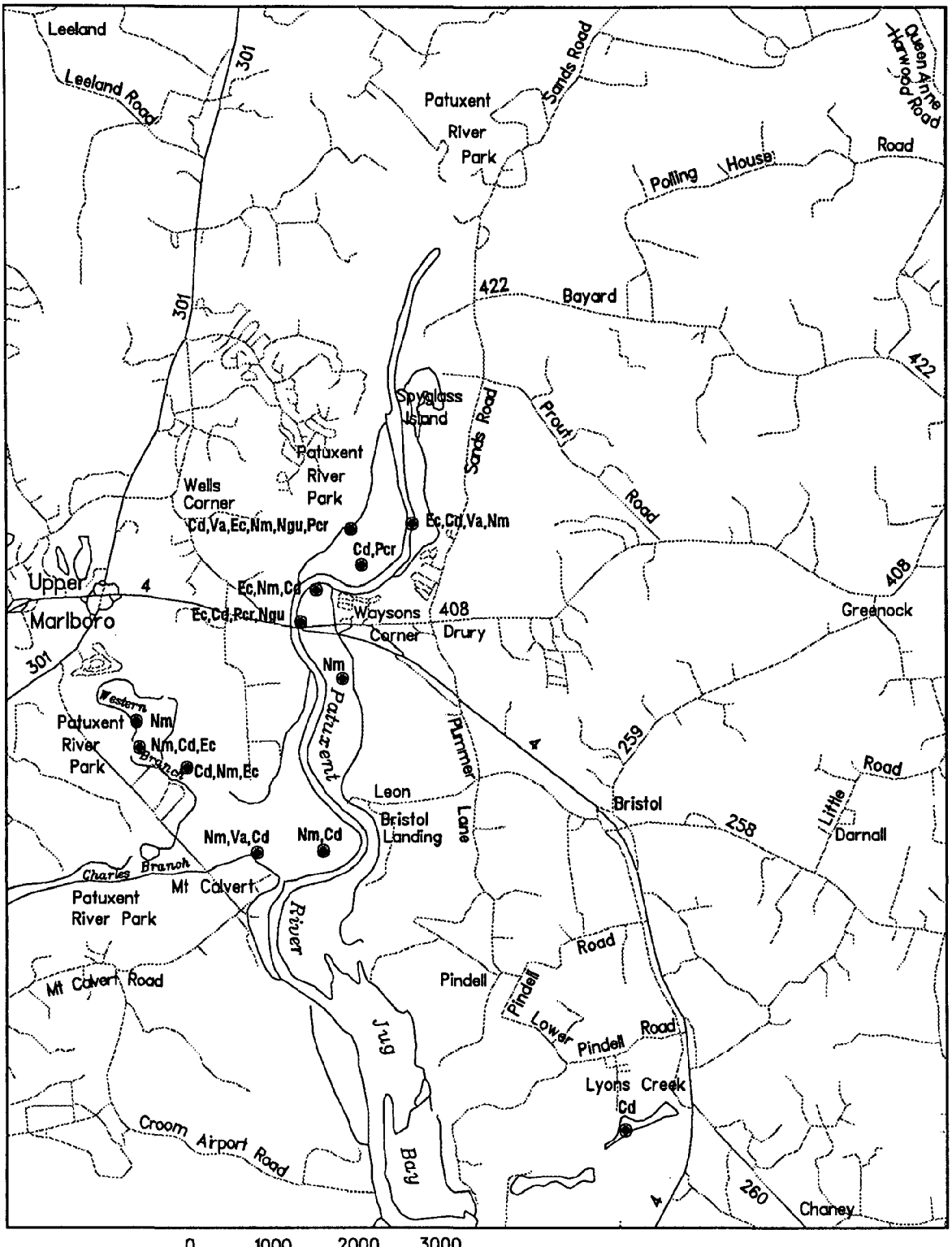
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 05-22-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Bristol, MD. (159)



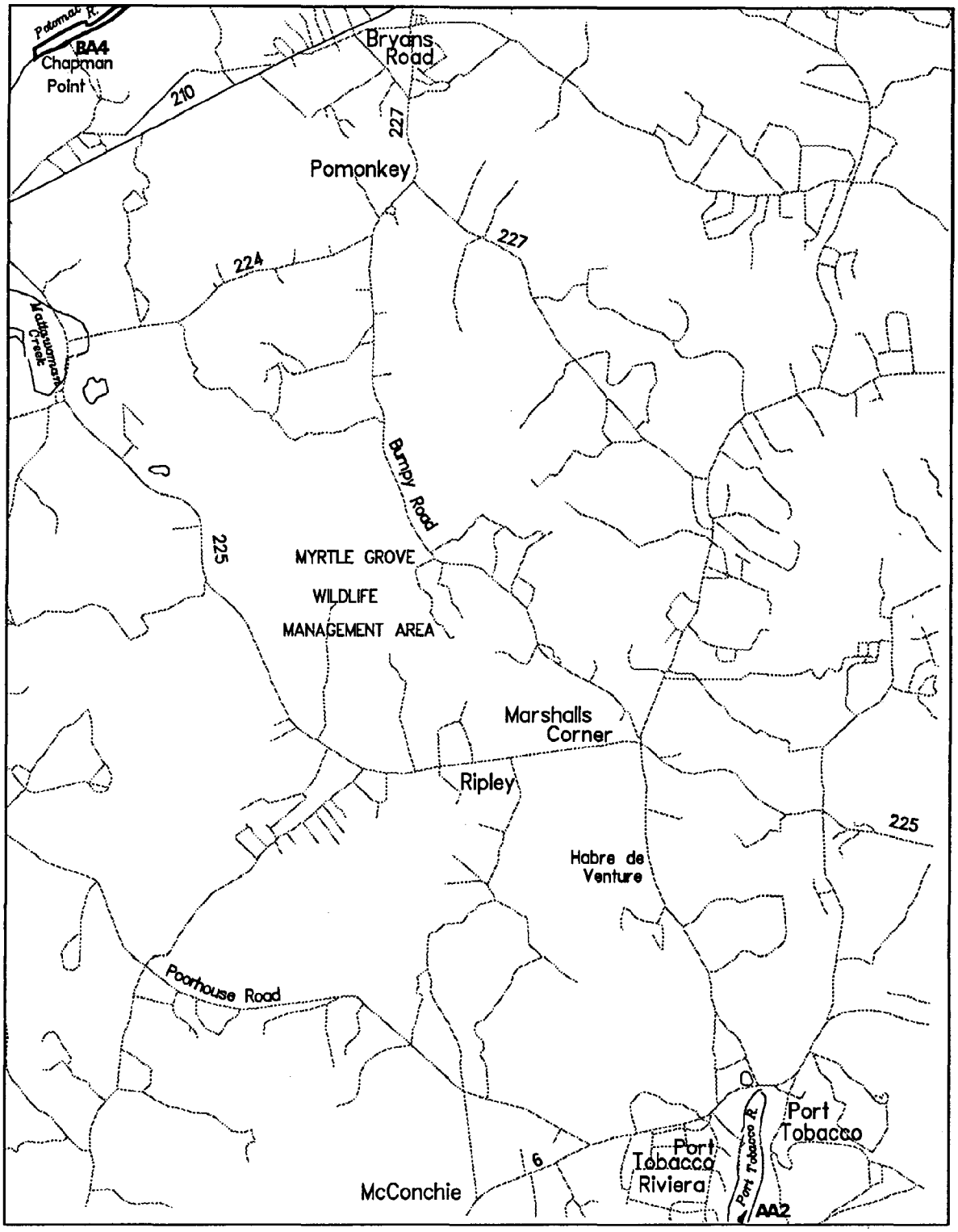
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-29-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Port Tobacco, MD. (161)



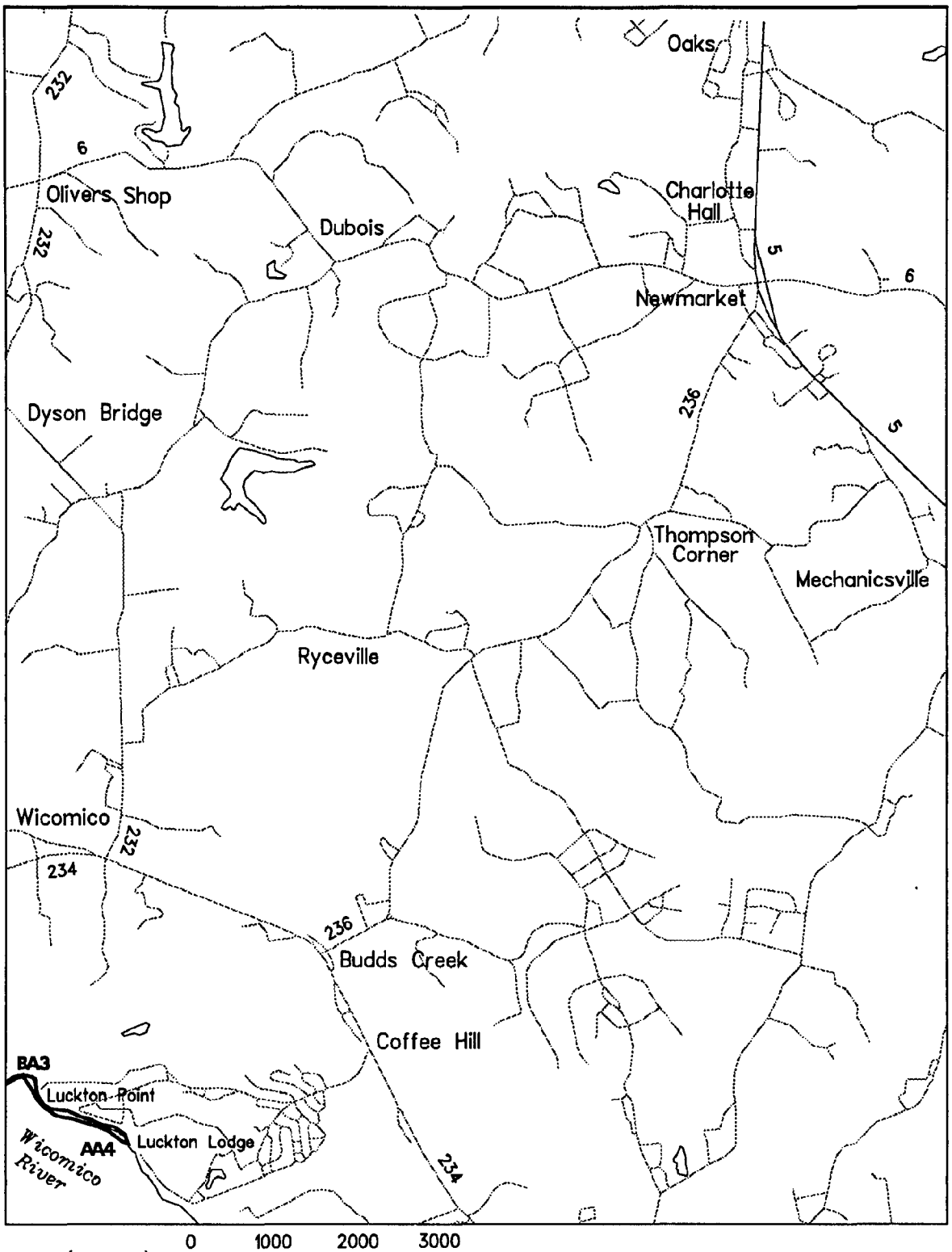
Scale (meters): 0 1000 2000 3000

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-23-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Charlotte Hall, MD. (162)



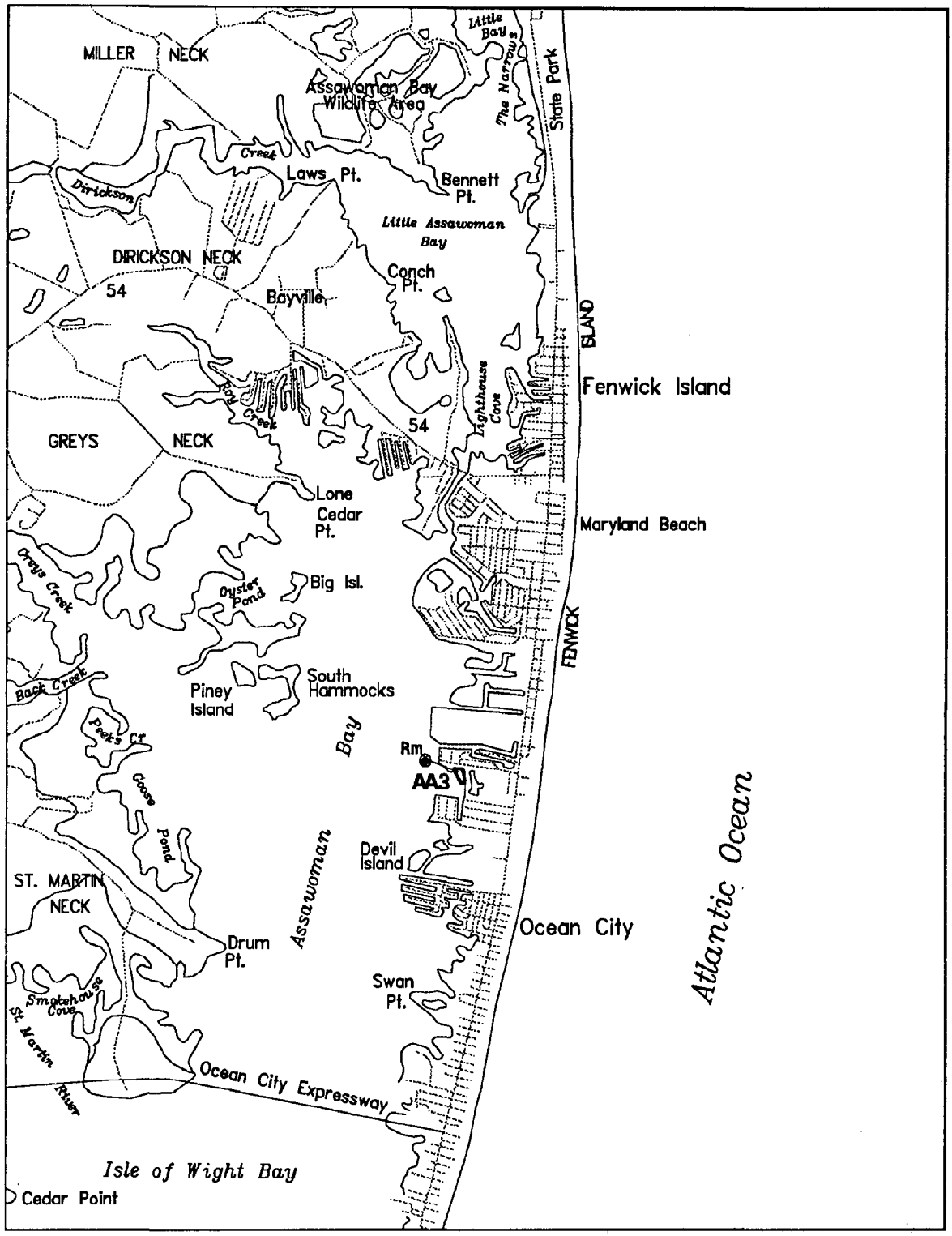
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 08-23-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Assawoman Bay, MD. (166)



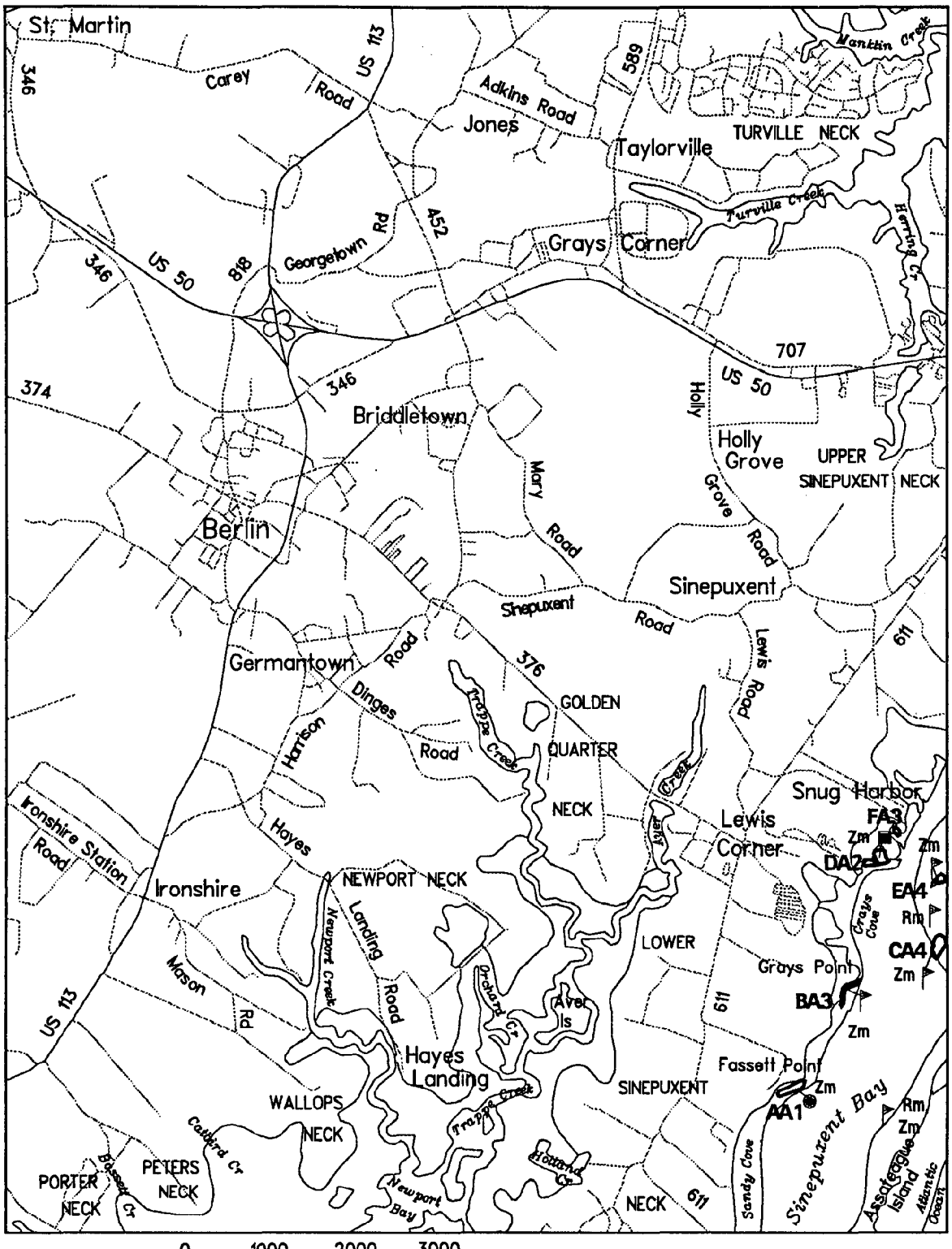
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-14-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Berlin, MD. (167)



