

Reports

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Gloucester County Shoreline And Tidal Marsh Inventory

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Gloucester County Shoreline And Tidal Marsh Inventory



Prepared by
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Center for Coastal Management and Policy
Virginia Institute of Marine Science
College of William and Mary
Gloucester Point, Virginia



Special Report in Applied Marine Science and Ocean Engineering
Number 351 of the Virginia Institute of Marine Science

VIMS
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February, 1999



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Gloucester County Shoreline And Tidal Marsh Inventory

Prepared by

Marcia Berman
Harry Berquist
Sharon Dewing
George Thomas
Rose Laird

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Cover photo by Michael Campana

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Marcia R. Berman - Director, Comprehensive Coastal Inventory Program (CCI)

Carl H. Hershner - Director, Center for Coastal Management and Policy (CMAP)

Introduction

This inventory is intended to serve as a useful planning tool for managers, planners, regulators, and environmentalists with an interest in Gloucester County. This report documents conditions measured in the County of Gloucester using remote sensing techniques. Two separate activities have occurred in tandem to develop this inventory of tidal marsh, and shoreline features. First, a delineation of tidal marshes within the county used high end image processing software along with color infra-red imagery to delineate the boundaries of tidal marshes within 33 geo-referenced scenes. The process calculates the amount of tidal marsh measured within each river segment in acres. Second, the report illustrates results from an aerial survey to delineate the types of shoreline structures, and general conditions observed along the shore.

Documentation describing the waterway segments has been edited from the earlier Tidal Marsh Inventory Report for Gloucester County. Frequent reference to the Marsh Types, as defined by the Virginia Marine Resources Commission and the Wetlands Advisory Program at VIMS, is noteworthy. Appendix 1 defines these types.

The report organizes the county into nine (9) river segments or waterways: the Poropotank River to Purtan Island, Purtan Bay to Sandy Creek, Jones Creek to Carmine Islands, Gloucester Point, Guinea, the Severn River, the Ware River, the North River, and the Piankatank River. Both shoreline features and tidal marshes are illustrated separately as a series of plates which divide the waterway into smaller segments. A composite image of the waterway segment is presented first, followed by the larger scale plates at 1:24,000. A brief description of each segment precedes the plates, and presents information related to the composition of the marshes, and the general state of the shoreline. Appendix 2 defines some important terms found in these sections.

Tidal Marsh Delineation - Collection and Reporting Techniques

Tidal marshes were delineated from 1994 color infra-red photography acquired through the United States Geological Survey's (USGS) National Aerial Photography Program (NAPP). This is currently the most recent set of aerial photography available through this program for this region. This photography is flown at a scale of 1:40,000 (1"=3,333').

Both 9"x9" prints and diapositives were acquired from the USGS. The diapositives, clearer images than the prints, are scanned at high resolution by a commercial agency on a Vexcel 4000 HT scanner. Scanned at 2,000 dots per inch (dpi), the digital file generated by the scanners maintain the reported NAPP resolution of 1-2 meters (3.3-6.6ft).

Color infra-red is a three (3) band medium with spectral bands to observe red, green, and near-infra-red. Color infra-red is very effective at distinguishing vegetative ecotones in the landscape, and has been used extensively by the US Fish and Wildlife Service to delineate wetlands for their National Wetlands Inventory (NWI) mapping program, and by the US Forest Service for their forest mapping activities.

Each image was geo-rectified and processed using the image processing software ERDAS. Imagery was rectified to a high resolution survey developed by the county of Gloucester in 1992. The images are projected in a Virginia South State Plane Coordinate projection, and referenced to the North American Datum for 1983 (NAD83).

Classifying landscapes in ERDAS is a process where distinctions between landscape signatures are based on statistical differences in the signatures. These distinctions are a measure of variations in thermal properties and reflectance in the spectral bands. The more spectral bands available in the product, the easier these distinctions can be measured. Color infra-red film is limited by its emulsion layers which are sensitive to red, green, and near-infra-red radiation (0.5-0.9 μm). Therefore, very fine distinctions in landscape properties can not always be made. Fortunately, color infra-red is fairly reliable for performing vegetation classifications, and is widely used among a number of state and federal resource agencies for mapping.

Thirty three (33) images cover the study area. Each image is processed separately. A small scale composite scene is prepared for each waterway. This scene reports the amount of tidal marsh area delineated in acres for the entire waterway. The larger scale plates which follow only delineate the marshes in green, and do not report the amount of wetlands delineated. Ancillary remote sensing data also used in this project include: Landsat Thematic Mapper satellite imagery, and low altitude natural color vertical photography (1990). Tidal marshes are delineated for each scene.

Shoreline Attributes - Collection and Reporting Techniques

Shoreline attributes were mapped from video collected in 1993. A low flying aircraft equipped with videography filmed the entire shoreline extent at an oblique angle. Information illustrated in the video was transposed into a GIS using visual transfer, and digitizing techniques. A high resolution shoreline coverage developed by the county of Gloucester in 1992 was the digital basemap used for creating the shoreline attribute files. The Geographic Information System (GIS) ArcInfo was used for all GIS mapping.

A set of attributes describing conditions along the shoreline was developed. The attributes include: shoreline protection structures, general composition of the shore land, and the relative stability of the shore lands where erosion control structures are not present. These are illustrated as a color coded shoreline, where each color pertains to a different set of conditions. Changes in the shoreline color represent a shift in the conditions observed from the videography. Appendix 2 describes the attribute features in detail. Gray scale images of color infra-red scenes provide a useful backdrop for the shoreline data. A color coded legend is provided at the bottom of each plate.

Poropotank River to Purtan Island

The center line of the Poropotank River is the border of Gloucester county and King and Queen county. Only marshes located along the eastern shore are described here.

Tidal freshwater marshes (type XI) are located in the upper third of the Poropotank River and are dominated by plant species such as wild rice and pickerelweed. Saltmarsh cordgrass is also found in this upstream portion of the Poropotank, but it does not dominate the plant community here as it does further downstream in regions of higher salinity.

Brackish water marshes (types I, II, III, and IV) dominate the lower two thirds of the Poropotank River as well as the Purtan Island area. These marshes are characteristic of most of the tidal marshes in Gloucester County. Saltmarsh cordgrass, sea lavender and saltmarsh aster are found growing along creek banks and in low areas that receive daily inundation by the tides. Just above this zone occur saltgrass and black needlerush, as well as saltmeadow hay and saltmarsh bulrush. Big cordgrass may also be found if the salinity is very low. At highest elevations are found the saltbushes and other species such as oxeye, saltmarsh fimbriatylis, and switchgrass.

This region of Gloucester County is relatively rural. The landscape is dominated by forest cover interspersed with agricultural uses and low density residential districts. Purtan Island is one of the more prominent features within the river segment, accounting for much of the 1300 acres of tidal marsh delineated.

Approximately 127 km (78.9 miles) of shoreline was surveyed from the air. Nearly 117 km (72.7 miles) of this has been measured as stable marsh habitat along the fringes of the shore and the larger Purtan Island. The outer edge of Purtan Island flanking the York River accounts for much of the unstable marsh habitat surveyed. The well protected reaches, along with the limited shorefront development, has left the shoreline of the Poropotank relatively untouched. Less than 270 meters (885.6 ft) of this segment have installed shoreline protection structures to counteract erosion problems. Tables 1a-1c reports the values for the shoreline attributes surveyed within each plate boundary.

Poropotank River to Purtan Island (Aerial Photo A)

The headwater marshes of the Poropotank River, near Wood Mill Swamp, are dominated by freshwater plant species (type XI marsh). Prior surveys of vegetation show that the marsh community contains mainly wild rice and beggar ticks, with smaller amounts of pickerelweed, saltmarsh cordgrass, water-hemp, smartweeds, jewel weed, water dock and trace amounts of cattails, saltmarsh aster, royal fern, and spikerush.

As we move down river the marshes change to large stands of predominately saltmarsh cordgrass mixed with freshwater species (type I marsh) consisting of pickerelweed, wild rice, and trace amounts of softstem bulrush, beggar ticks, cattails, and water-hemp.

The marshes furthest downstream this segment of the river, toward Red Bank Landing, are cordgrass (type I marsh) dominated with saltmarsh cordgrass and big cordgrass being almost exclusive of other species. Small amounts of cattails and pickerelweed can also be found.

Table 1a. Plate A - Shoreline Attributes Poropotank River to Purtan Bay

<u>Structure</u>	<u>Length(m)</u>	<u>Length (miles)</u>
Riprap	77.2	0.05
Bulkhead	91.4	0.06
Upland, No structures-erosional or unstable	1500.6	0.93
Upland, No structures-stable or accretionary	302.2	0.19
Unstable marsh	529.0	0.33
Stable marsh	14370.1	8.93

Poropotank River to Purtan Island (Aerial Photo B)

From the Red Bank Landing, marshes on this river segment are again cordgrass dominated (type I marsh) with saltmarsh cordgrass, big cordgrass, and small amounts of cattails, saltgrass, saltbush, saltmarsh bulrush and black needlerush.

Downstream the vegetation changes to a high marsh type (type XII marsh) that is dominated by saltmarsh cordgrass and black needlerush, containing saltmarsh bulrush, saltgrass, saltmeadow hay, and big cordgrass.

Moving toward Morris Bay on this segment of the river, the marshes become again cordgrass dominated (type I marsh) with saltmarsh cordgrass and big cordgrass with small amounts of saltgrass, saltbush, saltmeadow hay, and black needlerush.

Table 1b. Plate B - Shoreline Attributes Poropotank River to Purtan Bay

<u>Structure</u>	<u>Length (m)</u>	<u>Length (miles)</u>
Riprap	77.2	0.05
Bulkhead	91.4	0.06
Upland, No structures-erosional or unstable	1357.5	0.84
Miscellaneous	68.3	0.04
Unstable marsh	1241.3	0.77
Stable marsh	28590.2	17.76

Poropotank River to Purtan Island (Aerial Photo C)

At the mouth of the Poropotank River high marshes (type XII marsh) are dominated by saltmarsh cordgrass and black needlerush. They also contains saltmarsh bulrush, saltgrass, saltmeadow hay, and big cordgrass.

Purtan Island has cordgrass marshes (type I marsh) dominated with saltmarsh cordgrass and small amounts of saltgrass, saltmeadow hay, and black needlerush.

Plate 1c. Plate C - Shoreline Attributes Poropotank River to Purtan Island

<u>Structure</u>	<u>Length(m)</u>	<u>Length(miles)</u>
Bulkhead	62.4	0.04
Upland, No structures-erosional or unstable	1293.9	0.80
Miscellaneous	68.3	0.04
Upland, No structures-stable or accretionary	58.5	0.04
Unstable marsh	6001.1	3.73
Stable marsh	104619.3	65.0




Scale



Feet

Legend

Class_Names	Area
 tidal marsh	1299.85



Compiled from NAPP photos
 Index No: 7683-174 7683-175 7683-179
 Dated: 3/94

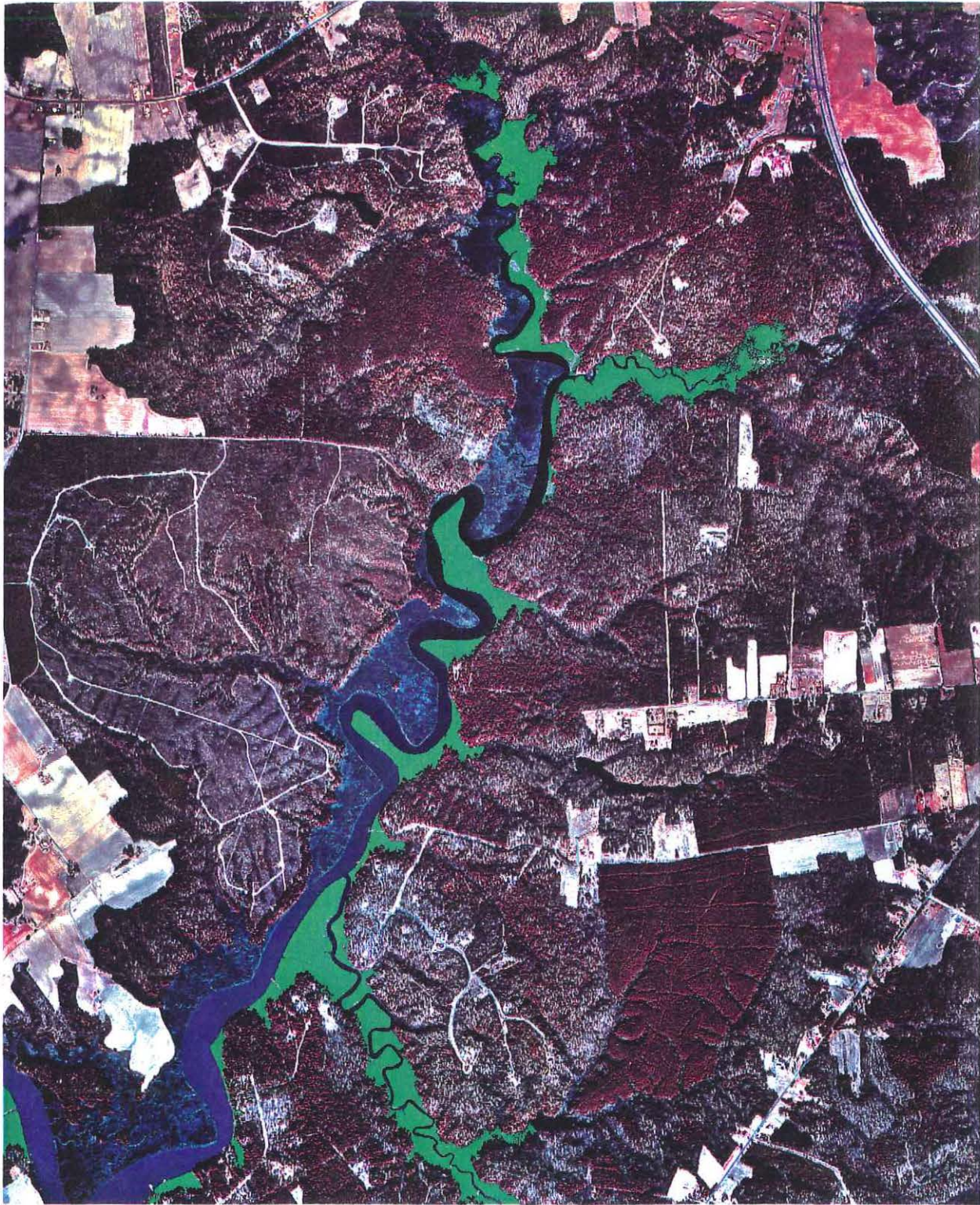
TIDAL MARSHES

Gloucester County VA

POROPOTANK R. - PURTAN IS.




Comprehensive Coastal Inventory



Scale



1 : 24000

 tidal marsh



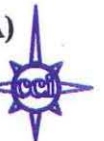
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Dated: 3/94

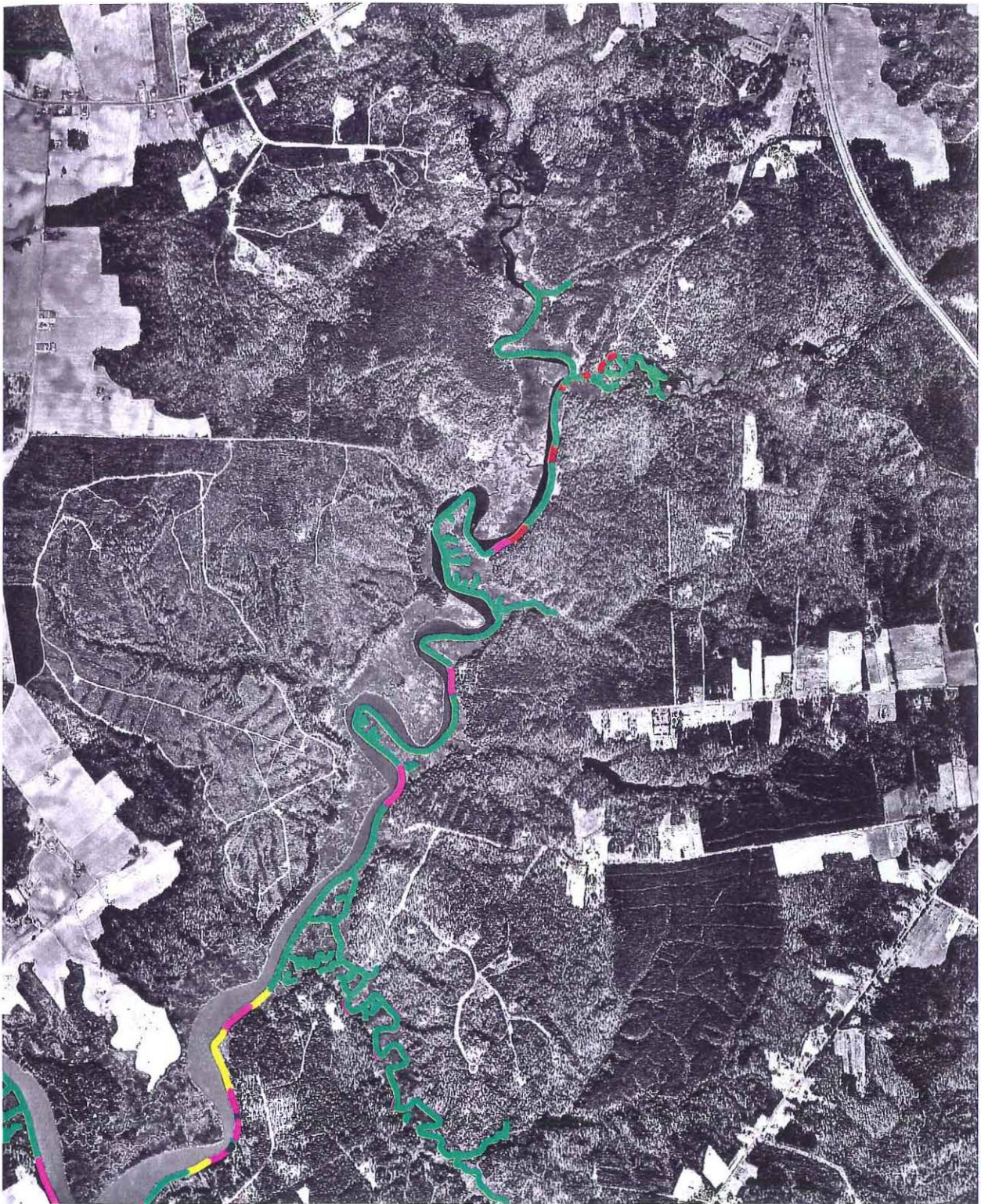
TIDAL MARSHES

Gloucester County VA

POROPOTANK R. - PURTAN IS. (A)

Comprehensive Coastal Inventory





Legend

- | | | | |
|--|-------------------------|--|---------------------------------|
| | Riprap | | Groinfield, Bulkhead and Riprap |
| | Bulkhead | | Bulkhead and Riprap |
| | Jetty | | Upland, No structures, Unstable |
| | Groins | | Miscellaneous |
| | Breakwaters | | Upland, No structures, Stable |
| | Groinfield and Bulkhead | | Marsh, Unstable |
| | Groinfield and Riprap | | Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