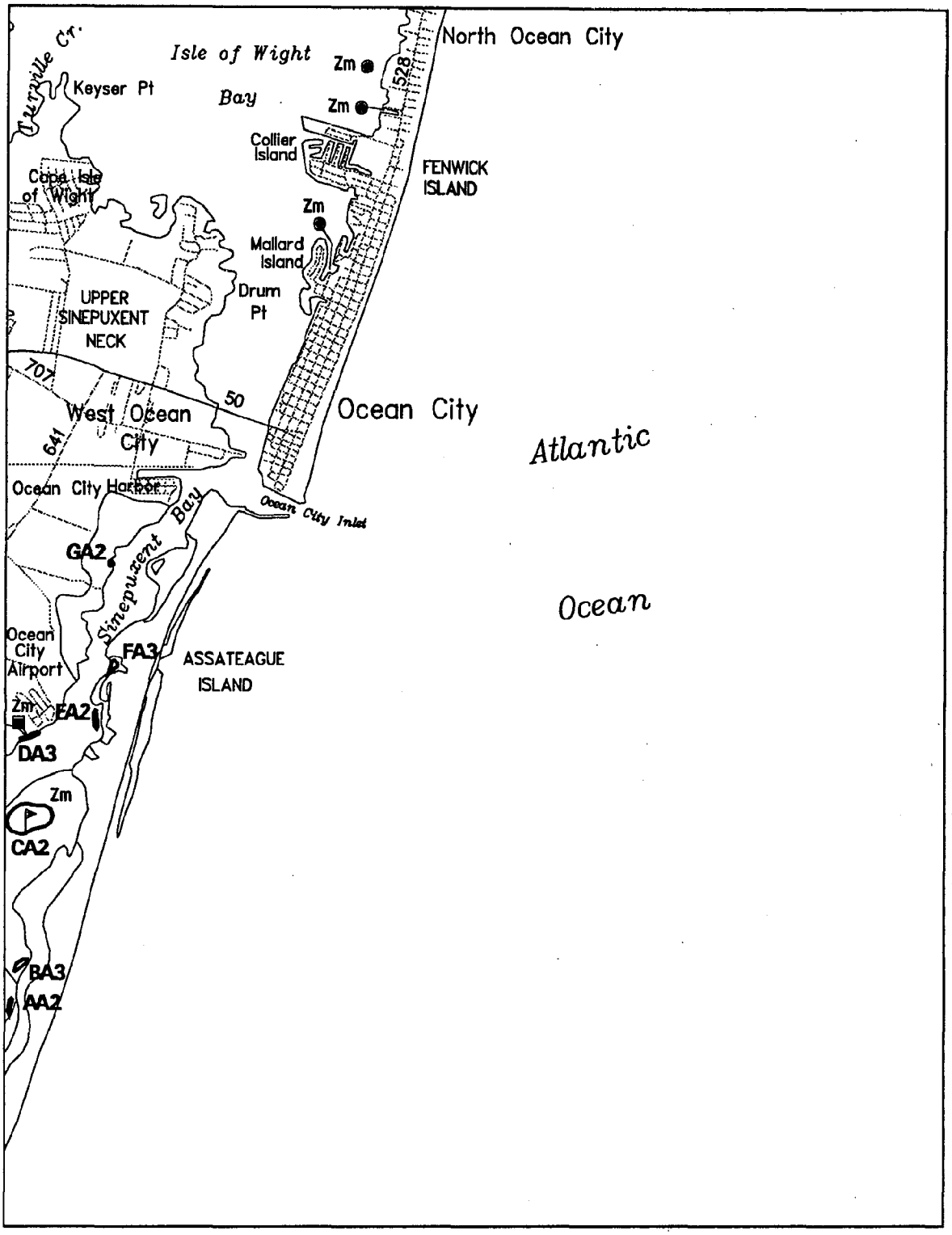
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-14-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Ocean City, MD. (168)



Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-14-91

Produced by:
Virginia Institute of Marine Science
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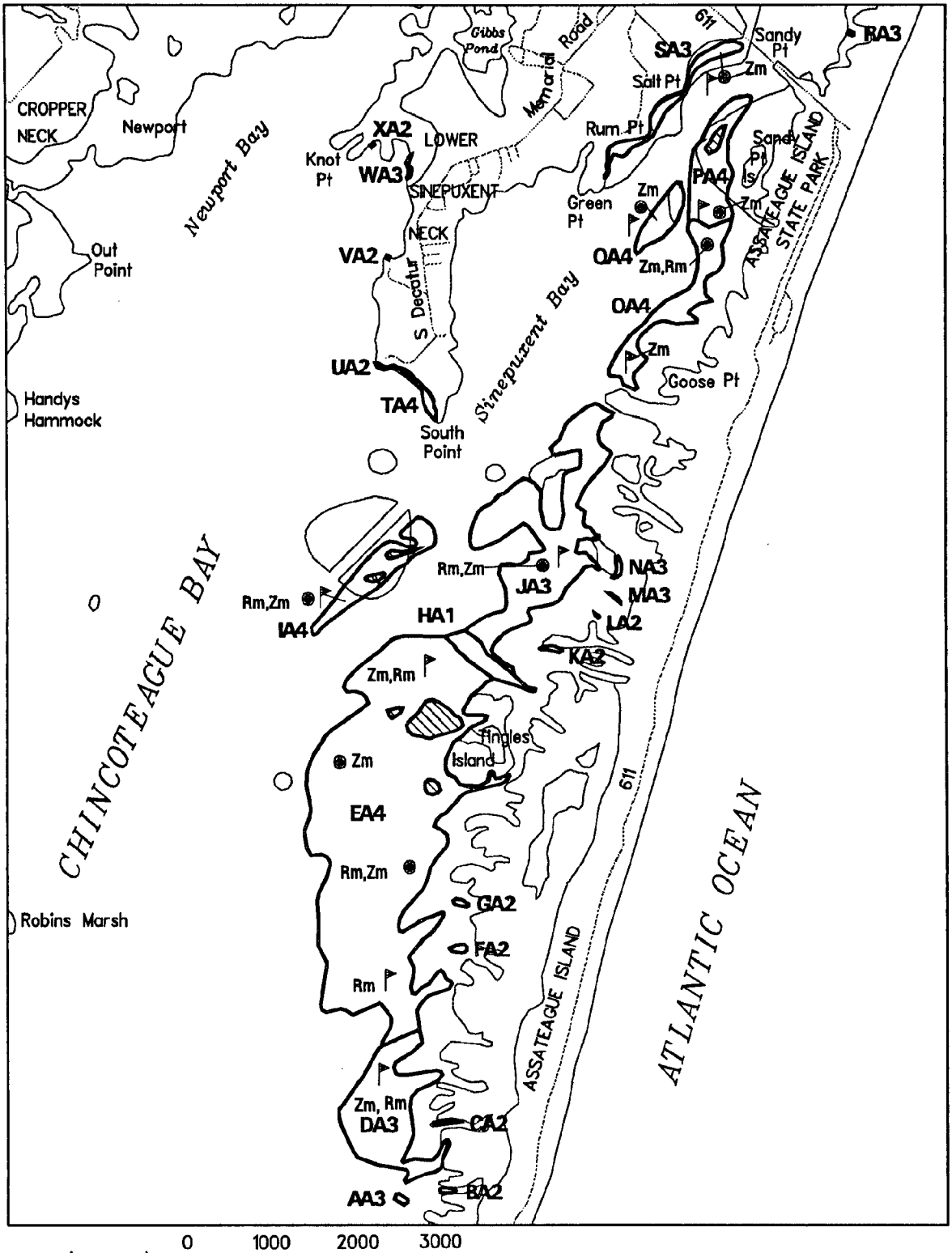
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Tingles Island, MD. (170)



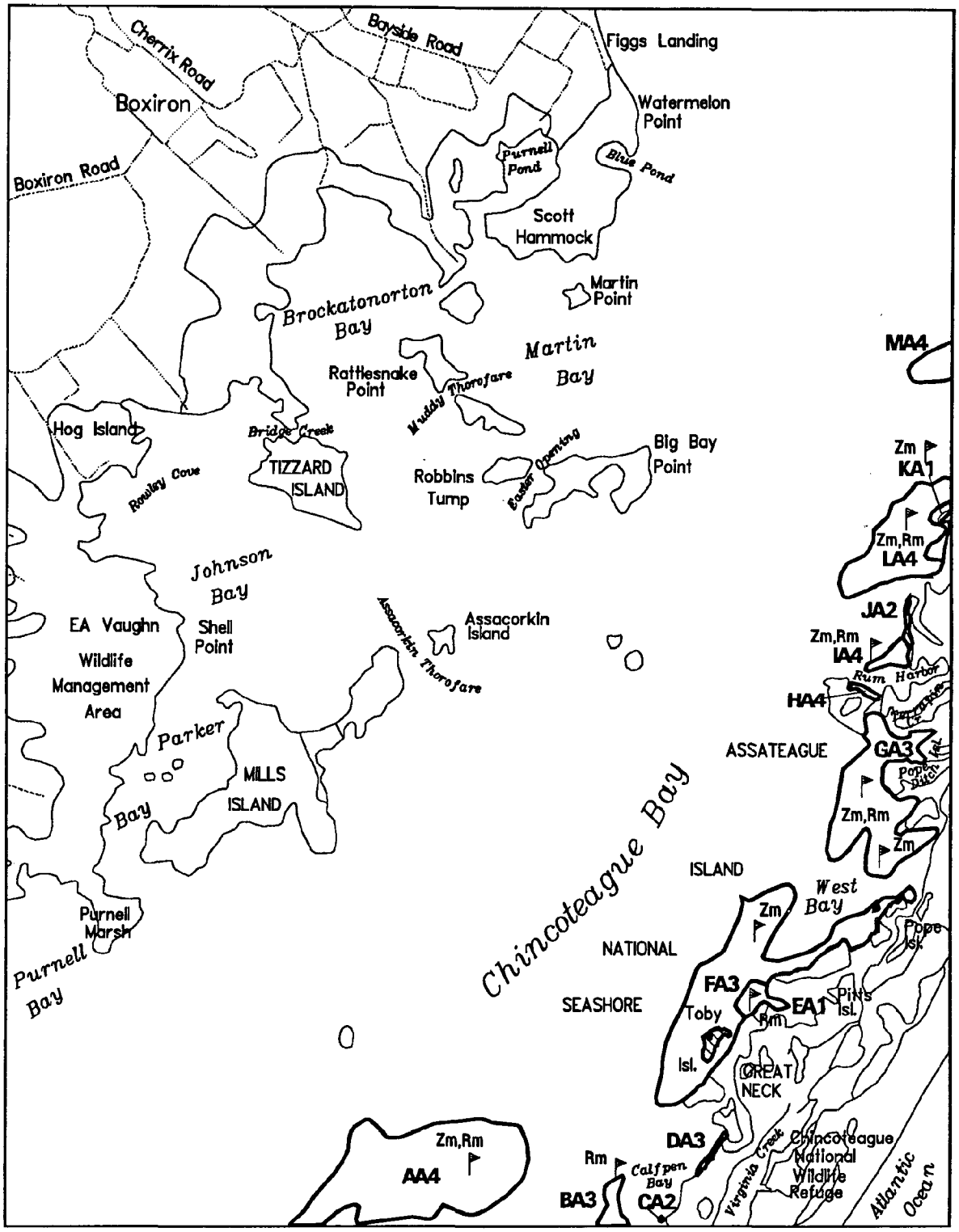
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-14-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Boxiron, MD.-VA. (172)



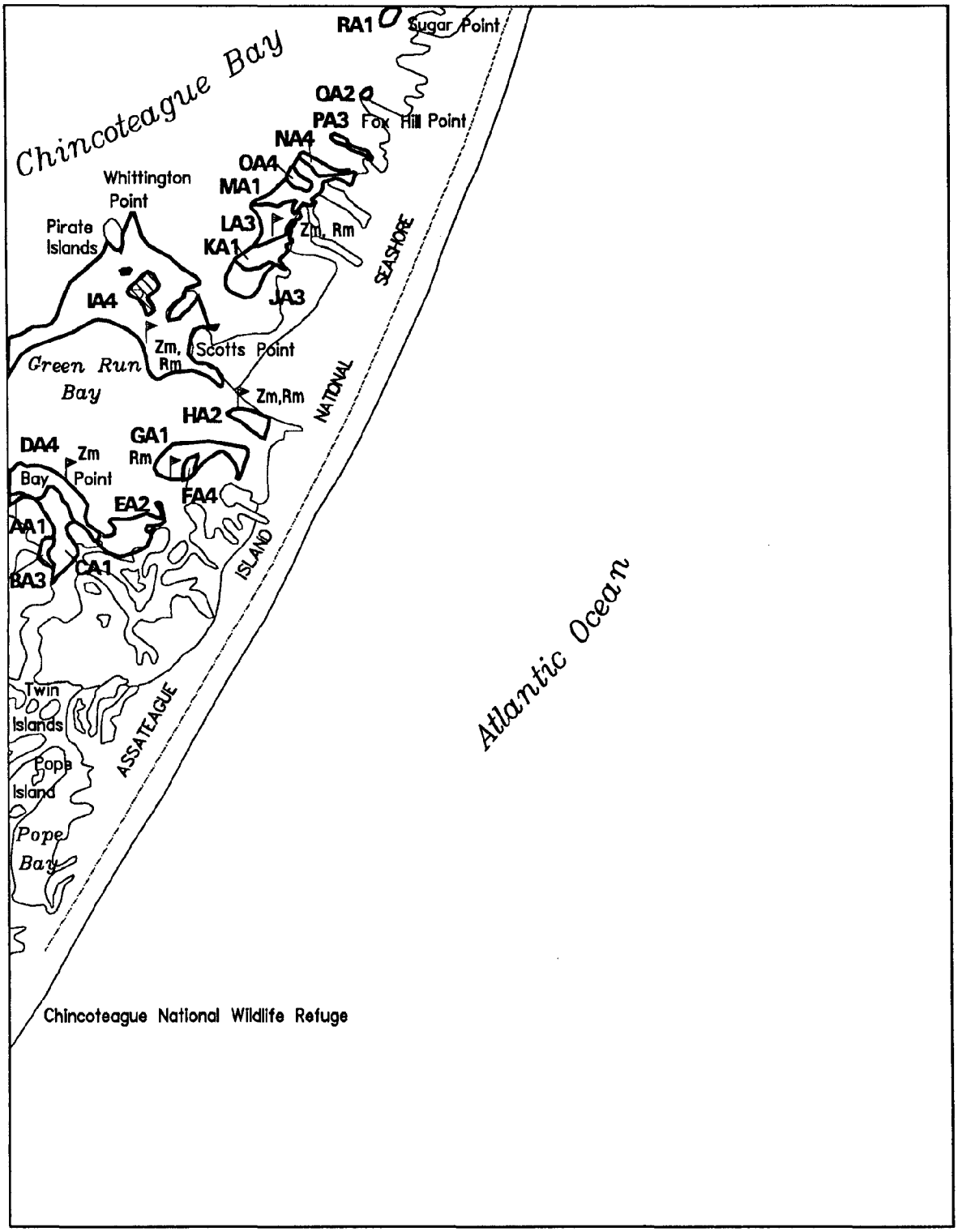
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-14-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Whittington Point, MD.-VA. (173)



0 1000 2000 3000

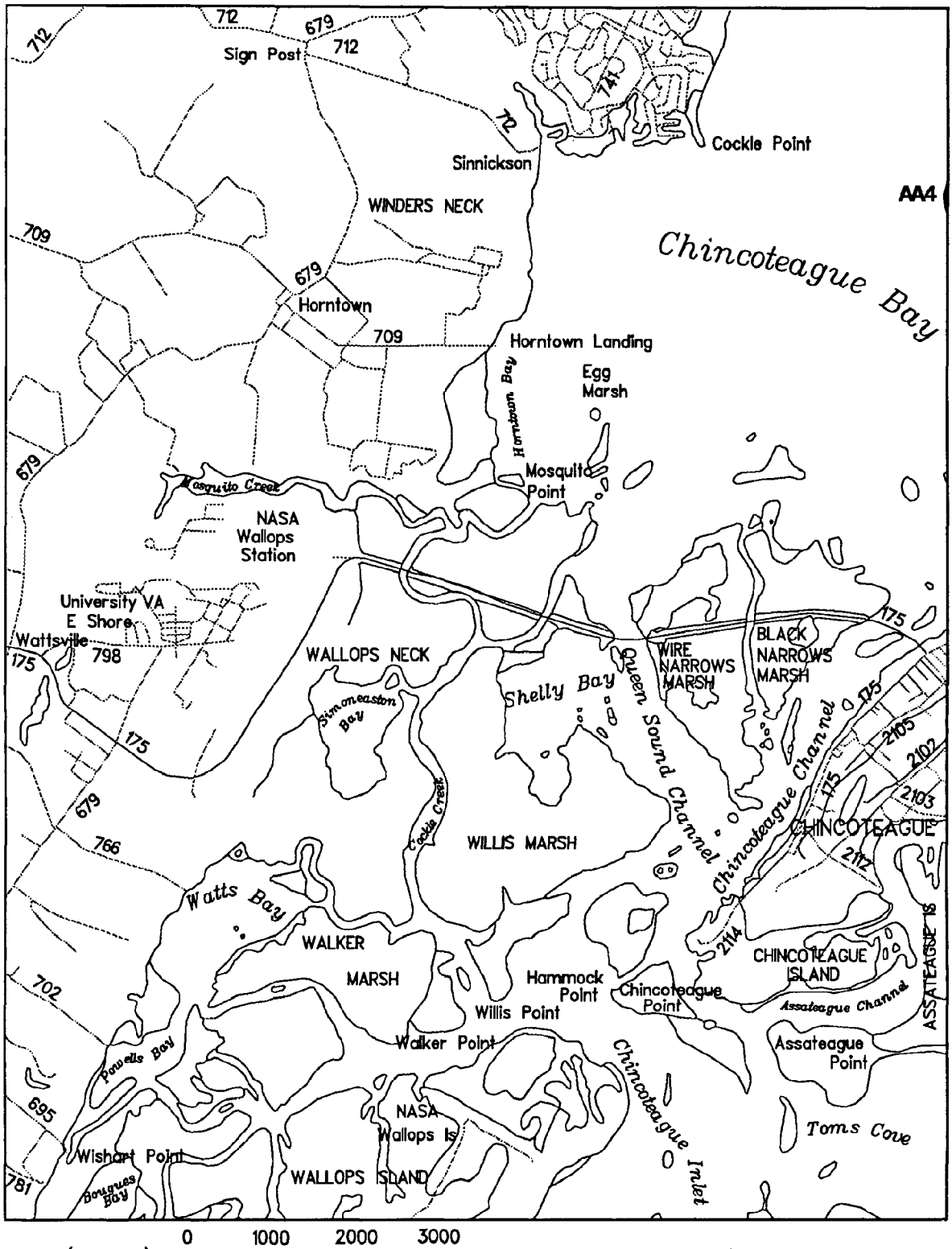
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-14-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Chincoteague West, VA. (174)