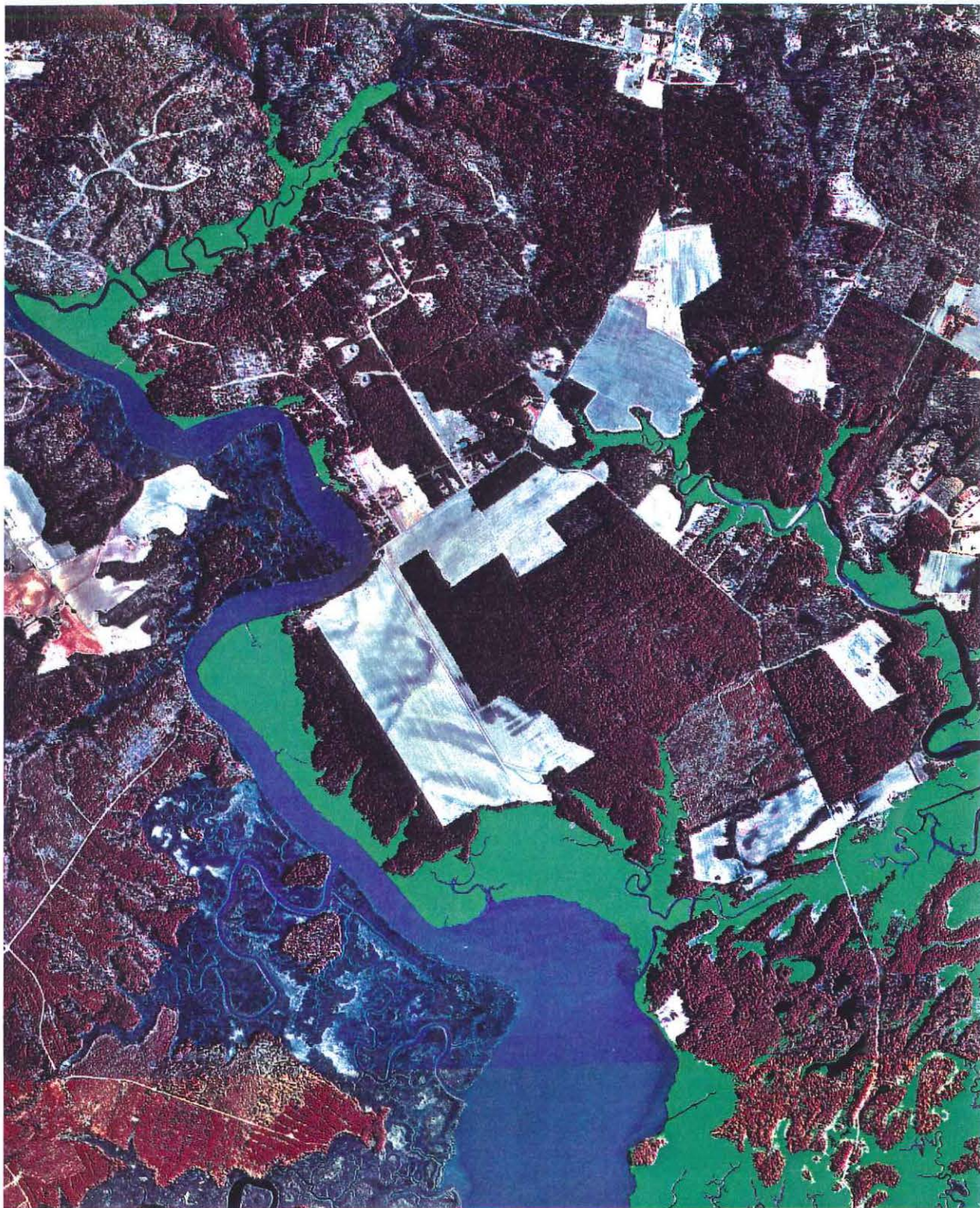
POROPOTANK R. - PURTAN IS. (A)

1:24000



Comprehensive Coastal Inventory






Scale



1 : 24000

 tidal marsh



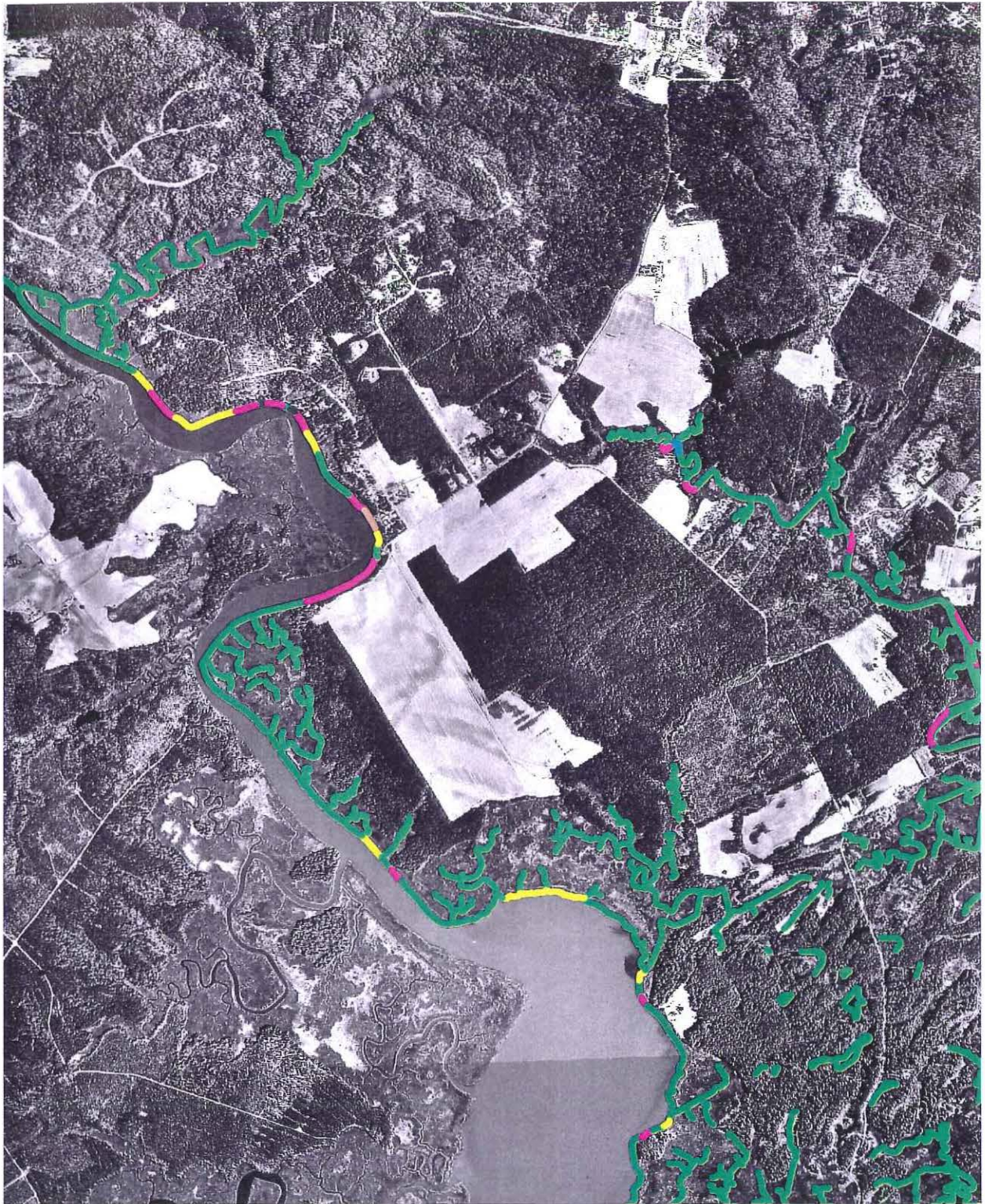
Compiled from NAPP photos
 Index No: 7683-174 7683-175 7683-179
 Dated: 3/94

TIDAL MARSHES Gloucester County VA

POROPOTANK R. - PURTAN IS. (B)

Comprehensive Coastal Inventory





Legend

- | | |
|---|---|
|  Riprap |  Groinfield, Bulkhead and Riprap |
|  Bulkhead |  Bulkhead and Riprap |
|  Jetty |  Upand, No structures, Unstable |
|  Groins |  Miscellaneous |
|  Breakwaters |  Upland, No structures, Stable |
|  Groinfield and Bulkhead |  Marsh, Unstable |
|  Groinfield and Riprap |  Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

POROPOTANK R. - PURTAN IS. (B)

1:24000



Comprehensive Coastal Inventory






Scale



1 : 24000

 tidal marsh

TIDAL MARSHES Gloucester County VA

POROPOTANK R. - PURTAN IS. (C)



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Comprehensive Coastal Inventory 



Legend

- | | |
|---|---|
|  Riprap |  Groinfield, Bulkhead and Riprap |
|  Bulkhead |  Bulkhead and Riprap |
|  Jetty |  Upland, No structures, Unstable |
|  Groins |  Miscellaneous |
|  Breakwaters |  Upland, No structures, Stable |
|  Groinfield and Bulkhead |  Marsh, Unstable |
|  Groinfield and Riprap |  Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

POROPOTANK R. - PURTAN IS. (C)

1:24000



Comprehensive Coastal Inventory



Purtan Bay to Sandy Creek

The Purtan Bay to Sandy Creek area is characterized by creek-marsh systems (types I, III, and XII) which drain into the York River. The vegetation within each creek-marsh system changes gradually as you proceed upstream. The lower portions of the creek are dominated by saltmarsh cordgrass and black needlerush which changes to saltgrass, saltmeadow hay, and saltbush as you proceed upstream.

This waterway segment includes Leigh, Bland, and Fox Creeks. They all have relatively well developed riparian forests, which are interrupted by sparse residential development, and a few agricultural farms, both cattle and grain. Well established fringe marshes are noted along the shorelines of these creeks, and most have been classified as stable marshes without shoreline protection structures. The primary shoreline along the York River, however, has been protected in various locations due to chronic shoreline retreat. Over 2,000 meters of shoreline has been armored with various combinations and types of structures. Groin fields and breakwaters are also in place at select areas to trap longshore sediment transported in the nearshore system. Tables 2a-2b quantify the shore characteristics mapped for this segment.