0 1000 2000 3000

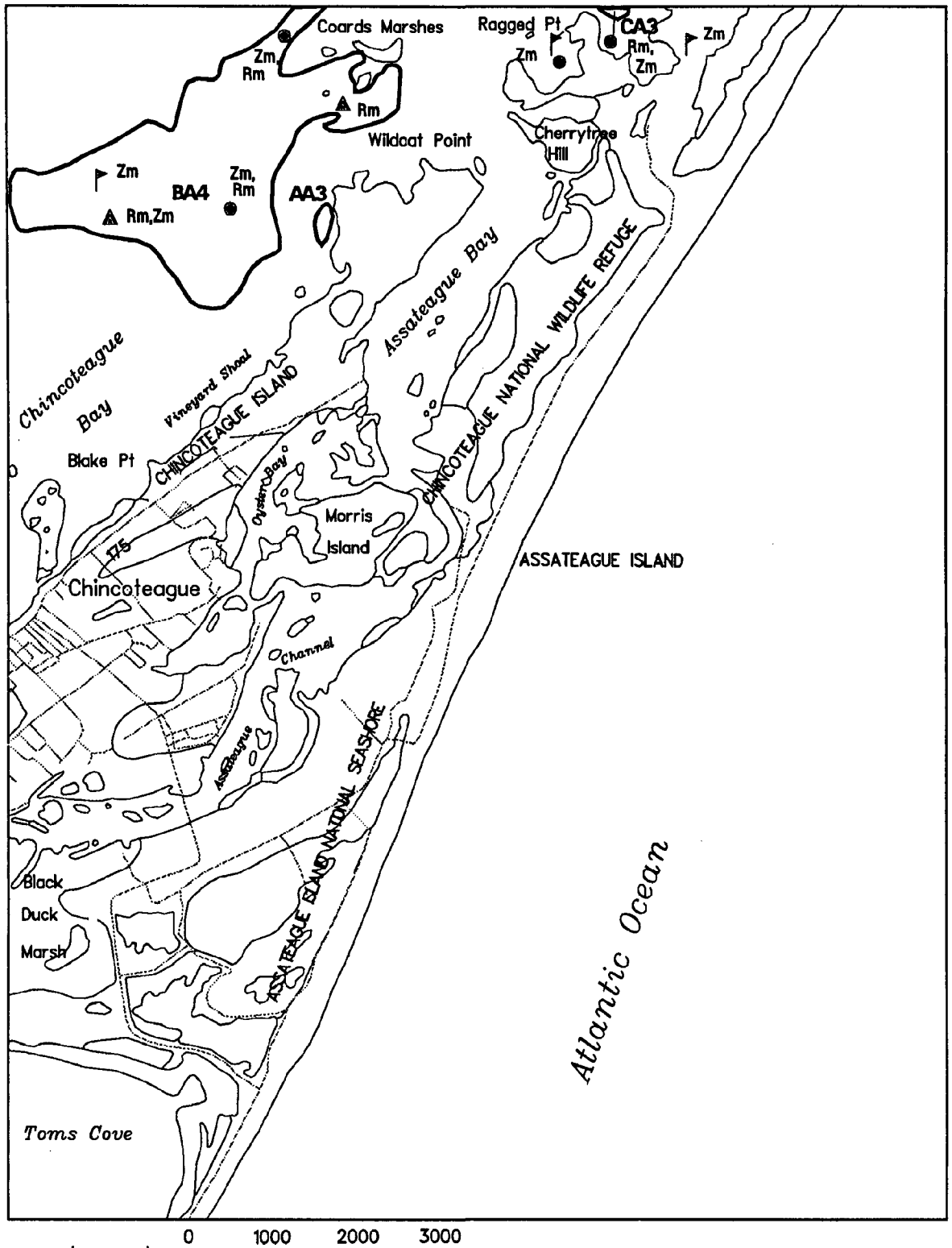
Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-14-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

SUBMERGED AQUATIC VEGETATION 1991
Chincoteague East, VA. (175)



Scale (meters):

Sources: Virginia Institute of Marine Science
U.S. Geological Survey

Date Flown: 06-14-91

Produced by:
Virginia Institute of Marine Science
School of Marine Science
College of William and Mary

APPENDIX D

1991 SAV Bed Areas For Each Topographic Quadrangle

APPENDIX D

Number of Square Meters of SAV in 1991 for Individual Beds and Totals for Density Categories by Topographic Quadrangle. [See Maps in Appendix C for Location of Each Bed. Quadrangles Are Listed Numerically by VIMS Map Number. Slight Differences (1 Square Meter) in Quadrangle Totals From Density Totals Are Due To Rounding.]

ABERDEEN, MD.
VIMS MAP # 002

AA4	6700
BA3	3269
CA4	4951
DA3	2410
EA3	2188
FA3	50758
GA4	9804
HA4	5646
IA4	2128
TOTAL AREA	
DENSITY 1 =	0
DENSITY 2 =	0
DENSITY 3 =	58625
DENSITY 4 =	29230
TOTAL =	87854

HAVRE DE GRACE, MD.
VIMS MAP # 003

AA2	8597
BA2	13507
CA2	118775
DA2	12914
EA2	19278
FA2	21288
GA4	25600
HA1	14961943
IA4	248557
JA4	14438
KA4	37009
LA4	17024
MA4	30698
NA4	3313
OA4	9984
PA4	188061
QA4	5284
RA4	7211
SA4	25983
TA4	2846
UA3	3755
VA4	1057
WA4	13677
XA4	4190
YA4	78539
ZA4	41960
AB4	35034
BB4	23690
CB4	13814
DB4	3694
EB4	1419
FB4	1173
GB4	3876
HB4	6872
IB4	9397
JB4	10152
KB4	4160
LB4	49545
MB2	33568
NB4	181463
OB4	86170
PB4	12012
QB3	51254
RB2	58610
SB2	6393
TB2	13515
UB1	7075
TOTAL AREA	
DENSITY 1 =	14969018
DENSITY 2 =	306443
DENSITY 3 =	55009
DENSITY 4 =	1197902
TOTAL =	16528372

NORTH EAST, MD.
VIMS MAP # 004

AA1	72739
BA1	66478
CA1	17470
DA2	38097
EA1	385386
FA1	37938
GA1	127255
HA1	8199

TOTAL AREA

DENSITY 1 =	715465
DENSITY 2 =	38097
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	753562

ELKTON, MD.-DEL.
VIMS MAP # 005

AA1	246780
BA1	2894

TOTAL AREA

DENSITY 1 =	249675
DENSITY 2 =	0
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	249675

SPESUTIE, MD.
VIMS MAP # 009

AA1	246946
BA2	203197
CA2	7374
DA1	165908
EA3	7318
FA3	10042
GA2	1867
HA2	4435
IA2	4066
JA3	3451
KA3	2481
LA3	2199
MA3	4746
NA3	12461
OA3	1640
PA2	10628
QA2	3832
RA2	12416
SA3	1732
TA2	16665
UA2	6867
VA1	4570
WA2	11286
XA2	4053
YA2	57291
ZA2	8050
AB2	22165
BB2	33798

TOTAL AREA

DENSITY 1 =	417423
DENSITY 2 =	407990
DENSITY 3 =	46071
DENSITY 4 =	0
TOTAL =	871485

EARLEVILLE, MD.
VIMS MAP # 010

AA1	9131
BA3	4355
CA1	29698
DA1	20922
EA1	12349
FA1	8384
GA1	574827
HA2	19167
IA2	95463
JA2	369918
KA2	276871
LA1	129026

TOTAL AREA

DENSITY 1 =	784337

DENSITY 2 =	761419
DENSITY 3 =	4355
DENSITY 4 =	0
TOTAL =	1550111

MIDDLE RIVER, MD.
VIMS MAP # 013

AA2	23900
BA2	6525
CA2	7414
DA3	6167

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	37840
DENSITY 3 =	6167
DENSITY 4 =	0
TOTAL =	44007

GUNPOWDER NECK, MD.
VIMS MAP # 014

AA2	2346
BA2	15339
CA2	3118
DA2	3690
EA3	25366
FA3	2856
GA3	2186
HA3	34086
IA2	5076
JA2	2285
KA3	58904
LA2	13323
MA2	2704
NA3	53461
OA3	371765
PA3	133207
QA3	4388
RA3	108259

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	47882
DENSITY 3 =	794477
DENSITY 4 =	0
TOTAL =	842359

HANESVILLE, MD.
VIMS MAP # 015

AA2	18174
BA2	2303
CA2	19724

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	40200
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	40200

BETTERTON, MD.
VIMS MAP # 016

AA2	3910
BA1	2090

TOTAL AREA

DENSITY 1 =	2090
DENSITY 2 =	3910
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	6000

GALENA, MD.
VIMS MAP # 017

AA3	38898

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	0
DENSITY 3 =	38898

DENSITY 4 =	0
TOTAL =	38898

SWAN POINT, MD.
VIMS MAP # 020

AA2	11273
BA2	12027
CA2	5168
DA2	9660

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	38129
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	38129

ROCK HALL, MD.
VIMS MAP # 021

AA2	4181
BA2	20480
CA4	33563
DA3	6729
EA3	12424
FA3	11310
GA3	8701

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	24661
DENSITY 3 =	39164
DENSITY 4 =	33563
TOTAL =	97389

LANGFORD CREEK, MD.
VIMS MAP # 026

AA2	8322
BA2	22287
CA2	13921
DA3	161755
EA3	8967
FA2	12369
GA2	11281
HA4	24177
IA2	13373
JA3	81915
KA2	7589
LA2	34284
MA3	20147

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	123426
DENSITY 3 =	272784
DENSITY 4 =	24177
TOTAL =	420387

WASHINGTON WEST, MD.-D.C.-VA.
VIMS MAP # 028

AA2	10368
BA2	9505
CA3	14556
DA2	1400
EA3	3774

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	21274
DENSITY 3 =	18330
DENSITY 4 =	0
TOTAL =	39604

KENT ISLAND, MD.
VIMS MAP # 032

AA2	10181
BA2	1756
CA1	3895

TOTAL AREA

DENSITY 1 =	3895

DENSITY 2 =	11937
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	15832

QUEENSTOWN, MD.
VIMS MAP # 033

AA2	3147
BA2	6957
CA1	21391
DA3	6033
EA2	4822

TOTAL AREA

DENSITY 1 =	21391
DENSITY 2 =	14926
DENSITY 3 =	6033
DENSITY 4 =	0
TOTAL =	42350

ALEXANDRIA, VA.-D.C.-MD.
VIMS MAP # 034

AA2	136626
BA4	95261
CA4	71767
DA4	9418
EA4	230019
FA4	551738
GA4	4463
HA4	4985
IA4	39585
JA4	3370
KA4	45596
LA4	31891
MA4	1048842
NA4	67100
OA2	31826
PA2	8662
QA3	22643
RA2	6682
SA2	7815
TA4	35580
UA2	14222
VA2	124313
WA1	190338
XA4	125133
YA3	16141
ZA2	1681
AB2	32035
BB2	17877
CB3	33786
DB2	8470
EB4	15377
FB4	6511
GB4	10380
HB4	4504
IB4	925977
JB1	457240
KB4	4960
LB3	9274
MB3	4312
NB3	20250
OB3	2763
PB3	57744

TOTAL AREA

DENSITY 1 =	647578
DENSITY 2 =	390207
DENSITY 3 =	166912
DENSITY 4 =	3332458
TOTAL =	4537155

CLAIBORNE, MD.
VIMS MAP # 036

AA1	37087
BA4	31832
CA3	29799
DA2	366750
EA1	25430
FA4	25287
GA1	78518

TOTAL AREA

DENSITY 1 =	141035
DENSITY 2 =	366750
DENSITY 3 =	29799

DENSITY 4 =	57118
TOTAL =	594702

ST. MICHAELS, MD.
VIMS MAP # 037

AA1	36846

TOTAL AREA

DENSITY 1 =	36846
DENSITY 2 =	0
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	36846

FORT BELVOIR, VA.-MD.
VIMS MAP # 039

AA4	449321
BA2	13893
CA4	250216
DA2	475537
EA4	59882
FA4	64412
GA3	280766
HA4	8642

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	489431
DENSITY 3 =	280766
DENSITY 4 =	832473
TOTAL =	1602670

MT. VERNON, VA.-MD.
VIMS MAP # 040

AA3	342301
BA4	397504
CA4	754595
DA1	52654
EA4	163314
FA4	333759
GA4	573256
HA4	987637
IA4	14855
JA4	8256
KA4	185311
LA1	34347
MA2	17872
NA4	34689
OA4	36536
PA2	54778
QA4	105642
RA2	133041
SA2	209817
TA1	51592
UA1	12932
VA3	12695
WA3	15445
XA4	102687
YA2	626205

TOTAL AREA

DENSITY 1 =	151525
DENSITY 2 =	1041713
DENSITY 3 =	370440
DENSITY 4 =	3698041
TOTAL =	5261719

TILGHMAN, MD.
VIMS MAP # 043

AA3	52063
BA2	73346

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	73346
DENSITY 3 =	52063
DENSITY 4 =	0
TOTAL =	125408

OXFORD, MD.
VIMS MAP # 044

AA3	23216

BA2	13076
CA3	15573
DA2	10909

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	23984
DENSITY 3 =	38788
DENSITY 4 =	0
TOTAL =	62773

QUANTICO, VA.-MD.
VIMS MAP # 047

AA4	543681
BA4	1447693
CA4	832902
DA4	79810
EA3	35768
FA4	435462
GA3	52627
HA4	44279
IA2	288416
JA4	34670
KA4	112663
LA4	2832521
MA4	601183
NA3	93160
OA4	64634
PA4	559870

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	288416
DENSITY 3 =	181556
DENSITY 4 =	7589367
TOTAL =	8059339

INDIAN HEAD, MD.- VA.
VIMS MAP # 048

AA3	169724
BA4	2111793
CA4	34896
DA4	54010
EA3	9753
FA4	131015
GA4	561488
HA2	39895
IA4	86785
JA4	288762
KA2	8423
LA2	17414
MA4	38717

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	65732
DENSITY 3 =	179477
DENSITY 4 =	3307466
TOTAL =	3552675

HUDSON, MD.
VIMS MAP # 051

AA2	2862
BA3	19716
CA3	68820
DA1	3097
EA2	401031
FA2	4737
GA2	109104
HA3	19092

TOTAL AREA

DENSITY 1 =	3097
DENSITY 2 =	517733
DENSITY 3 =	107628
DENSITY 4 =	0
TOTAL =	628458

CHURCH CREEK, MD.
VIMS MAP # 052

AA2	15277
BA1	7114

TOTAL AREA

DENSITY 1 =	7114
DENSITY 2 =	15277
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	22391

WIDEWATER, VA.-MD.
VIMS MAP # 055

AA4	499093
BA4	215725
CA1	45112
DA4	4858
EA3	21931
FA4	62149
GA1	877293
HA4	3248831
IA4	60365
JA4	176626
KA2	35189
LA4	452940
MA2	19718
NA4	646489
OA2	35439
PA2	2854
QA3	71088
RA2	5632

TOTAL AREA

DENSITY 1 =	922405
DENSITY 2 =	98832
DENSITY 3 =	93019
DENSITY 4 =	5367078
TOTAL =	6481335

NANJEMOY, MD.
VIMS MAP # 056

AA3	111230
BA3	116719
CA3	171183
DA3	28603
EA3	17015
FA2	3531
GA4	26425
HA4	8438
IA4	16273
JA3	36292
KA4	45446
LA4	48584
MA3	40739
NA4	12425
OA2	24628
PA4	9786
QA4	70534
RA4	122737
SA3	46386
TA4	450968

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	28159
DENSITY 3 =	568166
DENSITY 4 =	811616
TOTAL =	1407941

MATHIAS POINT, MD.-VA.
VIMS MAP # 057

AA2	32920
BA4	236971
CA1	51191
DA4	131339
EA4	171841
FA4	47202
GA2	22932
HA3	27948
IA4	231011
JA2	9698
KA3	16514
LA4	56642
MA4	55959
NA4	47128
OA2	16399
PA4	52405
QA4	291901
RA3	82280
SA4	285155
TA4	314538

UA2	202584
VA2	41963
WA3	11080
XA4	5778
YA3	12075
ZA4	79482
AB4	100593
BB4	37983
CB4	73048
DB4	29078
EB2	9090
FB4	15592
GB4	3552
HB3	33291
IB3	1897
JB3	9229
KB3	54443

TOTAL AREA

DENSITY 1 =	51191
DENSITY 2 =	335586
DENSITY 3 =	248758
DENSITY 4 =	2267197
TOTAL =	2902733

POPES CREEK, MD.
VIMS MAP # 058

AA3	3620
BA2	6713
CA4	57788
DA2	78966
EA3	30774
FA4	15925
GA2	7511

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	93189
DENSITY 3 =	34394
DENSITY 4 =	73713
TOTAL =	201296

TAYLORS ISLAND, MD.
VIMS MAP # 062

AA2	118001
BA2	25730
CA3	151683
DA2	4720

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	148450
DENSITY 3 =	151683
DENSITY 4 =	0
TOTAL =	300133

GOLDEN HILL, MD.
VIMS MAP # 063

AA1	2838
BA2	13171
CA2	6897
DA2	7961
EA2	30421
FA2	7414
GA2	20503

TOTAL AREA

DENSITY 1 =	2838
DENSITY 2 =	86367
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	89205

KING GEORGE, VA.-MD.
VIMS MAP # 065

AA2	160590
BA1	17002
CA4	187680
DA3	276472

TOTAL AREA

DENSITY 1 =	17002

DENSITY 2 =	160590
DENSITY 3 =	276472
DENSITY 4 =	187680
TOTAL =	641743

DAHLGREN, VA.-MD.
VIMS MAP # 066

AA3	8019
BA2	2461
CA3	13864
DA3	38344
EA4	9064
FA4	2646
GA1	150199
HA3	51585
IA3	164825
JA4	59314
KA4	58838
LA4	4201
MA4	16761
NA4	3178

TOTAL AREA

DENSITY 1 =	150199
DENSITY 2 =	2461
DENSITY 3 =	276637
DENSITY 4 =	154001
TOTAL =	583297

COLONIAL BEACH NORTH, VA.-MD.
VIMS MAP # 067

AA4	94208
BA2	3256
CA4	8494
DA2	1235
EA4	68487
FA3	51469
GA3	56072
HA1	55433
IA3	120558
JA1	7012

TOTAL AREA

DENSITY 1 =	62445
DENSITY 2 =	4492
DENSITY 3 =	228098
DENSITY 4 =	171189
TOTAL =	466224

BARREN ISLAND, MD.
VIMS MAP # 072

AA2	224485
BA3	53011
CA2	51964
DA2	18575
EA2	869115

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	1164140
DENSITY 3 =	53011
DENSITY 4 =	0
TOTAL =	1217151

HONGA, MD.
VIMS MAP # 073

AA3	73361
BA1	46223
CA3	159125
DA3	136842
EA2	94787
FA1	35100
GA3	25769
HA3	75854
IA1	25814
JA3	13778
KA2	11953
LA4	93304
MA3	17274
NA2	479607
OA2	14890
PA3	10245
QA4	1937
RA4	1846

SA2	23764
TA2	50520
UA2	263752
VA2	5023
WA2	58307
XA2	56871
YA2	241781
ZA2	122895
AB1	27844
BB2	5189
CB2	19996
DB2	37327
EB2	21949
FB2	302291
GB1	115871
HB4	543359
IB1	43992
JB4	446184
KB2	71978
LB1	628551
MB2	78234
NB2	63455
OB2	87728
PB4	82823
QB2	34532
RB3	254792
SB2	44902
TB2	20574
UB4	2552798
VB1	39485
WB2	31090
XB3	486328
YB3	425323
ZB1	11049

TOTAL AREA

DENSITY 1 =	973928
DENSITY 2 =	2243396
DENSITY 3 =	1678692
DENSITY 4 =	3722251
TOTAL =	8618268

WINGATE, MD.
VIMS MAP # 074

AA1	13348
BA4	277661
CA2	54788
DA4	1583802
EA1	108606
FA3	176850
GA4	1686128
HA1	90101
IA2	116204
JA3	463302
KA1	32296

TOTAL AREA

DENSITY 1 =	244351
DENSITY 2 =	170993
DENSITY 3 =	640152
DENSITY 4 =	3547591
TOTAL =	4603087

RICHLAND POINT, MD.
VIMS MAP # 082

AA3	73767
BA3	73037
CA3	62346

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	0
DENSITY 3 =	209150
DENSITY 4 =	0
TOTAL =	209150

BLOODSWORTH ISLAND, MD.
VIMS MAP # 083

AA3	8474
BA3	4989
CA2	9062
DA3	2698
EA2	42222
FA2	29288
GA2	28380
HA3	30396

IA3	485885
JA3	71333
KA3	3012671
LA3	1284084
MA2	13389
NA2	432237
OA3	265669
PA2	5916
QA2	362088
RA4	573290
SA2	14399
TA3	29201
UA2	8572
VA2	3106
WA3	52734
XA2	174489
YA3	755514
ZA1	124485
AB4	35904
BB1	24402
CB2	1850
DB1	52733
EB4	71558
FB2	5989

TOTAL AREA

DENSITY 1 =	201619
DENSITY 2 =	1130986
DENSITY 3 =	6003649
DENSITY 4 =	680752
TOTAL =	8017007

DEAL ISLAND, MD.
VIMS MAP # 084

AA3	225789
BA2	17729

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	17729
DENSITY 3 =	225789
DENSITY 4 =	0
TOTAL =	243518

MONIE, MD.
VIMS MAP # 085

AA3	65363
BA3	7389

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	0
DENSITY 3 =	72752
DENSITY 4 =	0
TOTAL =	72752

ST. GEORGE ISLAND, MD.
VA.
VIMS MAP # 089

AA3	6283
BA3	11112

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	0
DENSITY 3 =	17395
DENSITY 4 =	0
TOTAL =	17395

KEDGES STRAITS, MD.
VIMS MAP # 091

AA4	67622
BA2	154612
CA4	98185
DA3	3105214
EA1	135373
FA3	252165
GA2	227261
HA3	75217
IA4	1456816
JA2	29934
KA3	417751
LA2	13023
MA1	61330
NA4	449960

OA2	3634
PA4	775515
QA2	77922
RA3	604663
SA3	61012
TA2	11575
UA2	22958
VA4	212794
WA2	13338
XA2	9634
YA2	16807
ZA3	300629
AB2	17337
BB1	106748
CB3	69267
TOTAL AREA	
DENSITY 1 =	303451
DENSITY 2 =	598034
DENSITY 3 =	4885918
DENSITY 4 =	3060892
TOTAL =	8848295

TERRAPIN SAND POINT, MD.
VIMS MAP # 092

AA2	22031
BA3	112353
CA4	1741813
DA1	116384
EA2	305514
FA4	140934
GA4	66972
HA1	78038
IA1	19337
JA2	4851
KA3	2467
TOTAL AREA	
DENSITY 1 =	213758
DENSITY 2 =	332396
DENSITY 3 =	114820
DENSITY 4 =	1949719
TOTAL =	2610694

MARION, MD.
VIMS MAP # 093

AA3	12201
BA3	7977
CA3	10257
DA3	66335
EA1	186557
FA3	46210
GA2	56801
HA4	67749
IA2	37929
JA4	63146
KA4	72068
LA3	204088
MA2	28038
NA4	421387
OA2	119912
PA2	18167
QA2	26537
RA2	7451
SA2	28491
TA2	47450
UA3	33406
VA2	138508
WA3	286480
XA2	97751
YA3	65000
ZA2	72246
AB4	9589
BB2	29244
CB3	22601
DB3	93686
EB4	192157
FB2	35601
GB1	36723
HB3	57948
IB2	34002
JB3	54625
KB3	128428
LB2	111968
MB3	2214
NB3	5514
OB3	12805
PB3	4603
QB2	3386
RB3	1200

SB3	865

TOTAL AREA

DENSITY 1 =	223280
DENSITY 2 =	893481
DENSITY 3 =	1116441
DENSITY 4 =	826096
TOTAL =	3059298

EWELL, MD.-VA.
VIMS MAP # 099

AA4	11910730
BA2	6035756
CA1	143972
DA4	2511069
EA2	139435
FA2	47890
GA2	63038
HA4	127665
IA1	161606
JA4	86235
KA4	33315
LA3	1370135
MA3	34456
NA3	484781
OA1	61085
PA4	277695
QA1	60488
RA2	44410
SA3	125054
TA2	3646
UA3	4532
VA3	36230
WA4	2066659
XA2	50183
YA2	39156
ZA2	140070

TOTAL AREA

DENSITY 1 =	427151
DENSITY 2 =	6563584
DENSITY 3 =	2055188
DENSITY 4 =	17013369
TOTAL =	26059291

GREAT FOX ISLAND, MD.-VA.
VIMS MAP # 100

AA4	4175072
BA1	55923
CA2	1406084
DA4	1227459
EA2	283082
FA3	163532
GA3	231699
HA3	708171
IA2	99645
JA3	13461
KA4	74403
LA2	18181
MA4	137609
NA2	19831
OA2	6415
PA2	7040
QA4	2852153
RA3	46488
SA3	46875
TA4	266002
UA2	147478
VA4	227279
WA4	1729818
XA1	256308
YA4	10216

TOTAL AREA

DENSITY 1 =	312231
DENSITY 2 =	1987756
DENSITY 3 =	1210226
DENSITY 4 =	10700011
TOTAL =	14210224

CRISFIELD, MD.-VA.
VIMS MAP # 101

AA4	1131324
BA2	73401
CA2	38923
DA2	47391

EA3	26880
FA2	15860
GA2	353458
HA4	168284
IA2	51776
JA2	13079
KA4	69145
LA3	91749
MA3	5880
NA2	5651
OA3	112965
PA3	113216
QA4	59874
RA2	19378
SA2	3001
TA2	12124
UA4	48777
VA4	307697
WA3	27666
XA4	81627
YA2	12063
ZA3	290341
AB3	5746

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	646106
DENSITY 3 =	674443
DENSITY 4 =	1866728
TOTAL =	3187277

SAXIS, VA.-MD.
VIMS MAP # 102

AA2	2592
BA2	2403
CA2	7610

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	12604
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	12604

REEDVILLE, VA.
VIMS MAP # 106

AA2	13972
BA2	39023
CA2	87317
DA1	95140
EA4	1169453
FA2	628202
GA4	273075
HA2	46802
IA2	5490
JA1	18345
KA2	2844
LA2	11014
MA1	37211

TOTAL AREA

DENSITY 1 =	150696
DENSITY 2 =	834663
DENSITY 3 =	0
DENSITY 4 =	1442528
TOTAL =	2427887

TANGIER ISLAND, VA.
VIMS MAP # 107

AA3	447513
BA1	152747
CA4	1337455
DA2	43162
EA2	115617
FA2	16965
GA2	115279
HA3	764935
IA2	40961
JA4	211943
KA4	4475707
LA2	69415
MA1	30421

TOTAL AREA

DENSITY 1 =	183168
DENSITY 2 =	401399
DENSITY 3 =	1212448

DENSITY 4 =	6025105
TOTAL =	7822119

CHESCONESSEX, VA.
VIMS MAP # 108

AA2	116697
BA2	54540
CA4	163943
DA4	17127
EA2	47951
FA3	1126
GA4	256783
HA2	125671
IA2	232312
JA3	490998
KA2	233008
LA3	338142
MA4	350092
NA3	369577
OA4	948076
PA2	249972
QA2	283839
RA4	159291
SA2	603588
TA4	632918
UA1	174999
VA4	332011
WA2	531324
XA4	730359
YA4	53461
ZA3	4618
AB2	32761
BB2	118757
CB3	298783
DB2	107797
EB4	857990
FB3	1461424
GB1	145120

TOTAL AREA

DENSITY 1 =	320119
DENSITY 2 =	2738215
DENSITY 3 =	2964667
DENSITY 4 =	4502052
TOTAL =	10525053

PARKSLEY, VA.
VIMS MAP # 109

AA4	19478
BA2	53821
CA1	20259
DA3	48217
EA2	104226
FA2	4594
GA4	22507
HA3	4696
IA2	79467
JA2	6308
KA2	458804
LA1	94738
MA3	164542
NA1	17872
OA2	31522
PA3	23162
QA3	456622
RA2	212568
SA3	305295
TA1	25668
UA3	13130
VA3	11974
WA2	2859
XA2	6811
YA4	32545
ZA4	1516
AB4	87867
BB3	43126
CB4	2476813

TOTAL AREA

DENSITY 1 =	158536
DENSITY 2 =	960979
DENSITY 3 =	1070762
DENSITY 4 =	2640725
TOTAL =	4831003

URBANNA, VA.
VIMS MAP # 110

AA2	36639

BA2	13181
CA2	4047
TOTAL AREA	
DENSITY 1 =	0
DENSITY 2 =	53866
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	53866

IRVINGTON, VA.
VIMS MAP # 111

AA2	2183
BA2	5520
CA2	31856
DA4	8625
EA4	13831
FA3	87403
GA4	200535
HA3	164321
IA4	263874
JA3	12218
KA2	111659
LA2	37521
MA2	5250
NA2	3540
OA3	66777
PA2	8549
QA2	1540
RA2	27652
SA4	2648
TA3	18205
UA4	75179
VA3	96617
WA3	80655
XA4	158297
YA2	1769
ZA4	164122
TOTAL AREA	
DENSITY 1 =	0
DENSITY 2 =	237040
DENSITY 3 =	526195
DENSITY 4 =	887111
TOTAL =	1650346

FLEETS BAY, VA.
VIMS MAP # 112

AA2	570292
BA3	47097
CA3	23404
DA2	3131
EA3	300853
FA1	275857
GA3	258484
HA4	21969
IA2	331537
JA2	7214
KA3	22562
LA3	21467
MA3	6878
NA2	28510
OA2	40347
PA2	45594
QA3	877449
RA3	10697
SA2	40341
TA2	16326
UA3	18227
VA3	79589
WA2	116809
XA3	304050
YA1	19377
ZA2	9473
AB3	187639
BB2	111177
CB3	2320
DB2	56444
EB2	21135
FB2	29096
GB2	13199
TOTAL AREA	
DENSITY 1 =	295235
DENSITY 2 =	1440624
DENSITY 3 =	2160716
DENSITY 4 =	21969
TOTAL =	3918543

NANDUA CREEK, VA.
VIMS MAP # 113

AA1	33688
BA2	51082
CA1	118554
DA3	7344
EA4	96173
FA3	3236
GA4	458594
HA2	1294036
IA4	175051
JA4	84350
KA1	161576
LA4	157442
MA3	396269
NA2	1378145

TOTAL AREA

DENSITY 1 =	313818
DENSITY 2 =	2723263
DENSITY 3 =	406849
DENSITY 4 =	971610
TOTAL =	4415540

PUNGOTEAGUE, VA.
VIMS MAP # 114

AA4	156876
BA1	414509
CA3	150548
DA2	2974
EA4	5711
FA2	68850
GA4	369270
HA1	28456
IA2	11046
JA3	9244
KA4	3784341
LA2	2129231
MA2	223275
NA3	338526
OA1	276043
PA3	291240
QA2	1764
RA2	1190
SA2	2751
TA2	47550
UA3	7903
VA3	1435
WA3	6952
XA2	18920
YA3	115977
ZA4	90632
AB4	71648
BB2	204464
CB1	282195
DB2	424561
EB3	137585
FB4	52671
GB3	4692
HB2	28775

TOTAL AREA

DENSITY 1 =	1001203
DENSITY 2 =	3165351
DENSITY 3 =	1064103
DENSITY 4 =	4531149
TOTAL =	9761806

WILTON, VA.
VIMS MAP # 117

AA3	3318
BA3	6082
CA3	1878
DA2	73210
EA3	67790
FA2	2975
GA3	4724

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	76185
DENSITY 3 =	83793
DENSITY 4 =	0
TOTAL =	159978

DELTAVILLE, VA.
VIMS MAP # 118

AA1	6525
BA1	3394
CA2	121551
DA2	302564
EA4	18019
FA2	152372
GA2	8318
HA2	37024
IA2	52498
JA3	21947
KA2	97364
LA2	15000
MA3	16934
NA2	21454
OA3	18834
PA4	10814
QA2	37820
RA3	133009

TOTAL AREA	
DENSITY 1 =	9919
DENSITY 2 =	845965
DENSITY 3 =	190723
DENSITY 4 =	28833
TOTAL =	1075440

JAMESVILLE, VA.
VIMS MAP # 119

AA2	140673
BA1	42261
CA2	592211
DA4	773038
EA3	85719
FA1	90906
GA3	5413
HA3	7123
IA2	21959
JA2	10279
KA3	12790
LA2	7321
MA1	12703
NA4	15933
OA3	53557
PA1	265214
QA3	668808
RA4	193505
SA1	739310
TA2	78044
UA2	2786
VA3	30612
WA4	680139
XA2	41473
YA2	1031
ZA3	84364
AB2	430326
BB4	194647
CB2	154815
DB4	316375
EB1	11096
FB1	51584
GB4	166250
HB2	172229
IB3	61907

TOTAL AREA	
DENSITY 1 =	1213073
DENSITY 2 =	1653148
DENSITY 3 =	1010294
DENSITY 4 =	2339887
TOTAL =	6216401

WARE NECK, VA.
VIMS MAP # 122

AA2	4830
BA2	437975
CA3	53411
DA4	98074
EA2	93206
FA3	293004
GA2	358499
HA3	293948
IA3	202240
JA3	109577
KA3	177672
LA3	141080
MA3	953753

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	894509
DENSITY 3 =	2224685
DENSITY 4 =	98074
TOTAL =	3217268

MATHEWS, VA.
VIMS MAP # 123

AA4	56956
BA4	190594
CA3	10232
DA3	3239
EA3	103296
FA3	92416
GA2	20581
HA4	2575
IA2	1341
JA2	231796
KA4	597524
LA1	38195
MA2	153954
NA4	103213
OA2	2527
PA4	313314
QA2	188645
RA2	148984
SA2	35208
TA4	13835
UA3	14073
VA4	11823
WA4	16179
XA1	5004
YA3	33250
ZA2	1678
AB2	215947

TOTAL AREA

DENSITY 1 =	43199
DENSITY 2 =	1000661
DENSITY 3 =	256506
DENSITY 4 =	1306013
TOTAL =	2606379

FRANKTOWN, VA.
VIMS MAP # 124

AA4	104869
BA4	7042
CA1	579663
DA3	71403
EA4	303339
FA4	444841
GA3	16425
HA2	25178
IA3	125830
JA3	34019
KA2	9970
LA3	233033
MA2	3772
NA2	159284
OA2	280568
PA4	1624117
QA2	68580
RA2	32894
SA2	47322
TA2	140035
UA1	553650
VA3	84258
WA4	319073
XA2	65056
YA1	17535
ZA2	16693
AB3	7583
BB3	3953
CB2	3274
DB3	159196
EB3	16096
FB2	83106
GB2	7788
HB2	22975
IB2	108175
JB2	137576
KB2	163693
LB4	194283