Purtan Bay to Sandy Creek (Aerial Photo A)

Saltmarsh cordgrass and black needlerush dominate the mouths of the creeks in Purtan Bay and the creek-marsh systems (types I, III, and XII) below the bay. Just above this zone saltmeadow hay, saltgrass, saltbushes, and saltmarsh bulrush thrive. Big cordgrass may also be found if the salinity is very low.

Table 2a. Plate A - Shoreline Attributes Purtan Bay to Sandy Creek

<u>Structure</u>	<u>Length(m)</u>	<u>Length (miles)</u>
Riprap	392.0	0.24
Bulkhead	492.3	0.31
Breakwaters	272.8	0.17
Groin field and bulkhead	7.7	0.00
Upland, No structures-erosional or unstable	2649.6	1.65
Miscellaneous	251.3	0.16
Upland, No structures-stable or accretionary	616.9	0.38
Unstable marsh	1912.7	1.19
Stable marsh	29071.4	18.06

Purtan Bay to Sandy Creek (Aerial Photo B)

Fox Creek and Sandy Creek are creek-marsh systems (types I and XII) dominated by Saltmarsh cordgrass with some saltmeadow hay, saltgrass, saltbushes, saltmarsh bulrush, and cattails.

Table 2b. Plate B - Shoreline Attributes Purtan Bay to Sandy Creek


<u>Structure</u>	<u>Length(m)</u>	<u>Length(miles)</u>
Riprap	557.3	0.35
Bulkhead	1052.1	0.65
Groin field	81.3	0.05
Breakwater	272.8	0.17
Groin field and bulkhead	195.3	1.21
Upland, No structures-erosional or unstable	3207.2	1.99
Miscellaneous	353.7	0.22
Upland, No structure-stable or accretionary	610.40	0.38
Unstable marsh	774.7	0.48
Stable marsh	14135.1	8.78



Scale



Legend

Class_Names	Area
 tidal marsh	202.241

TIDAL MARSHES
Gloucester County VA
PURTAN BAY-SANDY CREEK



Compiled from NAPP photos
 Index No: 7683-172 7683-173
 Dated: 3/94

Comprehensive Coastal Inventory





Scale



1 : 24000

■ = tidal marsh

TIDAL MARSHES
Gloucester County VA
PURTAN BAY-SANDY CREEK (A)



Compiled from NAPP photos
 Index No: 7683-173
 Dated: 3/94

Comprehensive Coastal Inventory





Legend

- | | |
|---|---|
|  Riprap |  Groinfield, Bulkhead and Riprap |
|  Bulkhead |  Bulkhead and Riprap |
|  Jetty |  Upland, No structures, Unstable |
|  Groins |  Miscellaneous |
|  Breakwaters |  Upland, No structures, Stable |
|  Groinfield and Bulkhead |  Marsh, Unstable |
|  Groinfield and Riprap |  Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

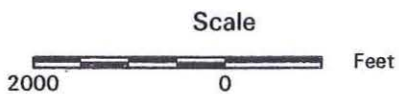
PURTAN BAY - SANDY CREEK (A)

1:24000




Comprehensive Coastal Inventory





1 : 24000

 = tidal marsh



Compiled from NAPP photos
Index No: 7683-172
Dated: 3/94

TIDAL MARSHES

Gloucester County VA

PURTAN BAY-SANDY CREEK (B)

Comprehensive Coastal Inventory





Legend

- | | | | |
|--|-------------------------|--|---------------------------------|
| | Riprap | | Groinfield, Bulkhead and Riprap |
| | Bulkhead | | Bulkhead and Riprap |
| | Jetty | | Upland, No structures, Unstable |
| | Groins | | Miscellaneous |
| | Breakwaters | | Upland, No structures, Stable |
| | Groinfield and Bulkhead | | Marsh, Unstable |
| | Groinfield and Riprap | | Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

PURTAN BAY - SANDY CREEK (B)

1:24000



Comprehensive Coastal Inventory



Jones Creek to Carmine Islands

The Jones Creek to Carmine Islands area is characterized by several creek-marsh systems (types I and XII) which drain into the York River. The vegetation in these creek-marsh system changes with the salinity gradient, the lower portions of the creek being predominantly saltmarsh cordgrass and black needlerush, changing to saltgrass, saltmeadow hay, and saltbush upstream.

The marshes of the Catlett Islands are dominated by saltmarsh cordgrass and black needlerush as well as saltmeadow hay, and saltgrass. These marshes have an interesting configuration as they are characterized by a series of upland ridges of pine and cedar separating areas of high marsh.

The Carmine Islands, south of the Catlett Islands, are mostly low marsh dominated by saltmarsh cordgrass with saltmeadow hay, saltgrass, and saltbush fringing the upland area.

Over 118 km (73.3 miles) of creek shoreline and primary York River shoreline was surveyed from Jones Creek to the Carmine Islands. A large portion of this extent includes the tidal channels of the Catlett Islands and Carmine Island. Moving south east along the York River, the survey also includes Jones Creek, Aberdeen Creek, Carters Creek, Cedarbush, and Timberneck Creek. Each of these varies with the level of residential development, and land cover types. As illustrated in plates A through C, 84 linear km (52.2 miles) of the total 118 km surveyed is stable fringe marsh, compared with 16 km (9.9 miles) of unstable marsh. Less than five percent of the shoreline surveyed has been stabilized. Tables 3a-3c breakdown the distribution of shoreline characteristics along the segment.

Jones Creek to Carmine Islands (Aerial Photo A)

From Jones Creek to Gum Point, the reach is dominated by creek-marsh systems (types I and XII), grading from saltmarsh cordgrass in the downstream segments of the creeks to saltgrass, saltmeadow hay, saltmarsh bulrush, cattails, saltbush, and saltmarsh aster as you move upstream.
Jones Creek - Carmine Islands

Table 3a. Plate A - Shoreline Attributes Jones Creek to Carmine Islands

<u>Structure</u>	<u>Length(m)</u>	<u>Length(miles)</u>
Riprap	403.3	0.25
Bulkhead	2038.6	1.27
Groin field	47.1	0.03
Groin field and bulkhead	550.4	0.34
Groin field, bulkhead, and riprap	15.9	0.01
Bulkhead and riprap	290.2	0.18
Upland, No structures-erosional or unstable	3604.3	2.24
Miscellaneous	480.1	0.30
Upland, No structures-stable or accretionary	215.4	0.13
Unstable marsh	3033.9	1.88
Stable marsh	30684.5	19.06

Jones Creek to Carmine Islands (Aerial Photo B)

Types I and XII marshes from Carter Creek to Cedarbush Creek, are dominated by saltmarsh cordgrass; shifting to saltgrass, saltmeadow hay, saltmarsh bulrush, cattails, saltbush, and saltmarsh aster upstream. There are also some pocket marshes, fringing marshes and a spit marsh which are cordgrass dominated.

Table 3b. Plate B - Shoreline Attributes Jones Creek to Carmine Islands

<u>Structure</u>	<u>Length(m)</u>	<u>Length (miles)</u>
Riprap	176.2	0.11
Bulkhead	145.9	0.09
Bulkhead and riprap	122.1	0.07
Upland, No structures-erosional or unstable	6291.7	3.91
Miscellaneous	110.8	0.07
Upland, No structures-stable or accretionary	635.9	0.39
Unstable marsh	6113.5	3.80
Stable marsh	26905.3	16.71

Jones Creek to Carmine Islands (Aerial Photo C)

The Catlett and Carmine Islands have the same type of creek-marsh systems (types I and XII) with some pocket, fringing and spit marshes. Dominated by saltmarsh cordgrass near the stream mouth; saltgrass, saltmeadow hay, saltmarsh bulrush, cattails, saltbush, and saltmarsh aster is typical upstream at higher elevations.

Table 3c. Plate C - Shoreline Attributes Jones Creek to Carmine Islands

<u>Structure</u>	<u>Length(m)</u>	<u>Length(miles)</u>
Riprap	377.8	0.23
Bulkhead	325.9	0.20
Groin field	134.2	0.08
Breakwater	4.2	0.00
Upland, No structures-erosional or unstable	3671.7	2.28
Miscellaneous	48.3	0.03
Upland, No structures-stable or accretionary	746.2	0.46
Unstable marsh	10201.6	6.34
Stable marsh	41005.9	25.47




Scale



Feet

Legend

Class_Names	Area
 tidal marsh	646.423

TIDAL MARSHES Gloucester County VA

JONES CR. - CARMINES IS.



Compiled from NAPP photos
 Index No: 7683-79 7683-116 7683-117
 Dated: 3/94

Comprehensive Coastal Inventory





Scale



1 : 24000

 Tidal Marsh



Compiled from NAPP photos
Index No: 7683-116
Dated: 3/94

TIDAL MARSHES Gloucester County VA

JONES CR. - CARMINES IS. (A)

Comprehensive Coastal Inventory





Legend

- | | |
|---|---|
|  Riprap |  Groinfield, Bulkhead and Riprap |
|  Bulkhead |  Bulkhead and Riprap |
|  Jetty |  Upland, No structures, Unstable |
|  Groins |  Miscellaneous |
|  Breakwaters |  Upland, No structures, Stable |
|  Groinfield and Bulkhead |  Marsh, Unstable |
|  Groinfield and Riprap |  Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

JONES CR. - CARMINES IS. (A)

1:24000



Comprehensive Coastal Inventory





Scale



1 : 24000

■ Tidal Marsh



Compiled from NAPP photos
 Index No: 7683-79 7683-116 7683-117
 Dated: 3/94

TIDAL MARSHES Gloucester County VA

JONES CR. - CARMINES IS. (B)

Comprehensive Coastal Inventory





Legend

- | | |
|---|---|
|  Riprap |  Groinfield, Bulkhead and Riprap |
|  Bulkhead |  Bulkhead and Riprap |
|  Jetty |  Upland, No structures, Unstable |
|  Groins |  Miscellaneous |
|  Breakwaters |  Upland, No structures, Stable |
|  Groinfield and Bulkhead |  Marsh, Unstable |
|  Groinfield and Riprap |  Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

JONES CR. - CARMINES IS. (B)