TOTAL AREA

DENSITY 1 =	1150847
DENSITY 2 =	1375938
DENSITY 3 =	751795

DENSITY 4 =	2997564
TOTAL =	6276144

ACHILLES, VA.
VIMS MAP # 131

AA2	59876
BA3	65913
CA3	28365
DA4	47941
EA4	1176394
FA2	134459
GA1	19359
HA4	19588
IA4	32946
JA4	1286151
KA2	268840
LA2	48494
MA2	6815
NA2	11827
OA4	62196
PA4	958872
QA3	297179
RA2	10283
SA4	1254171
TA2	230192
UA1	87846
VA3	152168
WA3	2632
XA3	2820
YA4	230959
ZA2	17219
AB4	17732
BB4	264361
CB2	15472
DB4	1406738
EB2	38617
FB4	584129
GB2	94540
HB2	55317
IB2	8348
JB3	45707
KB2	29895
LB3	219066
MB4	488643
NB2	314122
OB2	12595

TOTAL AREA

DENSITY 1 =	107205
DENSITY 2 =	1356911
DENSITY 3 =	813849
DENSITY 4 =	7830820
TOTAL =	10108785

NEW POINT COMFORT, VA.
VIMS MAP # 132

AA2	413907
BA2	316925
CA2	160192
DA4	4976767
EA2	154059
FA4	540688
GA2	296762
HA3	167654
IA3	1363050
JA4	764889
KA1	60239
LA1	134080
MA1	75356
NA4	1078273
OA2	113550
PA1	283908
QA3	553175
RA4	1086998
SA2	181078
TA3	85898
UA3	24170
VA4	923419
WA2	515893
XA3	113416
YA4	102601

TOTAL AREA

DENSITY 1 =	553583
DENSITY 2 =	2152366
DENSITY 3 =	2307363

DENSITY 4 =	9473635
TOTAL =	14486948

CAPE CHARLES, VA.
VIMS MAP # 133

AA2	150852
BA1	113334
CA4	20222
DA3	288240
EA2	7416
FA4	786013
GA2	102565
HA2	15467
IA2	12841
JA2	41489
KA3	69389
LA3	158079
MA1	831559
NA4	831390
OA2	53660

TOTAL AREA

DENSITY 1 =	944893
DENSITY 2 =	523500
DENSITY 3 =	515708
DENSITY 4 =	1637626
TOTAL =	3621727

CHERITON, VA.
VIMS MAP # 134

AA2	94725
BA4	165860
CA2	186115
DA4	380570

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	280840
DENSITY 3 =	0
DENSITY 4 =	546430
TOTAL =	827270

YORKTOWN, VA.
VIMS MAP # 139

AA1	1483
BA2	5595

TOTAL AREA

DENSITY 1 =	1483
DENSITY 2 =	5595
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	7078

POQUOSON WEST, VA.
VIMS MAP # 140

AA4	38373
BA4	29385
CA3	88437
DA2	579459
EA3	398276
FA2	94520
GA4	65475
HA3	25208
IA2	34396
JA4	159820
KA2	104416
LA1	697616
MA3	716220
NA3	94359
OA4	32228
PA2	809479
QA4	462895
RA2	233662
SA4	635382
TA4	16900
UA2	73308
VA2	22744
WA3	24524
XA3	53615
YA4	55763

TOTAL AREA

DENSITY 1 =	697616
DENSITY 2 =	1951985

DENSITY 3 =	1400639
DENSITY 4 =	1496221
TOTAL =	5546460

POQUOSON EAST, VA.
VIMS MAP # 141

AA2	750841
BA4	5521553
CA4	419709
DA1	1692467
EA2	118392
FA3	1584619
GA3	1335586
HA3	61558
IA4	11204
JA4	6188
KA2	2522
LA4	8421
MA2	1049

TOTAL AREA

DENSITY 1 =	1692467
DENSITY 2 =	872804
DENSITY 3 =	2981763
DENSITY 4 =	5967074
TOTAL =	11514108

ELLIOTTS CREEK, VA.
VIMS MAP # 142

AA2	12778
BA2	60092
CA3	17349
DA2	16705
EA1	262609
FA3	284865
GA2	27261

TOTAL AREA

DENSITY 1 =	262609
DENSITY 2 =	116835
DENSITY 3 =	302213
DENSITY 4 =	0
TOTAL =	681657

TOWNSEND, VA.
VIMS MAP # 143

AA2	2088
BA2	5130

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	7218
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	7218

HAMPTON, VA.
VIMS MAP # 147

AA3	27356
BA1	66281
CA3	329045
DA4	89073
EA3	570470
FA1	291815
GA2	3537
HA3	107896
IA3	122341
JA4	464393
KA4	49381
LA2	657499
MA4	564219
NA3	24397
OA4	367581
PA1	77096

TOTAL AREA

DENSITY 1 =	435192
DENSITY 2 =	661036
DENSITY 3 =	1181504
DENSITY 4 =	1534646
TOTAL =	3812378

CAPE HENRY, VA.
VIMS MAP # 152

AA3	41815
BA2	57983
CA2	16501
DA3	22831
EA2	5534
FA3	10665
GA1	62029
HA2	19265

TOTAL AREA

DENSITY 1 =	62029
DENSITY 2 =	99283
DENSITY 3 =	75311
DENSITY 4 =	0
TOTAL =	236624

PORT TOBACCO, MD.
VIMS MAP # 161

AA2	1936
BA4	124586

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	1936
DENSITY 3 =	0
DENSITY 4 =	124586
TOTAL =	126522

CHARLOTTE HALL, MD.
VIMS MAP # 162

AA4	62312
BA3	27435

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	0
DENSITY 3 =	27435
DENSITY 4 =	62312
TOTAL =	89747

ASSAWOMAN BAY, MD.
VIMS MAP # 166

AA3	12337

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	0
DENSITY 3 =	12337
DENSITY 4 =	0
TOTAL =	12337

BERLIN, MD.
VIMS MAP # 167

AA1	23666
BA3	14080
CA4	30095
DA2	27993
EA4	10240
FA3	5224

TOTAL AREA

DENSITY 1 =	23666
DENSITY 2 =	27993
DENSITY 3 =	19304
DENSITY 4 =	40335
TOTAL =	111298

OCEAN CITY, MD.
VIMS MAP # 168

AA2	6228
BA3	10422
CA2	134630
DA3	7098
EA2	8253
FA3	7967
GA2	2150

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	151261
DENSITY 3 =	25486
DENSITY 4 =	0
TOTAL =	176747

TINGLES ISLAND, MD.
VIMS MAP # 170

AA3	12628
BA2	9029
CA2	12639
DA3	1032231
EA4	5638755
FA2	15576
GA2	11637
HA1	181657
IA4	421797
JA3	1725045
KA2	13333
LA2	1762
MA3	3060
NA3	14731
OA4	551437
PA4	533540
QA4	203027
RA3	2593
SA3	211753
TA4	42205
UA2	14414
VA2	970
WA3	8864
XA2	1711

TOTAL AREA

DENSITY 1 =	181657
DENSITY 2 =	81071
DENSITY 3 =	3010905
DENSITY 4 =	7390760
TOTAL =	10664392

BOXIRON, MD.-VA.
VIMS MAP # 172

AA4	2247909
BA3	111231
CA2	2759
DA3	26738
EA1	115705
FA3	1761897
GA3	1184457
HA4	25953
IA4	87632
JA2	30505
KA1	93206
LA4	870128
MA4	167116

TOTAL AREA

DENSITY 1 =	208911
DENSITY 2 =	33264
DENSITY 3 =	3084322
DENSITY 4 =	3398739
TOTAL =	6725237

WHITTINGTON POINT, MD.-VA.
VIMS MAP # 173

AA1	13652
BA3	40924
CA1	234779
DA4	289082
EA2	220612
FA4	29994
GA1	251043
HA2	84242
IA4	1633576
JA3	136577
KA1	150645
LA3	163557
MA1	208052
NA4	56532
OA4	44037
PA3	31287

QA2	11925
RA1	36296
TOTAL AREA	
DENSITY 1 =	894467
DENSITY 2 =	316779
DENSITY 3 =	372345
DENSITY 4 =	2053222
TOTAL =	3636813

CHINCOTEAGUE WEST, VA.
VIMS MAP # 174

AA4	6316
TOTAL AREA	
DENSITY 1 =	0
DENSITY 2 =	0
DENSITY 3 =	0
DENSITY 4 =	6316
TOTAL =	6316

CHINCOTEAGUE EAST, VA.
VIMS MAP # 175

AA3	68606
BA4	6030491
CA3	29508
TOTAL AREA	
DENSITY 1 =	0
DENSITY 2 =	0
DENSITY 3 =	98114
DENSITY 4 =	6030491
TOTAL =	6128605

APPENDIX E

1991 Submerged Aquatic Vegetation Ground Truth Surveys.

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
002	FA3	GA4	Ms,Va/Ms,Hv,Hd	Cit./Harford	9\30/8\15
	BA3	CA4	Ms/Ms,Hv,Hd	Cit./Harford	9\30/8\15
	*	FA3	Ms/Ms,Hd	Cit./Harford	6\16/8\15
	*	EA3	Va	Cit.	6\16
003	PA1	NB4	Ms,Hv,Cd	Cit.	7\17
	OA2	MB2	Ms,Cd/Ms,Hv,Hd,Va	Cit./Harford	7\17/8\15
	MA4	NB4	Va,Ms/Ms,Ngu,Va	Cit./Harford	7\17/8\15
	LA4	OB4	Hv,Ms,Cd,Va/Ms	Cit./Harford	7\17/8\15
	DA2	CA2	Cd,Ms/Ms,Hv,Hd	Cit./Harford	7\17/8\15
	Poplar Point #		Cd,Ms	Cit.	7\17
	AA2	AA2	Ms	Cit.	9\01
	IB4	PA4	Ms,Hv,Pcr,U	Cit.	9\15
	CB4	*	Ms,Hv,U	Cit.	9\15
	EA1	HA1	Ms/Ms	Cit./Harford	9\12/8\15
	Northeast R. #		Ms,Cd	Cit.	9\21
	AB2	JA4	Ms,Hv,U/Ms,Cd,Hd	Cit./Harford	8\22/8\15
	IB4	PA4	Ms,Hv,U/Ms,Cd,Hd,Hv	Cit./Harford	8\22/8\15
	KB4	AB4	Ms,U,Hv/Ms,Hv,Cd,Hd	Cit./Harford	8\22/8\15
	JB4	AB4	Ms,Hv	Cit.	8\22
	HB4	*	Ms	Cit.	8\22
	GB4	*	Ms	Cit.	8\22
	FB4	BB4	Ms,U,Hv/Ms,Hv,Cd,Hd,Ngu	Cit./Harford	8\22/8\15
	EB4	CB4	Ms,Hv,U/Hv,Ms,Cd,Hd,Nm	Cit./Harford	8\22/8\15
	ZA3	DB4	Ms,Hv,U	Cit.	8\22
	SA4	IA4	Ms	Cit.	8\22
	YA3	EB4,FB4	Ms	Cit.	8\22
	XA4	GB4	Ms	Cit.	8\22
	WA4	HB4	Ms/Hv,Ms,Va	Cit./Harford	8\22/8\15
	VA4	IB4	Ms/Hv,Ms,Hd	Cit./Harford	8\22/8\15
	UA4	JB4	Ms/Hv,Va,Ms,Hd	Cit./Harford	8\22/8\15

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
003	RB3	WA4	Ms,U/Ms,U	Cit./Harford	9\30/8\15
	QB3	ZA4	Ms,Hv	Cit.	9\30
	MB3	YA4	Ms,Hv,U,Va/Ms,Hv,Cd	Cit./Harford	9\30/8\15
	LB4	ZA4	Ms,U/Ms,U	Cit./Harford	9\30/8\15
	DB4	MA4,LA4	Ms,U/Ms,Hd	Cit./Harford	9\30/8\15
	DB4	MA4,LA4	Ms,Hv,Hd,Cd,Va	Harford	8\15
	TB4	SA4	Ms,Hv,U/Cd,Hv,Ms,Hd	Cit./Harford	9\30/8\15
	BB3	KA4	Ms,Hv/Ms,Cd,Hv,Va	Cit./Harford	9\30/8\15
	NB4	QA4	U/Ms,Hd	Cit./Harford	9\14/8\15
	CA1	DA2	Ms,Cd	Harford	8\15
	EA1	HA1	Ms	Cit.	No Date
	EA1	HA1	Ms,U	Cit.	No Date
	BA2	BA2	Ms	Harford	8\15
	CA1	EA2	Ms,Cd	Harford	8\15
	DA2	FA2	Ms,Hv,Cd,Hd	Harford	8\15
	QA4	GA4	Va,Ms,Hv,Hd,N,Cd	Harford	8\15
	SA4	IA4	Hv,Ms,Hd,Cd	Harford	8\15
	SA4	IA4	Hv,Ms,Cd,Hd,Va,N	Harford	8\15
	DB4	OA4	Ms,Cd	Harford	8\15
	OB4	RA4	Ms,Cd,Hd	Harford	8\15
	*	TA4	Ms,Hd	Harford	8\15
	Susquehanna State Pk. #		Hd,Hv	Cit.	No Date
	PB3	XA4	Ms	Harford	8\15
	TA3	KB4	Hv,Ms,Va,Hd,Cd	Harford	8\15
	NA3	LB4	Ms,Hd,Va,Hv	Harford	8\15
	NA3	LB4	Ms,Hd,Va,Hv	Harford	8\15
	KA2	PB4	Hv,Ms,Ngr	Harford	8\15
	JA4	QB3	Ms,Hv,Hd,Cd,N	Harford	8\15
	HA2	RB2	Ms,Hd,Hv,Va	Harford	8\15
	HA2	SB2	Ms,Va,Hd	Harford	8\15

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
003	GA2	TB2	Ms	Harford	8\15
	FA1	UB1	Ms	Harford	8\15
004	DA2	DA2,EA1	Ms/Ms	Cit./Harford	5\20,8\10/8\15
	FA2	FA1	Ms/Ms	Cit./Harford	8\27/8\15
	HA2	HA1	Ms,Va/Ms	Cit./Harford	8\27/8\15
	GA2	GA1	Ms/Ms	Cit./Harford	5\26,7\16\,8\10/8\15
	Seneca Point #		Ms	Cit.	8\31
005	Elk River #		Ms	Cit.	8\27
	Paddy Piddle Cv. #		Ms	Cit.	8\27
	AA2	AA1	Ms/Ms	Cit./Harford	8\27/8\15
	BA2	BA1	Ms/Ms	Cit./Harford	6\15-9\13/8\15
	Elk River #		Ms	Cit.	6\15-9\13
006	Gunpowder Falls #		Pcr	Cit.	9\8
	Gunpowder Falls #		Pcr	Cit.	9\8
	Gunpowder Falls #		Cd	Cit.	9\8
	Gunpowder Falls #		Pcr,Ngr	Cit.	9\8
	Gunpowder Falls #		Pcr,Ngr	Cit.	9\8
	Gunpowder Falls #		Cd	Cit.	9\8
	Gunpowder Falls #		Pcr,Ngr	Cit.	9\8
	Gunpowder Falls #		Ngr	Cit.	9\8
007	Otter Point Creek #		Ec,Pcr,Ms	Cit.	7\24
	Bird River #		Ms	Cit.	9\8
	Otter Point Creek #		Cd,Ms,Va	Cit.	9\14
009	FA2	BB2	Ms,U/Ms	Cit./Harford	7\5/8\15
	DA1	DA1	Ms,U/Ms	Cit./Harford	7\5/8\15
	BA2	AA1	Ms,Va,U/Ms	Cit./Harford	8\26/8\15
	AA2	AA1	Ms,Hv	Cit.	6\23

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
009	EA2	YA2	Ms,Va,Hv,U/Ms,Va,Hd,Hv,Cd	Cit./Harford	No Date/8\15
	GA2	TB2	Ms	Harford	8\15
	CA2	BA2	Ms	Harford	8\15
	*	AB2	Ms	Harford	8\15
	*	ZA2	Ms	Harford	8\15
010	AA2	AA1	Ms/Ms	Cit./Harford	6\23/08/15
	BA2	CA1	Ms,Va	Cit.	8\26
	CA2	*	Ms,Va	Cit.	8\26
	EA2	EA1	Ms,U/Ms	Cit./Harford	9\09/8\15
	JA1	FA1	Ms/Ms	Cit./Harford	9\09/8\15
	IA2	GA1	Ms/Ms	Cit.	5\26
	Veazy Cove #		Ms,Zp,U	Cit.	5\26
	FA2	*	Ms,N	Cit.	No Date
	IA2	HA2	Ms,Va	Harford	8\15
	IA2	GA1	Va	Harford	8\15
	IA2	GA1	Ms,Va	Harford	8\15
	DA1	DA1	Ms	Harford	8\15
	GA1	LA1	Ms	Harford	8\15
	HA2	KA2	Ms,Va	Harford	8\15
	IA2	JA2	Ms	Harford	8\15
	IA2	JA2	Ms,Va	Harford	8\15
	IA2	JA2	Ms	Harford	8\15
	IA2	IA2	Ms,Va,Ppc	Harford	8\15
013	N. of Log Pt. #		U	Cit.	5\22
	Seneca Creek #		Cd,Zp	Essex	6\09
014	PA4	OA3	Ms,Va,Ec/Ec,Ms	Cit./Harford	5\09/8\15
	DA2	DA2,CA2	Ms/Cd	Cit./Essex	6\09/6\09, 9\12

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
014	CA2	*	Cd,Ms/Cd	Cit./Essex	6\09,8\13/6\09,9\15
	White Oak Pt. #		Cd,Ms	Cit.	No Date
	FA3	IA2,HA3	Cd,Ms,Va,Ec	Cit.	6\09, 7\23
	HA3	KA3,LA2	Ms,U	Cit.	6\09
	*	BA2	Cd	Cit.	6\09
	White Oak Pt. #		Cd,Ec,Ms/Cd,Ms	Cit./Essex	6\09/6\15, 8\27
	Saltpeter Cr. #		Ms	Cit.	6\09
	N. of White Oak Pt. #		Ec	Cit.	6\09
	Saltpeter Creek #		Cd/Ms,Cd,Va	Cit./Essex	6\09/6\15,8\27
	EA2	EA3	Ms,Pcr/Ms,Pcr	Cit./Essex	04-08/6\09,9\12
	MA3	QA3	Ms/Ms,Cd,Va,Ec	Harford/Essex	08\15 /6\14,7\30
	HA3	KA3	Ms	Harford	08\15
	PA4	OA3	Va,Cd,Ngu/Ms,Cd,Zp,Ec,Va	Harford/Essex	08\15/6\14
	PA4	OA3	Ms,Va,Ec	Essex	5\16,7\30,9\26
	HA3	KA3	Ms	Essex	4\16
	KA3	*	Ms,Ec	Essex	5\16,7\17,9\12
	KA3,JA3	NA3	Ms,Ec	Essex	5\16,7\17,8\27
	*	JA2	Ms	Essex	5\16,7\17,8\27
	Saltpeter Creek #		Ms,Va,Ec	Essex	6\14,7\30
	OA3	PA3	Ms	Essex	1\17-4\21
	OA3	PA3	Ec,Ms,Va	Essex	6\13-7\27
	OA3	PA3	Ms,Ec,Va,Zp	Essex	5\09
	OA3	PA3	Ms,Va,Ec	Essex	8\4,9\22,9\26,10\23,11\14
015	AA2	AA2	Ms	Cit.	5\18
	CA2	CA2	Ms	Cit.	5\18
	Stillpond Neck #		Ms	Cit.	5\18
	*	BA2	Ms,U	Cit.	5\18
	Plum Point #		Ms	Cit.	5\18
016	BA2	*	Ms	Cit.	9\05

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
016	AA2	AA2	Ms	Harford	8\15
	*	BA1	Ms	Harford	8\15
018	Stony Creek #		Rm	Cit.	June-July
019	Main Creek #		Zp	Cit.	5\15-7\15
	Wall Cove #		Zp	Cit.	7\06
	N. of Wall Cove #		Zp,U	Cit.	7\06
021	CA3	CA4	Ppf	HPEL	7\30
023	Old Man Creek #		Zp	Cit. & DNR	5\17
	Severn Run #		Zp	Cit.	6\21
	Lakeland #		Zp	Cit.	6\21
	Valentine Creek #		Zp	Cit.	6\21
	Mayneider Creek #		Zp	Cit.	6\21
	Brewer Creek #		Zp	Cit.	6\21
	Henderson Point #		Zp	Cit.	June
	Forked Creek #		Zp	Cit.	5\11
	Yantz Creek #		Zp	Cit.	5\11
	Benfield #		Zp	Cit.	June-July
	N. Herald Harbor #		Zp	Cit.	June-July
	S. Herald Harbor #		Zp	Cit.	June-July
	Sullivan Cove #		Zp	Cit.	Feb.-Sept.
	Asquith Creek # (3)		Zp	Cit.	Feb.-Sept.
	Chase Creek # (2)		Zp	Cit.	Feb.-Sept.
	Severn Run #		Zp,U	Cit.	Feb.-Sept.
	Sunrise Beach #		U	Cit.	Feb.-Sept.
	Ringhold Cove #		Zp	Cit.	Feb.-Sept.
	Hopkins Creek # (2)		Zp	Cit.	Feb.-Sept.
	Clement Creek # (2)		Zp	Cit.	Feb.-Sept.

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
023	Saltworks Creek # (2)		Zp	Cit.	Feb.-Sept.
	Forked Creek #		U	Cit.	Feb.-Sept.
	Brewer Pond #		Zp	Cit.	Feb.-Sept.
	Luce Creek #		Zp,U	Cit.	Feb.-Sept.
024	Forked Creek #		Zp	Cit.	5\30
	Meredith Creek # (5)		Zp,U	Cit.	5\15,7\05
	Sandy Point #		Zp	Cit.	5\15,7\05
026	LA3	JA3	Ms,Ec,Rm,Ppf,Ppc,Zp	Cit.	7\24
	CA1	*	Rm	Cit.	7\27
	Calfpasture Cv. #		Rm,Ppf	Cit.	7\27
	Reed Creek #		Rm	Cit.	Feb.-Sept.
	East Fork #		Ms	Cit.	9\14
	DA3	DA3	Ec	HPEL	7\30
	DA3	DA3	Ppf,Rm,Ec	HPEL	7\30
	Church Creek #		Ec,Ppf	HPEL	7\30
028	*	CA3	Hd	COG	No Date
	*	BA2	Hd	COG	No Date
	Roosevelt Island #		Hd	COG	No Date
	Key Bridge #		Hd	COG	No Date
	*	AA2	Hd	COG	No Date
	Roosevelt Island #		Hd,Hv	COG	No Date
	Memorial Bridge #		Hv,Hd,Va	COG	No Date
029	Colmar Manor Pk. # (3)		N	Cit	8\2
	Kenilworth Grdns #		Hv	Cit.	8\2
	Anacostia River #		Hv	COG	No Date

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
030	Beards Creek #		Zp,U	Cit.	5\13
	Muddy Creek #		Zp,Cd	Cit.	5\13
	Larkington Cove #		Zp	Cit.	Feb.-Sept.
	Glebes Bay # (8)		Zp	Cit.	Feb.-Sept.
	Cedar Point #		Zp	Cit.	Feb.-Sept.
	South River #		Zp	Cit.	Feb.-Sept.
	Glebe Creek #		Zp	Cit.	Feb.-Sept.
	Glebe Creek #		Zp	Cit.	Feb.-Sept.
	Pocahontas Creek #		Zp	Cit.	Feb.-Sept.
	Harness Creek #		Zp	Cit.	Feb.-Sept.
	Broad Creek #		Zp	Cit.	Feb.-Sept.
	Flat Creek #		Zp	Cit.	Feb.-Sept.
	Granville Creek #		Zp	Cit.	Feb.-Sept.
	Beards Creek # (2)		Zp	Cit.	Feb.-Sept.
	Warehouse Creek # (2)		Zp	Cit.	Feb.-Sept.
	Edgewater Beach #		Zp	Cit.	Feb.-Sept.
	Almhouse Creek # (4)		Zp	Cit.	Feb.-Sept.
	Aberdeen # (6)		Zp	Cit.	Feb.-Sept.
	Wild Rose Sh. #		Zp	Cit.	Feb.-Sept.
	Crab Creek # (5)		Zp	Cit.	Feb.-Sept.
	Church Creek # (2)		Zp	Cit.	Feb.-Sept.
	Gingerville # (2)		Zp	Cit.	Feb.-Sept.
	Cape St. John #		Zp	Cit.	Feb.-Sept.
	Broad Creek # (2)		Zp	Cit.	Feb.-Sept.
	Harness Creek # (4)		Zp	Cit.	Feb.-Sept.
	Ramsey Lake # (4)		Zp	Cit.	Feb.-Sept.
	Selby Bay # (2)		Zp	Cit.	Feb.-Sept.
	Limehouse Cove # (2)		Zp	Cit.	Feb.-Sept.
031	Lake Ogleton # (6)		Zp	Cit.	6\6
	Black Walnut Crk. # (6)		Zp,Ms	Cit.	6\6

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
031	Kitty Duvall # (2)		Zp	Cit.	May-June
	Big Pond #		Zp	Cit.	March-Sept.
	Ramsey Lake #		Zp	Cit.	March-Sept.
	Fishing Creek #		Rm	Cit.	March-Sept.
	Carr Creek #		Zp	Cit.	March-Sept.
	Oakwood #		Zp	Cit.	March-Sept.
	Lake Ogleton # (2)		Zp	Cit.	March-Sept.
	Spa Creek # (4)		Zp	Cit.	March-Sept.
032	Kirwan Creek #		U	Cit.	5\23
	IA2	*	Rm	HPEL	7\30
	QA1	BA2	Rm	HPEL	7\30
033	Hood Point #		Rm	Cit.	7\23
	GA2	*	Zp,U	Cit.	5\25-7\15
	HA2	*	Zp	Cit.	5\25-7\15
	*	EA2	Zp	Cit.	5\25-7\15
	Narrows #		U	Cit.	5\25-7\15
	Winchester Cove #		Zp	Cit.	5\25-7\15
	Drum Point #		U	Cit.	July
	Drum Point #		U	Cit.	July
	Granary Creek #		U	Cit.	6\16
034	Broad Creek #		Ms,Hv	COG	No Date
	Broad Creek #		Ms	COG	No Date
	*	AA2	Ms	COG	No Date
	LB3	AA2	Ms,Cd	COG	No Date
	LB3	BA4	Ms,Va	COG	No Date
	KB4	BA4	Ms,Va	COG	No Date
	KB4	BA4	Hv,Ms,Hd,Cd	COG	No Date
	JB2	CA4	Ms,Cd,Hd,Hv	COG	No Date
	JB2	CA4	Hd,Hv,Ms	COG	No Date

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
034	JB2	CA4	Hv,Ms,Hd,Cd	COG	No Date
	IB4	*	Va	COG	No Date
	IB4	DA4	Hv,Cd	COG	No Date
	FB2	GA4	Hv,Hd,Ms	COG	No Date
	Spoil area #		Hv,Cd,Ms,Hd,Va	COG	No Date
	EB4	HA4	Hv,Ms,Hd	COG	No Date
	CB4	IA4	Hv	COG	No Date
	CB4	IA4	Hv,Ms,Hd,Cd	COG	No Date
	CB4	IA4	Hv,Ms,Cd	COG	No Date
	DB4	JA4	Hv,Cd,Hd	COG	No Date
	Oxon Creek #		Hv,Ms,Cd	COG	No Date
	AB4	KA4	Hv,Hd	COG	No Date
	ZA4	LA4	Ms,Hv,Hd,Cd	COG	No Date
	NA4	NA4	Ms,Hv	COG	No Date
	BB4	MA4	Hd,Hv,Ms,Va,Cd	COG	No Date
	*	NA4	Ms,Hv,Va,Cd,Hd	COG	No Date
	*	OA2	Hd	COG	No Date
	*	s.of PA2	Va	COG	No Date
	*	PA2	Va	COG	No Date
	XA3	QA3	Va,Ms	COG	No Date
	Anacostia River #		Hv,Ms,Va	COG	No Date
	UA4	TA4	Hv,Hd,Ms,Va,Cd	COG	No Date
	UA4	TA4	Hv,Va	COG	No Date
	*	UA2	Hd	COG	No Date
	*	VA2	Hd	COG	No Date
	*	VA2	Hd,Ms,Hv	COG	No Date
	SA1	VA2	Hd,Ms,Va	COG	No Date
	SA1	*	Hd	COG	No Date
	SA1,TA3	WA1,XA4	Hv,Hd	COG	No Date
	PA2	*	Hd,Hv,Ms,Cd	COG	No Date
	QA2	ZA2	Va,Hd,Hv	COG	No Date

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
034	Daingerfield Is. #		Hv,Hd,Ms,Cd,Va	COG	No Date
	OA2	AB2	Va,Hd,Ms	COG	No Date
	NA3	BB2	Ms,Hd	COG	No Date
	KA4	DB2	Hv,Hd,Va,Ms,Cd	COG	No Date
	IA2	EB4	Hv,Va,Hd	COG	No Date
	HA2	FB4	Ms,Hv,Hd	COG	No Date
	*	GB4,HB4	Hv,Cd	COG	No Date
	FA2	JB1	Hv,Ms	COG	No Date
	FA2	JB1	Hv	COG	No Date
	FA2	IB4	Hv,Ms,Cd,Hd	COG	No Date
	GA4	IB4	Hv	COG	No Date
	*	KB4	Hv,Ms,Cd,Va	COG	No Date
	EA2	NB3	Hv,Ms,Va,Cd	COG	No Date
	EA2	NB3	Hv,Ms	COG	No Date
	DA3	LB3	Hv,Ms,Va	COG	No Date
	CA3,EA2	MB3,NB3	Hv,Ms	COG	No Date
	BA3	OB3	Hv,Va,Cd	COG	No Date
	*	s. of NB3	Hv,Ms,Cd	COG	No Date
	*	s. of OB3	Hv,Ms,Hd	COG	No Date
	AA3	PB3	Hv,Hd,Ms,Va	COG	No Date
	AA3	PB3	Hv,Hd,Ms,Va	COG	No Date
	Hog Island #		Va,Hv,Ms,Cd,Hd	COG	No Date
	Hog Island #		Hv,Va,Hd	COG	No Date
035	Lerch Creek #		Zp	Cit.	03-07/91
	Deep Cove #		Zp	Cit.	03-07/91
	Rockhold Creek #		Zp,U	Cit.	03-07/91
	Tracys Creek #		Zp	Cit.	03-07/91
	South Creek # (3)		Zp	Cit.	03-07/91
036	CA3	DA2	Zp,U	Cit.	6\29
	s. of Wades Pt. #		Zp	Cit.	6\29

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
036	AA3	CA3	Zp,U	Cit.	6\29
	IA3	EA1,FA4,GA1	Zp,U	Cit.	6\29
	Edgar Cove # (2)		U	Cit.	9\01
	AA3	AA1,BA4	Zp	Cit.	No Date
	AA3	AA1	Rm	HPEL	10\22
	AA3	CA3	Rm	HPEL	10\22
	BA1,CA3	DA2	Rm	HPEL	10\22
037	s. of Woodland Cr. #		Zp	Cit.	5\18-6\07
	EA1	AA1	U	Cit.	5\18-6\07
	FA2	*	Rm,U	Cit.	7\30
	Leeds Creek #		Rm	Cit.	7\30
	DA2	*	Rm,U	Cit.	7\30
038	Pickering Creek # (2)		Zp	Cit.	Spring\Summer 91
039	AA4	AA4	Hv,Ms,Nm,Cd,Va	COG	9\18
	BA4	AA4	Hv,Ms,Nm	COG	9\18
	BA4	AA4	Hv	COG	9\18
	CA1	AA4	Hv,Va,Nm,Ms	COG	9\18
	CA1	AA4	Hv,Va,Ms,Nm	COG	9\18
	CA1	AA4	Va,Hv,Ms	COG	9\18
	CA1	BA2	Va,Ms,Hv	COG	9\18
	DA3	CA4	Hv,Va,Nm,Ms	COG	9\18
	DA3	CA4	Hv,Va,Nm,Cd,Ms	COG	9\18
	DA3	CA4	Hv,Va,Ms,Nm	COG	9\18
	EA2	CA4	Va,Hv,Ms	COG	9\18
	EA2	CA4	Ms,Hv,Hd,Va	COG	9\18
	EA2	CA4	Hv,Va,Ms	COG	9\18
	EA2	CA4	Ms,Va	COG	9\17
	EA2	CA4	Ms	COG	9\17
	EA2	CA4	Ms,Va,Hv,Cd	COG	9\17

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
039	Pohick Bay #		Cd,Hv	COG	9\17
	GA3	GA3	Hv,Cd	COG	9\17
	Pohick Bay #		Hv	COG	9\17
	Pohick Bay #		Cd,Hv	COG	9\17
	Accotink Bay #		Hv,Ms	COG	9\17
	Accotink Bay #		Hv,Ms,Cd	COG	9\17
	Accotink Bay #		Hv,Cd	COG	9\17
	Accotink Bay #		Hv	COG	9\17
	Gunston Cove #		Ms	COG	9\17
	HA4	FA4	Hv,Ms,Va	COG	9\17
	HA4	FA4	Ms,Hv	COG	9\17
	HA4	FA4	Ms	COG	9\17
	HA4	FA4	Ms	COG	9\17
	HA4	FA4	Ms,Hv,Cd,Nm	COG	9\17
	HA4	FA4	Hv,Ms,Nm,Cd	COG	9\17
	FA1	DA2	Ms,Va	COG	9\17
	FA1	DA2	Va,Ms,Cd	COG	9\17
	JA4	EA4	Hv,Va,Ms	COG	9\17
	JA4	EA4	Hv,Va,Ms,Cd,Hd	COG	9\17
	JA4	EA4	Va,Ms,Hd,Hv	COG	9\17
	JA4	EA4	Va,Ms,Hv	COG	9\17
	KA4	HA4	Hv,Nm	COG	9\17
	Dogue Creek #		Hv	COG	9\17
	Dogue Creek #		Hv	COG	9\17
	Dogue Creek #		Hv	COG	9\17
	Occoquan River #		Ms	COG	No Date
	Occoquan River #		Ms	COG	No Date
	Occoquan River #		Ms	COG	No Date
	Massey Creek #		Ms	COG	No Date
	Massey Creek #		Ms	COG	No Date
	Massey Creek #		Ms	COG	No Date

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
039	Belmont Bay #		Ms	COG	No Date
	Belmont Bay #		Hv	COG	No Date
	Belmont Bay #		Ms	COG	No Date
040	IA2	HA4	Ms,Hd	Cit.	June-Sept.
	HA4	HA4	Ms,Hd	Cit.	June-Sept.
	BA4	GA4	Hd,Hv,Va	Cit.	June-Sept.
	CA1	GA4	Hd,Hv	Cit.	June-Sept.
	EA3	*	Hd,Pcr	Cit.	June-Sept.
	AA4	AA3	Hv,Nm,Cd	COG	No Date
	AA4	AA3	Hv,Hd,Ms,Ngr,Cd	COG	No Date
	AA4	AA3	Hv	COG	No Date
	AA4	AA3	Hv,Va,Hd,Cd,Ms	COG	No Date
	BA4	BA4	Hv,Cd,Ms,Va	COG	No Date
	BA4	BA4	Hv,Va	COG	No Date
	BA4	BA4	Hv,Cd,Va,Ms,Nm	COG	No Date
	BA4	CA4	Hv,Cd,Va,Ms,Nm	COG	No Date
	BA4	CA4	Hv,Va,Cd,Hd	COG	No Date
	BA4	CA4	Hv,Va,Cd,Hd	COG	No Date
	BA4	CA4	Hv,Va,Cd	COG	No Date
	BA4	EA4	Hv,Va,Cd,Hd	COG	No Date
	BA4	EA4	Hv,Va,Cd,Hd	COG	No Date
	BA4	FA4	Hv,Ms,Va,Cd,Hd	COG	No Date
	BA4	FA4	Hv,Ms,Cd,Va	COG	No Date
	BA4	FA4	Hv,Cd,Ms,Hd	COG	No Date
	BA4	FA4	Hv	COG	No Date
	BA4	FA4	Hv,Cd,Ms,Hd	COG	No Date
	BA4	FA4	Hv,Cd,Hd	COG	No Date
	BA4	FA4	Hv,Ms,Cd,Hd	COG	No Date
	BA4	FA4	Hv,Ms,Cd,Hd	COG	No Date
	BA4,CA1	GA4	Hv,Ms,Cd,Hd	COG	No Date