1:24000



Comprehensive Coastal Inventory






Scale



1 : 24000

 Tidal Marsh



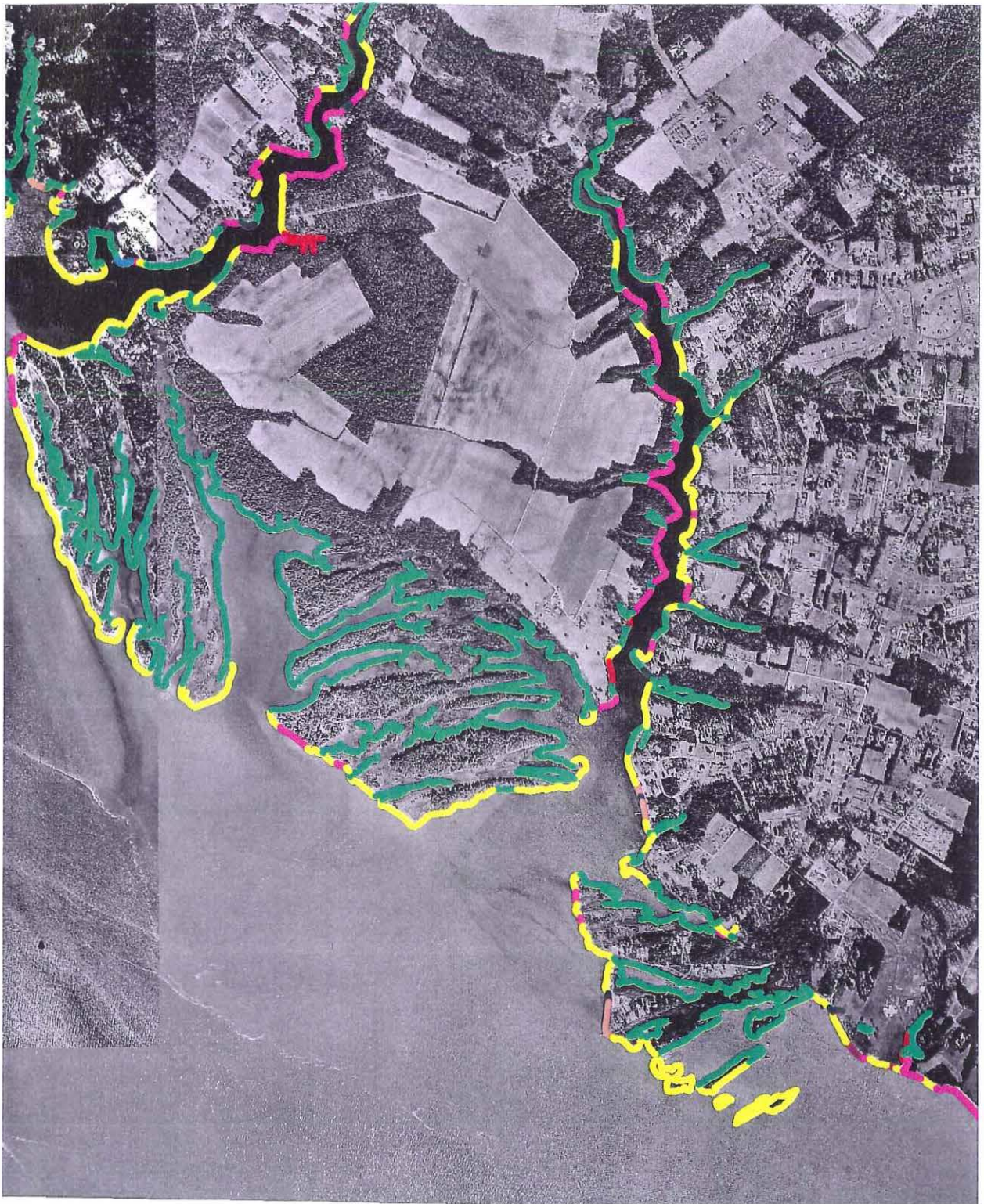
Compiled from NAPP photos
Index No: 7683-79 7683-116 7683-117
Dated: 3/94

TIDAL MARSHES Gloucester County VA

JONES CR. - CARMINES IS. (C)

Comprehensive Coastal Inventory





Legend

- | | |
|---|---|
|  Riprap |  Groinfield, Bulkhead and Riprap |
|  Bulkhead |  Bulkhead and Riprap |
|  Jetty |  Upland, No structures, Unstable |
|  Groins |  Miscellaneous |
|  Breakwaters |  Upland, No structures, Stable |
|  Groinfield and Bulkhead |  Marsh, Unstable |
|  Groinfield and Riprap |  Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

JONES CR - CARMINES IS. (C)

1:24000



Comprehensive Coastal Inventory



Gloucester Point

The Gloucester Point area includes cove, fringe, island, and pocket marshes (Type I). Mumfort Island has low marsh surrounding an interior of high marsh with pine and cedar at the highest elevation. The lower marsh is dominated by saltmarsh cordgrass which changes to saltgrass, saltmeadow hay, and saltbush in the higher elevations of the marsh.

Development is prominent along much of the shoreline in this segment. Of the 43 km (26.7 miles) surveyed, including primary and secondary shorelines, more than 17 km (10.5 miles) have been hardened. Much of the public and private beaches rounding Gloucester Point have some type of shoreline defense structure or mechanism to trap longshore sand. Still, one third of the shoreline surveyed remains as undisturbed marsh, but this is primarily confined to the tidal branches of Sarah Creek and Mumfort Island just north of Gloucester Point. Small segments of unstable marsh are noted along the York River shore in the vicinity of Mumfort Island. Tables 4a-4b describe the shoreline attributes illustrated in the plates.

Gloucester Point (Aerial Photo A)

This area of Gloucester county, from Mumfort Island to Quarter Point, is dominated by cove marshes vegetated by saltmarsh cordgrass, saltgrass, saltmeadow hay, and saltbush. Mumfort Island has a fringe marsh of saltmarsh cordgrass surrounding the interior high marsh of saltgrass, saltmeadow hay, saltbush, and black needlerush.

Table 4a. Plate A - Shoreline Attributes Gloucester Point

<u>Structure</u>	<u>Length(m)</u>	<u>Length(miles)</u>
Riprap	1476.5	0.92
Bulkhead	5075.9	3.15
Jetty	68.8	0.04
Groin field	41.4	0.03
Breakwater	253.3	0.16
Groin field and bulkhead	2580.3	1.60
Groin field and riprap	106.4	0.07
Groin field, bulkhead, and riprap	595.2	0.37
Bulkhead and riprap	661.5	0.41
Upland, No structures-erosional or unstable	2986.0	1.85
Miscellaneous	282.1	0.17
Upland, No structures-stable or accretionary	3481.6	2.16
Unstable marsh	2526.8	1.57
Stable marsh	8390.2	5.21

Gloucester Point (Aerial Photo B)

Aerial photo B illustrates the marshes in Sarah Creek; these are fringe and pocket marshes dominated by saltmarsh cordgrass with small amounts of saltgrass, saltmeadow hay, and saltbush.

Table 4b. Plate B - Shoreline Attributes Gloucester Point


<u>Structure</u>	<u>Length(m)</u>	<u>Length(miles)</u>
Riprap	1358.0	0.84
Bulkhead	6816.6	4.23
Groin field	355.3	0.22
Breakwater	88.1	0.05
Groin field and bulkhead	1347.0	0.84
Groin field, bulkhead, and riprap	107.5	0.07
Bulkhead and riprap	187.9	0.12
Upland, No structures-erosional or unstable	3148.1	1.95
Miscellaneous	504.9	0.31
Upland, No structures-stable or accretionary	3616.8	2.25
Unstable marsh	656.6	0.41
Stable marsh	6151.7	3.82



Scale



Legend

Class_Names	Area
 Tidal Marsh	30.0864

TIDAL MARSHES Gloucester County VA

GLOUCESTER POINT



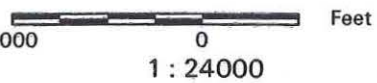
Compiled from NAPP photos
Index No: 7683-27 7683-77
Dated: 3/94

Comprehensive Coastal Inventory






Scale



Legend

Class_Names

 Tidal Marsh

TIDAL MARSHES Gloucester County VA

GLOUCESTER POINT (A)



Compiled from NAPP photos
Index No: 7683-27 7683-77
Dated: 3/94

Comprehensive Coastal Inventory





Legend

- | | | | |
|--|-------------------------|--|---------------------------------|
| | Riprap | | Groinfield, Bulkhead and Riprap |
| | Bulkhead | | Bulkhead and Riprap |
| | Jetty | | Upland, No structures, Unstable |
| | Groins | | Miscellaneous |
| | Breakwaters | | Upland, No structures, Stable |
| | Groinfield and Bulkhead | | Marsh, Unstable |
| | Groinfield and Riprap | | Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

GLOUCESTER POINT (A)

1:24000



Comprehensive Coastal Inventory






Scale



1 : 24000

Legend

Class_Names
 Tidal Marsh

TIDAL MARSHES Gloucester County VA

GLOUCESTER POINT (B)

















Compiled from NAPP photos
Index No: 7683-27
Dated: 3/94

Comprehensive Coastal Inventory





Legend

- | | |
|--|---|
|  Riprap |  Groinfield, Bulkhead and Riprap |
|  Bulkhead |  Bulkhead and Riprap |
|  Jetty |  Upland, No structures, Unstable |
|  Groins |  Miscellaneous |
|  Breakwaters |  Upland, No structures, Stable |
|  Groinfield and Bulkhead |  Marsh, Unstable |
|  Groinfield and Riprap |  Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

GLOUCESTER POINT (B)

1:24000



Comprehensive Coastal Inventory



Guinea

The Guinea marshes (types I and XII) are the dominant wetland system in this low portion of Gloucester County. They are a broad band of marshes, islands, and creeks that extend from Mobjack Bay on the east to lowland farms and pine woods on the west. Saltmarsh cordgrass dominates the low marsh areas, which grade up into high marsh abundant with saltgrass, saltmeadow hay, and black needlerush.

Also included in this segment is Jenkins Neck with the Perrin River and Monday Creek. The Perrin River is similar in orientation to Monday Creek, but lacks the extensive thick fringe marshes. Videography reveals a thin fringe of stable marsh along the Perrin River. There are only a few miscellaneous structures installed for shore protection. The York River shoreline of this segment has been significantly modified by shoreline construction. The island of Guinea and its marshes are relatively stable along the more protected shorefaces. The marshes with exposure to the York River and Chesapeake Bay proper experience erosion at the marsh edge due to storm generated waves. Twenty two percent of the area surveyed is defined as unstable or eroding marsh. In contrast, 72 percent of the segment is stable marsh. Tables 5a-5c quantify the attributes surveyed from video.

Guinea (Aerial Photo A)

This photograph, the southern section of the Guinea Marshes from Allens's Island to Sandy Point, includes extensive, fringe, pocket, spit, creek, and island marshes. The vegetation is predominately saltmarsh cordgrass in the low marsh areas, changing to high marsh with saltgrass, saltmeadow hay, black needlerush and occasional saltmarsh aster, sea oxeye, sea lavender, saltwort and marsh mallow.

Table 5a. Plate A - Shoreline Attributes Guinea

<u>Structure</u>	<u>Length(m)</u>	<u>Length(miles)</u>
Riprap	670.4	0.42
Bulkhead	1773.3	1.10
Breakwater	88.8	0.05
Groin field and bulkhead	83.8	0.05
Bulkhead and riprap	152.1	0.09
Upland, No structures-erosional or unstable	1991.9	1.24
Miscellaneous	597.3	0.37
Upland, No structures-stable or accretionary	1339.0	0.83
Unstable marsh	3782.6	2.35
Stable marsh	31395.8	19.5

Guinea (Aerial Photo B)

Aerial photo B, Mill Creek to Brown's Bay, shows extensive, fringe, creek, and island marshes. The vegetation is the same as in photo A: saltmarsh cordgrass in low areas which changes to saltgrass, saltmeadow hay, black needlerush and occasional saltmarsh aster, sea oxeye, sea lavender, saltwort and marsh mallow.

Table 5b. Plate B - Shoreline Attributes Guinea

<u>Structure</u>	<u>Length(m)</u>	<u>Length(miles)</u>
Riprap	392.0	0.24
Bulkhead	713.9	0.69
Bulkhead and riprap	108.9	0.07
Upland, No structures-erosional or unstable	1057.8	0.66
Miscellaneous	440.0	0.27
Upland, No structures-stable or accretionary	471.0	0.29
Unstable marsh	14949.3	9.29
Stable marsh	67583.7	41.98

Guinea (Aerial Photo C)

The eastern segment of the Guinea Marshes includes the marsh islands of Hog and Big Island and other smaller islands. These are mostly low marsh communities of saltmarsh cordgrass and some high marsh, vegetated with saltgrass, saltmeadow hay, and occasionally saltmarsh aster, sea lavender, and saltwort.

Table 5c. Plate C - Shoreline Attributes Guinea


<u>Structure</u>	<u>Length(m)</u>	<u>Length(miles)</u>
Riprap	60.0	0.04
Bulkhead	273.9	0.17
Upland, No structures-erosional or unstable	352.4	0.22
Miscellaneous	198.5	0.12
Upland, No structures-stable or accretionary	236.2	0.15
Unstable marsh	20701.5	12.86
Stable marsh	45799.5	28.45



Scale



Legend

Class_Names	Area
 tidal marsh	1211.63

TIDAL MARSHES Gloucester County VA

GUINEA




Compiled from NAPP photos
Index No: 7688-109 7688-160
Dated: 3/94

Comprehensive Coastal Inventory 



Scale



 tidal marsh

1 : 24000



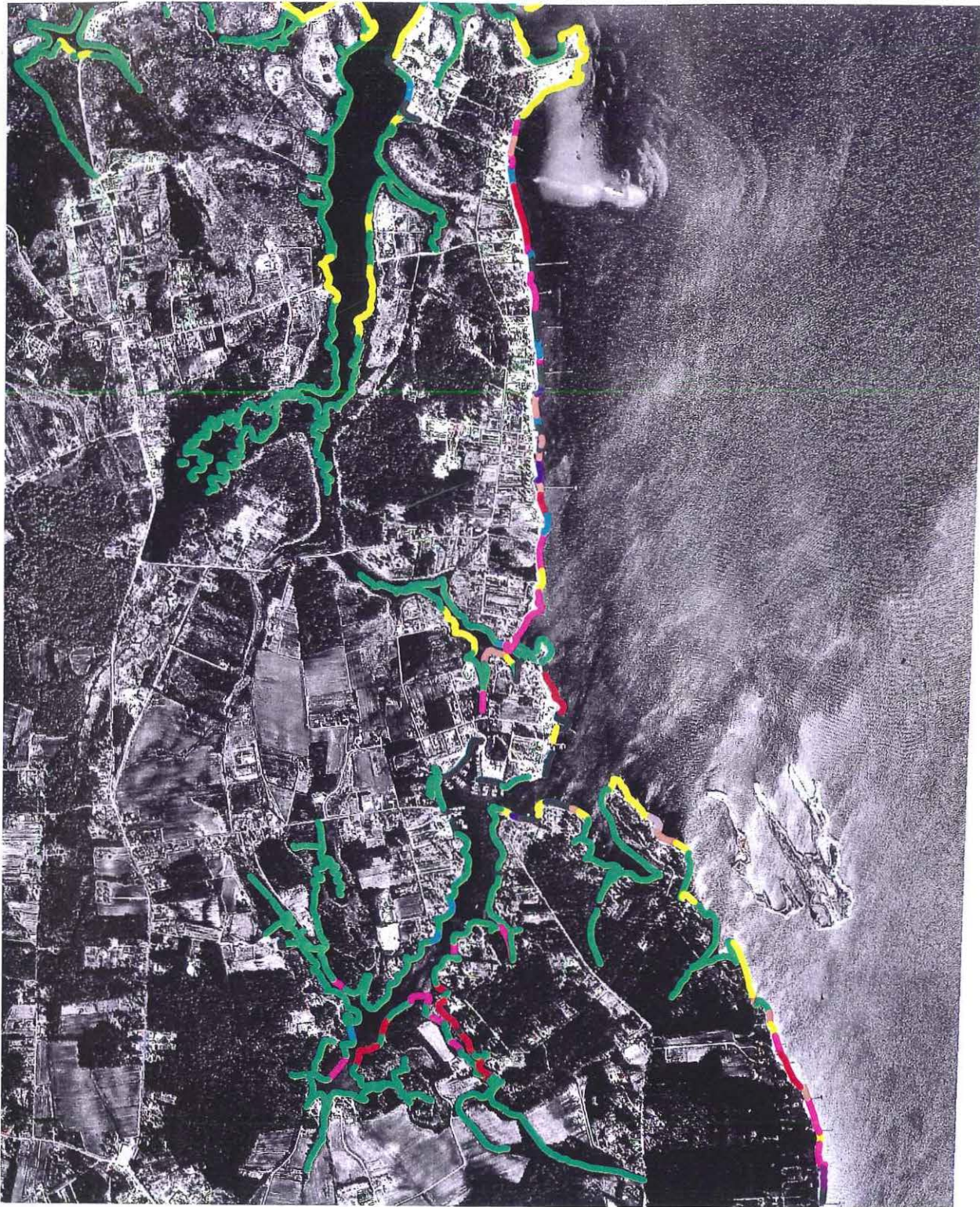
Compiled from NAPP photos
 Index No: 7688 -160
 Dated: 3/94

TIDAL MARSHES Gloucester County VA

GUINEA (A)

Comprehensive Coastal Inventory





Legend

- | | |
|--|---|
|  Riprap |  Groinfield, Bulkhead and Riprap |
|  Bulkhead |  Bulkhead and Riprap |
|  Jetty |  Upland, No structures, Unstable |
|  Groins |  Miscellaneous |
|  Breakwaters |  Upland, No structures, Stable |
|  Groinfield and Bulkhead |  Marsh, Unstable |
|  Groinfield and Riprap |  Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

GUINEA(A)