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
040	BA4,CA1	GA4	Hv,Ms,Cd,Hd	COG	No Date
	BA4,CA1	GA4	Hv,Ms	COG	No Date
	BA4,CA1	GA4	Hv,Ms,Cd,Hd	COG	No Date
	DA4,IA2,HA4	HA4	Hv,Va,Ms,Hd	COG	No Date
	DA4,IA2,HA4	HA4	Hv,Ms	COG	No Date
	*	IA4	Hv	COG	No Date
	Piscataway Creek #		Hv,Ms	COG	No Date
	Piscataway Creek #		Hv,Ms	COG	No Date
	Piscataway Creek #		Hv,Ms	COG	No Date
	Piscataway Creek #		Hv,Ms	COG	No Date
	Piscataway Creek #		Hv,Ms	COG	No Date
	Piscataway Creek #		Hv,Ms	COG	No Date
	Piscataway Creek #		Hv	COG	No Date
	Piscataway Creek #		Ms	COG	No Date
	EA3	*	Hv,Ms	COG	No Date
	EA3	*	Hv	COG	No Date
	Piscataway Creek #		Hv,Ms,Hd	COG	No Date
	GA3	JA4	Hv,Ms,Hd	COG	No Date
	JA4	KA4	Hv,Va	COG	No Date
	JA4	KA4	Ms	COG	No Date
	JA4	KA4	Va,Hd,Ms,Hv	COG	No Date
	JA4	KA4	Va,Hd,Ms,Hv	COG	No Date
	JA4	LA1	Va,Hd,Ms,Hv	COG	No Date
	KA2,LA4	MA2	Va,Hd	COG	No Date
	KA2,LA4	MA2	Va,Ms,Hd	COG	No Date
	LA4	NA4	Hv	COG	No Date
	Riverview #		Hv	COG	No Date
	Riverview #		Hv	COG	No Date
	Riverview #		Hv	COG	No Date
	Marina #		Hv	COG	No Date
	Marina #		Hv	COG	No Date

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
040	NA4	OA4	Hv	COG	No Date
	NA4	OA4	Hv,Hd	COG	No Date
	OA2	PA2	Ms,Va,Hv	COG	No Date
	OA2	PA2	Ms	COG	No Date
	Potomac River #		Ms,Hv	COG	No Date
	PA2	*	Ms	COG	No Date
	Potomac River #		Hv,Ms,Ppc	COG	No Date
	QA3	*	Ms,Hv	COG	No Date
	QA3	*	Ms,Hv	COG	No Date
	Broad Creek #		Hv,Ms	COG	No Date
	Broad Creek #		Hv,Ms	COG	No Date
	Broad Creek #		Hv,Ms	COG	No Date
	Broad Creek #		Hv,Ms	COG	No Date
	SA2	*	Hd,Hv,Ms	COG	No Date
	SA2	*	Hv,Nm	COG	No Date
	SA2	*	Hv,Ms	COG	No Date
	SA2	*	Hv,Ms	COG	No Date
	Arcturus #		Hv,Hd,Ms	COG	No Date
	Potomac River #		Hv,Hd,Ms	COG	No Date
	Parkway #		Hv	COG	No Date
	Parkway #		Hv,Cd	COG	No Date
	Parkway #		Hv	COG	No Date
	Sheridan Point #		Hv	COG	No Date
	Potomac River #		Hv,Ms	COG	No Date
	TA4	*	Hv,Ms	COG	No Date
	TA4	*	Hv,Ms	COG	No Date
	Little Hunting Cr. #		Hv	COG	No Date
	Little Hunting Cr. #		Hv	COG	No Date
	Little Hunting Cr. #		Hv	COG	No Date
	Little Hunting Cr. #		Hv	COG	No Date
	UA4	QA4	Ms,Hv,Va	COG	No Date

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
040	UA4	QA4	Hv,Cd,Ms,Hd,Va	COG	No Date
	Potomac River #		Ms	COG	No Date
	*	TA1	Ms,Hv	COG	No Date
	*	TA1	Hv,Ms	COG	No Date
	Yacht Haven #		Hv,Va,Ms	COG	No Date
	Dogue Creek #		Hv,Cd	COG	No Date
	YA2,ZA4	XA4	Hv,Nm,Cd,Ms	COG	No Date
	YA2,ZA4	XA4	Hv,Cd,Ms,Nm	COG	No Date
	YA2,ZA4	XA4	Hv,Ms,Cd,Nm,Va	COG	No Date
	YA2,ZA4	XA4	Hv,Va,Ms,Cd,Hd	COG	No Date
	YA2,ZA4	XA4	Va,Ms,Hd	COG	No Date
041	Mattaponi Cr. #		Cd,Nm	Cit.	8\15
	Hall Creek #		Va,Ngu,Cd,Ec	Cit.	8\13
043	Balls Creek #		Zp	Cit.	September
	AA3	AA3	Rm	HPEL	10\22
	*	BA2	Rm	HPEL	10\22
044	Trippe Creek #		Zp	Cit. & DNR	5\17
	Tred Avon River #		Zp	Cit.	5\5
	Tar Creek #		Zp	Cit.	5\5
	Tred Avon River #		Zp	Cit.	5\5
	N. of Royston Is. #		Rm,Zp	Cit.	8\16
	BA2	AA3	Rm	Cit.	8\16
	EA3	*	Rm	Cit.	8\16
	DA2	*	Rm	Cit.	8\16
	Boone Creek #		U	Cit.	6\1-8\28
	Boone Creek #		U	Cit.	6\1-8\28
	BA2	AA3	Rm	HPEL	10\22
	*	CA3	Rm	HPEL	10\22

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
044	*	DA2	Rm	HPEL	10\22
047	EA4	AA4	Hv,Va,Cd,Ms	COG	No Date
	EA4	AA4	Hv	COG	No Date
	EA4	AA4	Hv,Ms,Cd,Va,Hd	COG	No Date
	EA4	AA4	Hv	COG	No Date
	EA4	AA4	Hv,Va,Ms,Cd	COG	No Date
	EA4	AA4	Hv,Va,Ms,Cd	COG	No Date
	EA4	AA4	Hv	COG	No Date
	CA4	DA4	Hv	COG	No Date
	CA4	EA3	Hv,Ms,Cd	COG	No Date
	FA4	FA4	Hv,Ms,Cd	COG	No Date
	FA4	FA4	Hv,Cd,Ms	COG	No Date
	FA4	FA4	Hv,Cd,Ms	COG	No Date
	FA4	FA4	Hv	COG	No Date
	FA4	FA4	Hv,Cd	COG	No Date
	FA4	FA4	Hv,Cd	COG	No Date
	FA4	FA4	Hv,Ms,Cd	COG	No Date
	FA4	FA4	Hv	COG	No Date
	FA4	FA4	Hv	COG	No Date
	FA4	FA4	Hv	COG	No Date
	FA4	FA4	Hv,Cd	COG	No Date
	FA4	*	Ms	COG	No Date
	FA4	GA3	Hv,Cd	COG	No Date
	FA4	GA3	Hv,Ms	COG	No Date
	FA4	HA4	Hv	COG	No Date
	FA4	IA2	Hv,Va,Ms,Cd	COG	No Date
	DA4	KA4	Hv,Cd,Ms	COG	No Date
	DA4	KA4	Hv,Cd,Ms	COG	No Date
	GA4	LA4	Hv,Ms	COG	No Date
	GA4	LA4	Hv	COG	No Date

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
047	GA4,HA4	MA4	Hv,Ppc,Va,Ms,Cd	COG	No Date
	GA4,HA4	MA4	Hv,Ms,Cd	COG	No Date
	*	OA4	Hv,Ms,Cd,Nm	COG	No Date
	*	OA4	Ms	COG	No Date
	IA4	PA4	Hv,Cd,Ms	COG	No Date
048	AA3	AA3	Hv,Ms	COG	No Date
	BA4	BA4	Hv,Ms,Cd,Va,Nm,Ppc	COG	No Date
	CA1	BA4	Hv,Va,Cd,Ms,Hd	COG	No Date
	DA3	BA4	Hd,Ms,Hv	COG	No Date
	DA3	BA4	Hv,Va,Ms,Cd,N	COG	No Date
	EA3	BA4	Hv,Va,Cd,Ms,Nm	COG	No Date
	*	BA4	Nm,Hv,Va,Ms	COG	No Date
	FA4	CA4	Nm,Hv	COG	No Date
	*	DA4	Hv,Ms,Cd,Nm	COG	No Date
	Thoroughfare Isl. #		Ms,Hv,N	COG	No Date
	Proctors Wharf #		Hv	COG	No Date
	Mattawoman Creek #		Va	COG	No Date
	Nelson Point #		Hv,Ms,Va,Cd	COG	No Date
	Mattawoman Creek #		Va,Cd	COG	No Date
	Mattawoman Creek #		Va	COG	No Date
	HA4	FA4	Hv,Nm	COG	No Date
	IA4	FA4	Nm,Hv,Ms,Cd	COG	No Date
	GA4	GA4	Hv,Nm,Ms	COG	No Date
	GA4	GA4	Hv,Ms	COG	No Date
	JA2,KA4	GA4	Hv,Ms,Cd,Hd,Va	COG	No Date
	KA4	HA4	Hv,Ms,Hd,Cd	COG	No Date
	KA4	HA4	Ms,Hd,Va	COG	No Date
	*	IA4	Cd,Hd	COG	No Date
	LA3	IA4	Hv,Va,Hd	COG	No Date
	LA3	IA4	Hd,Ms,Hv,Va,Cd	COG	No Date

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
048	MA4	JA4	Hv,Va,Cd,Hd,Ms	COG	No Date
	MA4	JA4	Hv,Hd,Cd	COG	No Date
	MA4	JA4	Hv,Cd,Va	COG	No Date
	Mason Neck #		Ms,Hv	COG	No Date
	*	KA2	Ms,Hd	COG	No Date
	Mason Neck #		Ms	COG	No Date
	Farm Creek #		Ms,Cd	COG	No Date
	Freestone Point #		Ms,Hv	COG	No Date
049	Holland Cliff #		Zp,Ec,Pcr	Cit.	6\1
	Deep Landing #		Zp	Cit.	6\1
	Cocktown Crk #		Cd,Ec,Va,Nm	Cit.	8\15
	Black Swamp #		Cd	Cit.	8\15
051	GA3	CA3	Rm	Cit.	8\15
	HA3	*	Rm	Cit.	8\15
	IA3	DA1	Rm	Cit.	8\15
	JA3	EA2	Rm	Cit.	9\18
	Hills Point #		Rm	Cit.	9\18
	Hills Pt. Cove #		Rm	Cit.	9\18
	GA3	CA3	Rm	HPEL	8\12
	HA3	*	Rm	HPEL	8\12
	FA2	EA2	Rm	HPEL	8\12
	NA2,DA3	GA2	Rm	HPEL	8\12
052	Back Cr. # (2)		Zp	Cit.	6\7
	AA3	AA2	Rm	Cit.	6\7
	W. of AA3	*	Rm	Cit.	6\7
055	*	PA2	Cd,Va,Ms	COG	No Date
	FA4	OA2	Va,Ms,Hv,Cd	COG	No Date
	FA4	OA2	Va,Ms	COG	No Date

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
055	FA4	NA4	Va,Ms,Cd	COG	No Date
	FA4	NA4	Va,Ms,Cd	COG	No Date
	FA4	NA4	Va,Ms	COG	No Date
	FA4	NA4	Va,Ms,Hv,Cd	COG	No Date
	FA4	NA4	Va,Ms	COG	No Date
	FA4	NA4	Va,Ms,Cd	COG	No Date
	FA4	NA4	Ms,Va,Cd	COG	No Date
	FA4	NA4	Ms,Va,Cd	COG	No Date
	IA4	LA4	Hv	COG	No Date
	IA4	LA4	Hv	COG	No Date
	*	KA2	Hv,Cd	COG	No Date
	*	KA2	Hv,Va,Cd,Ms,Hd	COG	No Date
	JA4	JA4	Va,Hv	COG	No Date
	JA4	JA4	Va,Ms,Cd,Hv	COG	No Date
	JA4	JA4	Hv,Va,Ms,Cd	COG	No Date
	JA4	JA4	Hv	COG	No Date
	JA4	JA4	Hv,Va,Ms,Cd	COG	No Date
056	NA2	MA3	Cd,Va	Cit.	9\28
	MA3	MA3	Cd,Va	Cit.	9\28
	LA4	MA3	Cd,Va	Cit.	9\28
	KA4	LA4	Cd,Va	Cit.	9\28
	IA4	JA3,LA4	Cd,Va	Cit.	9\28
	JA4	JA3,KA4	Cd,Va	Cit.	9\28
057	DA2	GA2,FA4	Va,Ppc,Ppf,Ec,Rm	Cit. & FWS	8\1
	EA3	HA3	Va,Ppf,Rm	Cit. & FWS	8\1
	FA4	IA4,JA2	Va,Ppf,Rm	Cit. & FWS	8\1
	GA2	HA4,GA2	Va	Cit. & FWS	8\1
	HA4	NA4,MA4,LA4	Va,Rm	Cit. & FWS	8\1

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
057	IA2	PA4,OA2,NA4	Va	Cit. & FWS	8\1
	JA4	PA4	Va	Cit. & FWS	8\1
060	Island Creek #		Zp	Cit.	June
	Island Creek #		Zp	Cit.	June
061	Saw Pit Cove #		Zp	Cit.	April-May
	N. Saw Pit Cove #		Zp	Cit.	April-May
	Breedens Point #		Zp	Cit.	April-May
	Breedens Point #		Zp	Cit.	April-May
	Breedens Point #		Zp	Cit.	April-May
	Pipeline #		Zp	Cit.	April-May
	S. of Fort Hill #		Zp	Cit.	April-May
	W. of Pipeline #		Zp	Cit.	April-May
064	Accokeek Creek #		Hv	COG	No Date
067	AA4	AA4	Ec,Rm	VIMS	No Date
	AA4	AA4	Ec,Ppf	VIMS	No Date
	BA3	EA4	Ec,Rm	VIMS	No Date
	CA3,DA3	FA3	Ec,Rm	VIMS	No Date
	DA3,CA3	FA3	Ppf,Ec	VIMS	No Date
	GA2	GA3	Rm	VIMS	No Date
	HA3	HA1	Va,Ppf	VIMS	No Date
068	Nealle Sound #		Zp	Cit.	May
070	Back Creek #		Zp	Cit.	5\13
	Back Creek #		Zp	Cit.	5\13
	Forrest Landing #		Zp	Cit.	5\13
	Cuckold Creek #		Zp	Cit.	5\13

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
070	Cuckold Creek #		Zp	Cit.	5\13
	Cuckold Creek #		Zp	Cit.	5\13
	Mill Creek #		Zp	Cit.	5\13
	Mill Creek #		Zp	Cit.	5\13
	Sam Abell Cove #		Zp	Cit.	5\13
	W. of Sam Abell #		Zp	Cit.	5\13
071	Hellen Creek #		Zp	Cit.	Sept.-Oct.
	Hellen Creek #		Zp	Cit.	Sept.-Oct.
	Cuckold Cr. Cove #		Rm	Cit.	Sept.-Oct.
	Green Holly Pond #		Zp	Cit.	5\12
	Harper Creek #		Zp,Rm	Cit.	5\30
	Harper Creek #		Zp	Cit.	5\30
	Pearson Creek #		Zp	Cit.	5\31
	Pearson Creek #		Zp	Cit.	5\31
	Harpers Creek #		Zp	Cit.	5\31
	Pearson Creek #		Zp	Cit.	5\31
	Pearson Creek #		Zp	Cit.	5\31
	Pearson Creek #		Rm	Cit.	6\13
	Goose Creek #		Rm	Cit.	6\13
	Hog Point #		Rm	Cit.	6\13
	Solomons #		Zp	Cit.	No date
073	EA4	LA4	Rm	HPEL	8\13
	FB3,GB2	RB3	Rm	HPEL	8\13
	ZA3,AB2	JB4	Rm	HPEL	8\13
	VB2,UB4	ZA2	Rm	HPEL	8\13
074	Fishing Point #		Rm,Zm	Cit.	6\11
078	Weatherall Creek #		Zp,Rm	Cit.	5\5

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
078	Cabin Point Creek #		Zp	Cit.	5\5
	Cabin Point Creek #		Zp	Cit.	5\5
084	LA1	*	Rm	Cit.	6\4,9\12
	KA3	*	Rm	Cit.	6\4,9\12
	HA3	*	Rm	Cit.	6\4,9\12
	GA3	*	Rm	Cit.	6\4,9\12
	EA3	BA2	Rm	Cit.	6\4,9\12
	FA2	*	Rm	Cit.	6\4,9\12
	CA2	AA3	Rm	Cit.	6\4,9\12
	BA2	AA3	Rm	Cit.	6\4,9\12
	AA1	AA3	Rm	Cit.	6\4,9\12
086	Back Creek #		Zp,Cd	Cit.	6\8
093	LB3,MB4	ZA2	Rm	HPEL	9\11
	LB3	LA3	Rm	HPEL	9\11
	NA4,OA2	NA4	Rm	HPEL	9\11
	IB3	WA3	Rm	HPEL	9\11
099	EA2	LA3	Rm	Cit.	9\16
	OA3	PA4	Rm	VIMS	6\18
	NA2	QA1	Rm	VIMS	6\18
	EA2,FA1,GA3	LA3	Rm	VIMS	6\18
	DA4	KA4	Rm	VIMS	6\18
	BA1,CA1	JA4	Rm	VIMS	6\18
	AA4,BA1	IA1	Rm	VIMS	6\18
	AA4,BA1	HA4	Rm	VIMS	6\18
	AA4	GA2	Rm,Zm	VIMS	6\18
106	KA1	MA1	Rm	Cit.	6\1-22