1:24000



Comprehensive Coastal Inventory






Scale



1 : 24000

 tidal marsh

TIDAL MARSHES Gloucester County VA

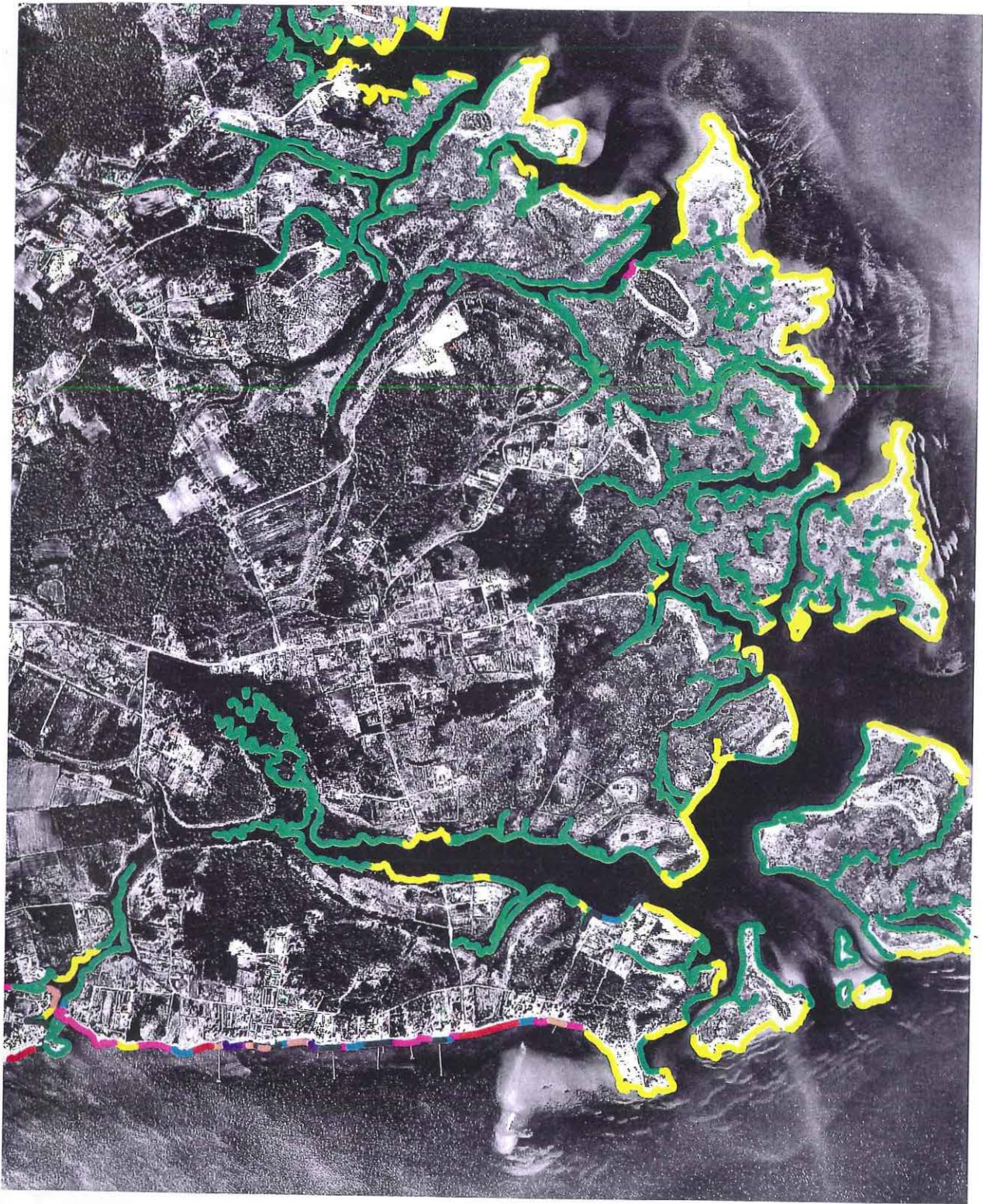
GUINEA (B)



Compiled from NAPP photos
Index No: 7688 -160
Dated: 3/94

Comprehensive Coastal Inventory





Legend

- | | | | |
|--|-------------------------|--|---------------------------------|
| | Riprap | | Groinfield, Bulkhead and Riprap |
| | Bulkhead | | Bulkhead and Riprap |
| | Jetty | | Upland, No structures, Unstable |
| | Groins | | Miscellaneous |
| | Breakwaters | | Upland, No structures, Stable |
| | Groinfield and Bulkhead | | Marsh, Unstable |
| | Groinfield and Riprap | | Marsh, Stable |

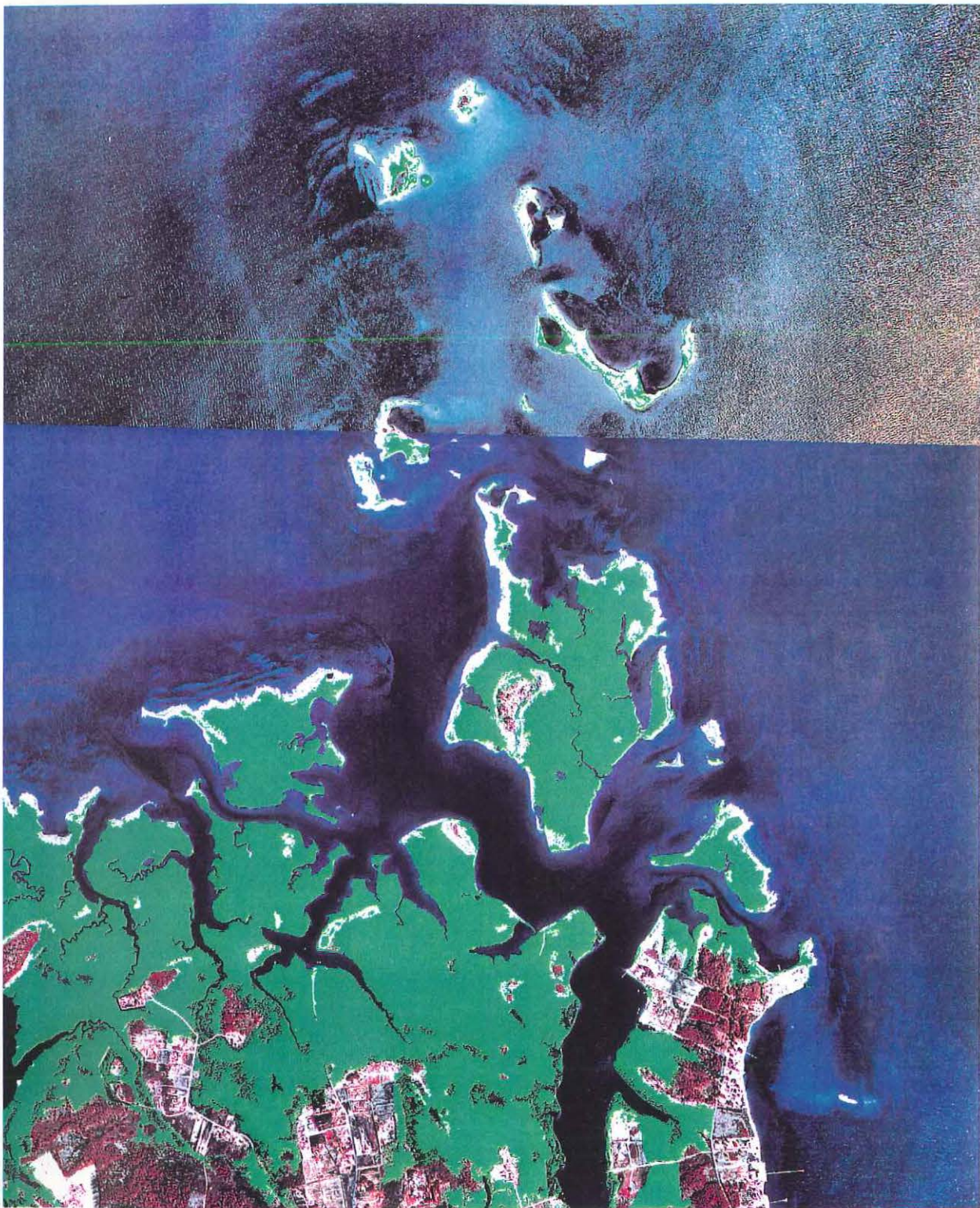
SHORELINE FEATURES Gloucester County VA

GUINEA(B)
1:24000



Comprehensive Coastal Inventory






Scale



1 : 24000

 tidal marsh

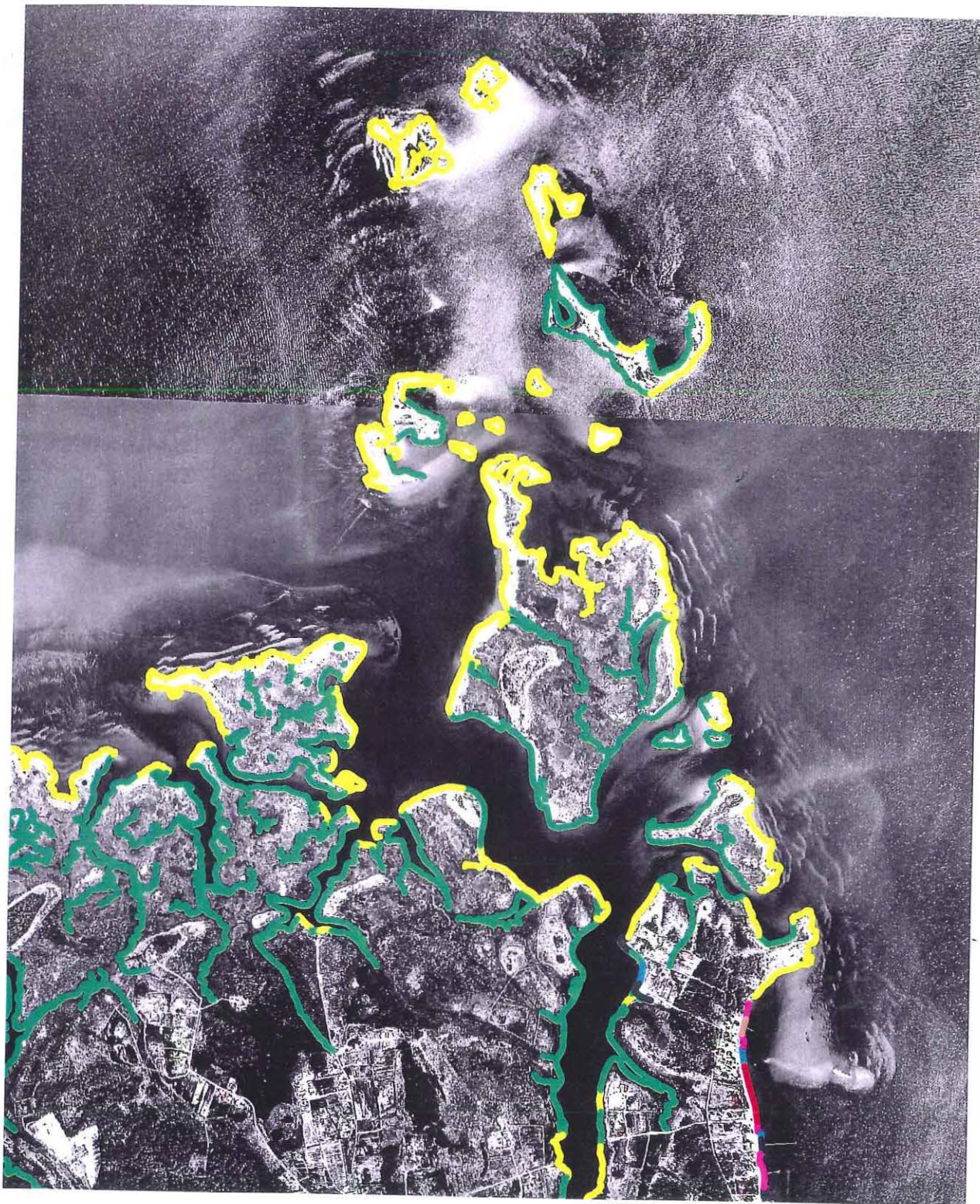
TIDAL MARSHES Gloucester County VA

GUINEA (C)