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
106	Tidal Flats #		Rm	Cit.	6\1-22
	EA1	EA4,FA2	Rm	Cit.	8\11
	DA4	DA1,EA4	Rm	Cit.	8\11
	JA2	*	Rm,Zm	Cit.	7\4
107	BA4,DA3	CA4	Rm,Zm	VIMS	6\18
	KA2	KA4	Rm,Zm	VIMS	6\18
108	BA2	BA2	Rm,Zm	VIMS	8\5
	JA2,KA2	JA3	Rm,Zm	VIMS	8\5
	TA2,UA4,VA2	OA4	Zm	VIMS	8\5
	XA2	SA2	Rm,Zm	VIMS	8\5
	TA4	ZA4	Rm,Zm	VIMS	8\5
	VA4	BB4	Rm,Zm	VIMS	8\5
	FB4,EB2	XA4	Rm,Zm	VIMS	6\19
	GB4	YA4	Rm	VIMS	6\19
	*	AB2	Rm	VIMS	6\19
	HB2	BB2	Rm	VIMS	6\19
	IB4,JB3	CB3	Rm,Zm	VIMS	6\19
	LB4	EB4	Zm,Rm	VIMS	6\19
109	LA2,KA4	CB4	Rm,Zm	VIMS	6\19
	AA2,BA3	BA2	Rm	VIMS	6\19
	KA4,MA2	CB4	Rm,Zm	VIMS	6\19
	LA2,KA4	CB4	Zm	VIMS	6\19
111	IA3	ZA4	Rm	VIMS	5\18,6\11
	JA3	IA4	Rm	VIMS	6\11
	JA3	GA4	Rm	VIMS	5\18,6\11
	NA3	WA3	Rm	VIMS	5\18
	HA3	FA3	Rm,Zm	VIMS	5\18

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
111	DA3	CA2	Rm,Zm	VIMS	5\18
112	Johnson Cove #		Zp,Rm	Cit.	6\4
	Johnson Cove #		Rm	Cit.	9\10
	BA2	AA2	Rm	Cit.	9\10
	CA4	BA3	Rm	Cit.	9\10
	DA1	CA3	Rm	Cit.	9\10
	EA4	CA3	Rm	Cit.	9\10
	*	LA3	Rm	Cit.	9\10
	QA3	QA3	Rm	Cit.	9\10
	KA4	NA2	Rm	Cit.	9\10
	Maple Grove #		Rm	Cit.	9\10
	JA3	KA3	Rm	Cit.	9\10
	*	DA2	Rm	VIMS	11\20
	FA3,GA1	EA3	Zm,Rm	VIMS	11\20
	IA2	IA2	Rm,Zm	VIMS	11\20
	IA2	IA2	Zm,Rm	VIMS	11\20
	*	HA4	Zm,Rm	VIMS	11\20
	QA3	QA3	Rm,Zm	VIMS	11\20
	QA3	QA3	Rm,Zm	VIMS	11\20
	YA3	VA3	Rm,Zm	VIMS	11\20
113	DA2	FA3	Rm	Cit.	9\25
	EA3	GA4	Rm	Cit.	9\25
114	EB2	XA2	Rm	Cit.	8\30
	IB2	BB2,CB3,AB4	Rm,Zm	Cit.	8\30
	LA2,NA2	KA4	Rm,Zm	VIMS	8\5
	NA2,MA1	LA2	Rm	VIMS	8\5
	NA2,MA1	LA2	Zm	VIMS	8\5

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
117	FA2	BA3	Rm	VIMS	5\22
	GA2	DA2	Zm,Rm	VIMS	5\22
118	GA2	HA2	Rm	Cit.	6\26
	HA2	IA2	Rm	Cit.	6\26
	FA4	GA2	Rm/Rm	Cit./VIMS	6\26/5\22
	AA2	FA2	Rm/Rm,Zm	Cit./VIMS	6\26/5\22
	BA2	DA2	Rm,Zm	Cit.	6\26
	CA3	DA2,EA4	Rm,Zm/Rm,Zm	Cit./VIMS	6\26/6\14
	CA3	DA2,EA4	Zm	VIMS	5\22
	JA2	KA2	Rm/Zm,Rm	Cit./VIMS	6\26/5\22
	IA3	JA3	Rm/Rm	Cit./VIMS	6\26/5\22
	NA2	LA2	Rm	Cit.	6\26
	*	AA1	Rm	VIMS	5\22
	TA3	OA3	Rm,Zm	VIMS	10\23
	UA3,VA2	RA3	Rm,Zp	VIMS	10\23
	*	PA4	Rm,Zm	VIMS	10\23
119	KB2	HB2	Rm	Cit.	9\5
	JB4	GB4	Rm	Cit.	9\5
	GA4,HA2,IA	DA4	Rm,Zm	VIMS	8\6
	TA2,SA3	QA3	Rm	VIMS	8\6
122	IA3	IA3	Rm	Cit.	9\9
	FA3,GA2	GA2	Rm	VIMS	7\12
	HA3	HA3	Rm	VIMS	7\12
	IA3	IA3	Rm	VIMS	7\12
	PA1,MA4,NA2,OA4	MA3	Rm	VIMS	7\12
123	GA2	GA2	Zm	VIMS	5\22
	NA4	NA4	Zm	VIMS	5\22

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
123	KA4	MA2	Zm	VIMS	5\22
	JA2,IA4	KA4	Zm	VIMS	5\22
	OA3,MA2	QA2	Rm,Zm	VIMS	6\14
	VA2	ZA2	Rm,Zm	VIMS	5\22
	UA3	YA3	Rm,Zm	VIMS	5\22
	TA4	WA4	Rm,Zm	VIMS	5\22
	VA4	VA4	Rm,Zm	VIMS	5\22
	*	UA3	Rm,Zm	VIMS	5\22
	*	XA1	Rm,Zm	VIMS	5\22
	PA2	RA2	Rm,Zm	VIMS	5\22
	DA4	BA4	Rm	VIMS	7\21
	FA4,EA1	AA4	Rm	VIMS	7\21
124	ZA3	WA4	Zm,Rm	Cit.	8\6
	BB4	LB4	Zm,U	Cit.	8\6
	AB3	DB3	U	Cit.	8\6
	HB2	KB2	Zm,U	Cit.	8\6
	GB2	FB2	Zm,U	Cit.	8\6
	FB3	EB3	Zm,U	Cit.	8\6
	IB2	HB2	Zm,Rm,U	Cit.	8\6
	KB2	IB2	U	Cit.	8\6
	DB4	AB3	Zm,Rm,U	Cit.	8\6
	FA4	CA1	Rm	VIMS	8\6
	VA4,TA2,QB2	PA4	Rm,Zm	VIMS	8\6
	VA4,TA2,QB2	PA4	Rm,Zm	VIMS	8\6
	VA4,TA2,QB2	PA4	Rm,Zm	VIMS	8\6
	*	XA2	Zm	VIMS	8\6
	*	XA2	Zm	VIMS	8\6
	ZA3	WA4	Rm,Zm	VIMS	8\6
125	Herring Creek #		Cd,Zp	Cit.	9\21

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
125	Herring Creek #		Cd	Cit.	9\21
127	Morris Creek #		Cd	Cit.	10\6
	Morris Creek #		Zp	Cit.	10\6
131	RA1	RA2	Rm,Zm	VIMS	7\9
	SA3,TA2,UA4	SA4	Rm,Zm	VIMS	7\9
	SA3,TA2,UA4	SA4	Zm	VIMS	7\12
	SA3,TA2,UA4	SA4	Rm	VIMS	7\12
	DB2,EB2,FB2	BB4	Rm	VIMS	7\12
	DB2,EB2,FB2	BB4	Rm	VIMS	7\12
	GB4,HB2	DB4	Zm	VIMS	7\12
	GB4,HB2	DB4	Rm	VIMS	7\12
	JB2	GB2	Rm	VIMS	7\12
	QB4,RB1	MB4	Rm,Zm	VIMS	7\9
	QB4	OB2	Rm,Zm	VIMS	7\9
132	MA4	HA3	Rm	Cit.	7\12
	AB4	QA3,RA4	Zm	Cit.	7\12
	ZA2	QA3,RA4	Zm	Cit.	7\12
	UA4	NA4	Zm	Cit.	7\12
	YA2	QA3,PA1	Zm	Cit.	7\12
133	CA2,DA4	DA3	Zm	VIMS	8\7
	FA4,GA2,IA3	FA4	Rm,Zm	VIMS	8\7
	FA4,GA2,IA3	FA4	Rm	VIMS	8\7
	FA4,GA2,IA3	FA4	Rm,Zm	VIMS	8\7
	KA3	LA4	Zm	VIMS	No Date
	NA1	MA1	Rm,Zm	VIMS	8\7
137	Grays Creek #		Cd	Cit.	6\15

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
137	Grays Creek #		Cd	Cit.	6\15
139	BA1	AA1	Zm	VIMS	No Date
140	RA1	TA4	Zm	Cit.	9\9
	SA3	NA3,OA4	Zm	Cit.	9\9
	TA2	PA2,RA2	Zm,Rm/Rm	Cit./VIMS	9\9/7-12
	VA4	SA4,RA2,TA2	Zm	Cit.	9\9
	UA4	QA4	Rm,Zm	VIMS	July
142	EA1	AA1	Zm	VIMS	8\7
152	AA3	*	Zm	Cit.	6\25
159	Patuxent R. #		Cd,Pcr,Ec,Va,Nm	Cit.	8\19
	Mill Creek #		Nm	Cit.	7\25
	N. Hills Bridge #		Ec,Cd,Pcr,Ngu	Cit.	7\25
	Back Channel #		Cd,Va,Ec,Nm,Ngu,Pcr	Cit.	7\25
	S. Back Channel #		Ec,Nm,Cd	Cit.	7\25
	Western Br. #		Nm,Va,Cd	Cit.	8\15
	Mid Western Br. #		Cd,Ec,Nm	Cit.	8\15
	Upper Western Br. #		Nm,Cd,Ec	Cit.	8\15
	Patuxent Park #		Nm	Cit.	8\15
	Railroad Creek #		Nm,Cd	Cit.	8\15
	Lyons Creek #		Cd	Cit.	8\15
166	*	AA3	Rm	Cit.	9\4
167	*	AA1	Zm	Cit.	8\14
	*	DA2	Zm	DNR	No Date
	*	FA3	Zm	DNR	No Date

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
167	CA3	EA4	Zm	NPS	6\25,9\25
	BA3	CA4	Rm/Zm	NPS/NPS	6\25/9\25
	AA4	BA3	Zm	NPS	6\25,9\25
	*	AA1	Zm	NPS	6\25
	Assateague Is. #		Rm	NPS	6\25
	Sinepuxent Bay #		Rm,Zm	NPS	6\25
168	S. of Mallard Is. #		Zm	Cit.	9\3-5
	E. of Mallard Is. #		Zm	Cit.	9\3-5
	Isle of Wight Bay #		Zm	Cit.	9\3-5
	Isle of Wight Bay #		Zm	Cit.	9\3-5
	*	DA3	Zm	DNR	No Date
	CA2	CA2	Zm	NPS	6\25,9\25
170	BA3	EA4	Zm,Rm/Rm	Cit./NPS	6\20/6\25
	BA3	EA4	Rm,Zm	NPS	6\25,9\25
	CA3	IA4	Zm,Rm/Zm	Cit./NPS	6\20/6\25
	DA3	IA4	Zm/Rm,Zm	Cit./NPS	6\20/6\25,9\25
	HA4	SA3	Zm/Zm,Rm	Cit./NPS	6\20/6\25,9\25
	JA4	SA3	Zm/Zm	Cit./NPS	6\20/6\25,9\25
	BA3	EA4	Zm	Cit.	No Date
	KA1	SA3	Zm/Zm	Cit./NPS	6\20/6\25,9\25
	EA3	OA4,PA4	Zm,Rm/Zm	Cit./NPS	6\20/6\25,9\25
	GA4	QA4	Zm/Zm	Cit./NPS	6\20/6\25,9\25
	LA3	SA3	Zm	Cit.	6\20
	AA3	DA3	Zm,Rm	NPS	6\26
	FA1	QA4	Zm	NPS	6\25,9\25
172	AA2,BA3	AA4	Rm,Zm	NPS	6\25
	CA3	BA3	Zm	NPS	6\25
	S. of Toby Islands #		Zm	NPS	6\25

1991 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1991 BED	SPECIES**	SOURCE***	1991 SURVEY DATE
172	DA3,EA1	FA3,EA1	Zm	NPS	6\25,10\2
	FA4	EA1	Rm	NPS	6\25
	DA3	FA3	Zm	NPS	6\25,10\2
	GA3	GA3	Zm	NPS	10\2
	HA4	HA4	Rm,Zm/Zm	NPS	6\25/10\2
	IA4	GA3	Zm	NPS	6\25,10\2
	KA3	IA4	Rm/Rm,Zm	NPS	10\2/6\25
	LA4	LA4,KA1	Zm	NPS	6\25,10\2
	LA4	LA4,KA1	Rm,Zm	NPS	6\25
173	AA4	AA4,CA1,DA4	Zm	NPS	6\20,9\26
	BA4	FA4,GA1	Rm	NPS	6\20,10\2
	DA4	HA2	Zm/Rm,Zm	NPS	9\25/9\25
	DA4	HA2	Rm	NPS	6\20
	HA2	OA4	Rm,Zm	NPS	6\20,9\25
	GA3	LA3,KA1	Rm,Zm	NPS	6\20,9\25
	FA3	JA3	Rm,Zm	NPS	6\20,9\26
	EA3	IA4	Rm	NPS	10\2
	EA3	IA4	Rm,Zm	NPS	6\20,9\25-26
	EA3	IA4	Zm	NPS	6\20,9\25-26
	EA3	IA4	Rm	NPS	6\20
	*	GA1	Rm	NPS	6\20,9\25
175	Ragged Point #		Zm/Zm	Cit./NPS	7\31,9\29/6\21
	*	CA3	Zm,Rm/Zm	Cit./NPS	7\31,9\29/6\21
	BA2	BA4	Zm,Rm	Cit.	7\31,9\29
	AA3	BA4	Zm/Rm,Zm	Cit./VIMS	7\31,9\29/No Date
	AA3	BA4	Zm	NPS	6\21

** Abbreviations under column "Species" are as follows:

Zm - *Zostera marina* (eelgrass)
Rm - *Ruppia maritima* (widgeon grass)
Ms - *Myriophyllum spicatum* (Eurasian watermilfoil)
Ppf - *Potamogeton perfoliatus* (redhead-grass)
Ppc - *Potamogeton pectinatus* (sago pondweed)
Zp - *Zannichellia palustris* (horned pondweed)
N - *Najas* spp. (naiad)
Ec - *Elodea canadensis* (common elodea)
Va - *Vallisneria americana* (wild celery)
Tn - *Trapa natans* (water chestnut)
Pe - *Potamogeton epihydrus* (leafy pondweed)
Hv - *Hydrilla verticillata* (hydrilla)
Hd - *Heteranthera dubia* (water stargrass)
Pcr - *Potamogeton crispus* (curly pondweed)
Cd - *Ceratophyllum demersum* (coontail)
Ppu - *Potamogeton pusillus* (slender pondweed)
Ngu - *Najas guadalupensis* (southern naiad)
Ngr - *Najas gracillima* (naiad)
C - *Chara* sp. (muskgrass)
Nm - *Najas minor* (slender naiad)
U - Unknown species composition

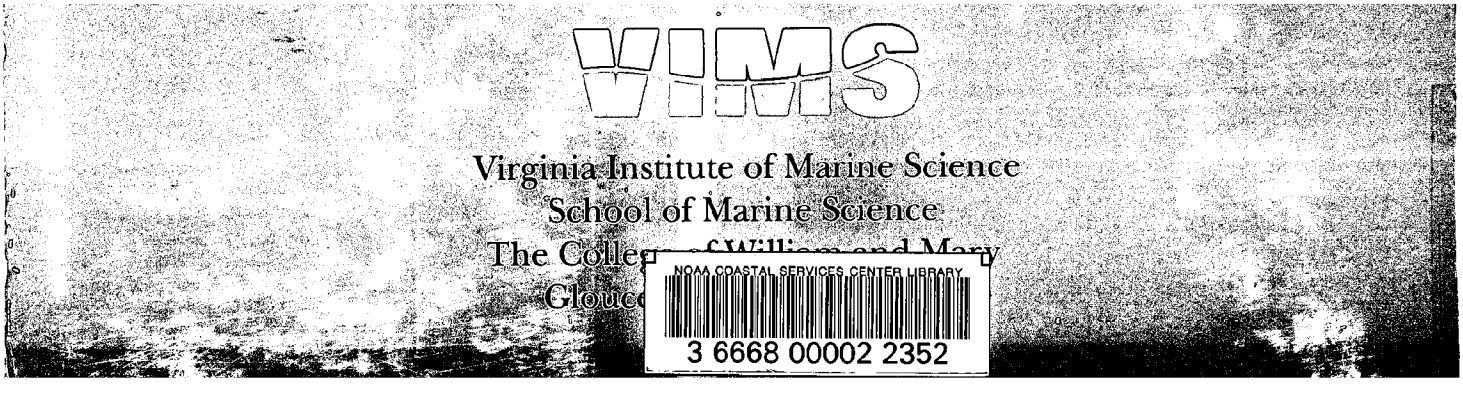
*** Abbreviations under column "Source" are as follows:

Cit. - Citizen's Survey
FWS - U. S. Fish and Wildlife Service Surveys
DNR - Maryland Department of Natural Resources
COG - Metropolitan Washington Council of Governments
HPEL - University of Maryland Horn Point Environmental Laboratory
Harford - Harford Community College
VIMS - Virginia Institute of Marine Science
NPS - National Park Service, Assateague Island National Seashore River Park
Essex - Essex Community College SAV Research Group

\ - Slash mark seperates species data of independent survey sources and independent survey dates.

- No SAV bed mapped from 1990 or 1991 aerial photography but SAV bed presence was verified by 1991 groundtruth survey at this location.

* - No SAV bed mapped from 1991 aerial photography but SAV bed presence was verified in 1991 at the 1990 bed location by groundtruth survey.



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