Compiled from NAPP photos
Index No: 7688 -160 7688 -109
Dated: 3/94

Comprehensive Coastal Inventory 



Legend

- | | | | |
|--|-------------------------|--|---------------------------------|
| | Riprap | | Groinfield, Bulkhead and Riprap |
| | Bulkhead | | Bulkhead and Riprap |
| | Jetty | | Upland, No structures, Unstable |
| | Groins | | Miscellaneous |
| | Breakwaters | | Upland, No structures, Stable |
| | Groinfield and Bulkhead | | Marsh, Unstable |
| | Groinfield and Riprap | | Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

GUINEA(C)
1:24000



Comprehensive Coastal Inventory



Severn River

This section of the Gloucester County shoreline includes numerous fringing and pocket marshes contained within the Severn River and its branches and connecting creeks. It also includes areas of broad extensive marsh which border on Mobjack Bay immediately north and south of the mouth of the Severn River. Many of the marshes in these photos are dominated by saltmarsh cordgrass (type I), but there are also significant areas of saltmeadow hay, saltgrass, black needlerush, big cordgrass and saltbush (types II, IV, V, and XII). Associated species like saltmarsh aster, sea oxeye, and sea lavender are found in these marshes.

Nearly 216 km (134 miles) of shoreline were measured along the Severn River and its branches. This waterway has mixed uses, ranging from low density residential to agricultural practices. Seventy km (43.5 miles) of shoreline defense structures have been installed as of 1993. This is most notable on the northern branch and mainstem of the Severn. Ninety percent of the shoreline mapped is characterized as stable or unstable marsh habitat without structures. Tables 6a-6d describe the conditions mapped from the 1993 videography.

Severn River (Aerial Photo A)

This photo shows the Northwestern Branch of the Severn River; the marshes pictured here are fringe, spit, pocket, creek, and cove marshes mainly of types I and XII, with a few type IV and V. They are low saltmarsh cordgrass marshes with some high marsh areas containing saltmeadow hay, saltgrass, black needlerush, big cordgrass and saltbush.

Table 6a. Plate A - Shoreline Attributes Severn River

<u>Structure</u>	<u>Length(m)</u>	<u>Length(miles)</u>
Riprap	87.3	0.05
Bulkhead	319.4	0.20
Groin field and bulkhead	41.8	0.03
Bulkhead and riprap	67.6	0.04
Upland, No structures-erosional or unstable	1148.0	0.71
Miscellaneous	139.8	0.09
Upland, No structures-stable or accretionary	3984.9	2.47
Unstable marsh	4511.8	2.80
Stable marsh	35433.9	22.01

Severn River (Aerial Photo B)

These marshes, from Cod Point to Mud Point, are much the same as photo A: mainly types I, IV, V, and XII consisting of fringe, spit, pocket, creek, cove, and extensive marshes. Low marshes contain saltmarsh cordgrass with some grading to high marsh areas of saltmeadow hay, saltgrass,

black needlerush, big cordgrass and saltbush. Some of the fringing marshes contain saltmarsh aster, sea oxeye, and sea lavender.

Table 6b. Plate B - Shoreline Attributes Severn River

<u>Structure</u>	<u>Length(m)</u>	<u>Length(miles)</u>
Riprap	1000.5	0.62
Bulkhead	1522.4	0.95
Groin fields	14.6	0.01
Bulkhead and riprap	183.8	0.11
Upland, No structures-erosional or unstable	1868.8	1.16
Miscellaneous	605.6	0.38
Upland, No structures-stable or accretionary	2196.7	1.36
Unstable marsh	13755.1	8.54
Stable marsh	45287.9	28.13

Severn River (Aerial Photo C)

This photograph shows the Southwestern Branch of the Severn River, including Willets, Heywood, and Thornton Creeks. The marshes here are fringe, spit, pocket, creek, cove, and extensive marshes of types I and XII. Again, low marshes contain saltmarsh cordgrass while the high marsh has saltmeadow hay, saltgrass, black needlerush, big cordgrass, saltbush and some saltmarsh aster, sea oxeye, and sea lavender.

Table 6c. Plate C - Shoreline Attributes Severn River

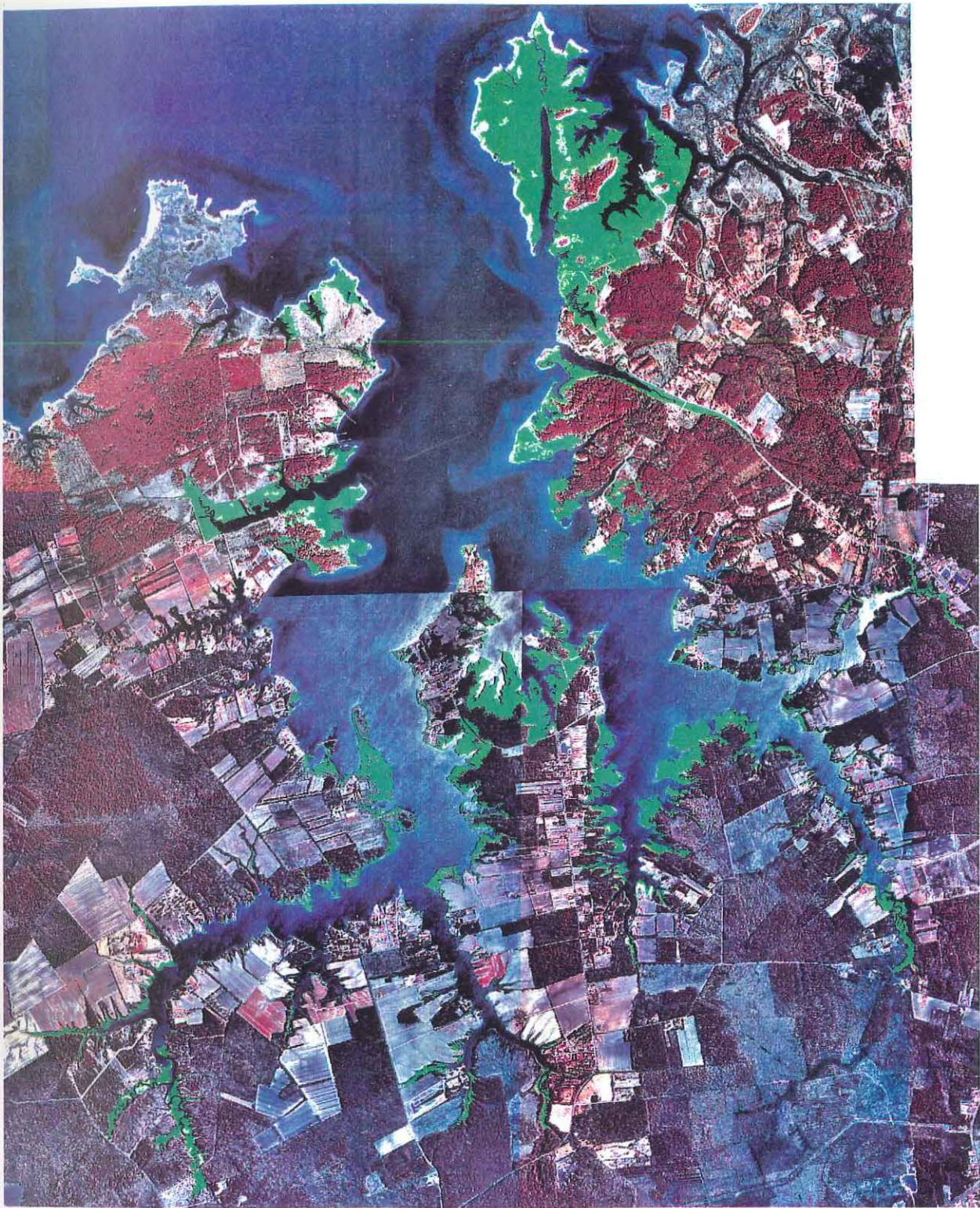
<u>Structure</u>	<u>Length(m)</u>	<u>Length(miles)</u>
Riprap	1574.7	0.98
Bulkhead	1730.7	1.07
Bulkhead and riprap	223.2	0.14
Upland, No structures-erosional or unstable	1291.5	0.80
Miscellaneous	1596.4	0.99
Upland, No structures-stable or accretionary	4380.6	2.72
Unstable marsh	9855.1	6.12
Stable marsh	51283.3	31.86

Severn River (Aerial Photo D)

Marshes in photo D, Rows Point to Little Monday Creek, are mainly type XII extensive, fringe, pocket, cove, with a few type I creek marshes. They are still largely cordgrass but with higher percentages of saltmeadow hay, saltgrass, black needlerush, and saltbush.

Table 6d. Plate D - Shoreline Attributes Severn River


<u>Structure</u>	<u>Length(m)</u>	<u>Length(miles)</u>
Riprap	926.0	0.58
Bulkhead	559.1	0.35
Upland, No structures-erosional or unstable	897.5	0.56
Miscellaneous	406.2	0.25
Upland, No structures-stable or accretionary	1104.4	0.69
Unstable marsh	15917.8	9.89
Stable marsh	65810.3	40.88



Scale



Legend

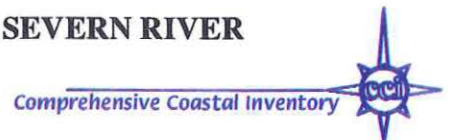
Class_Names	Area
 tidal marsh	1125.46

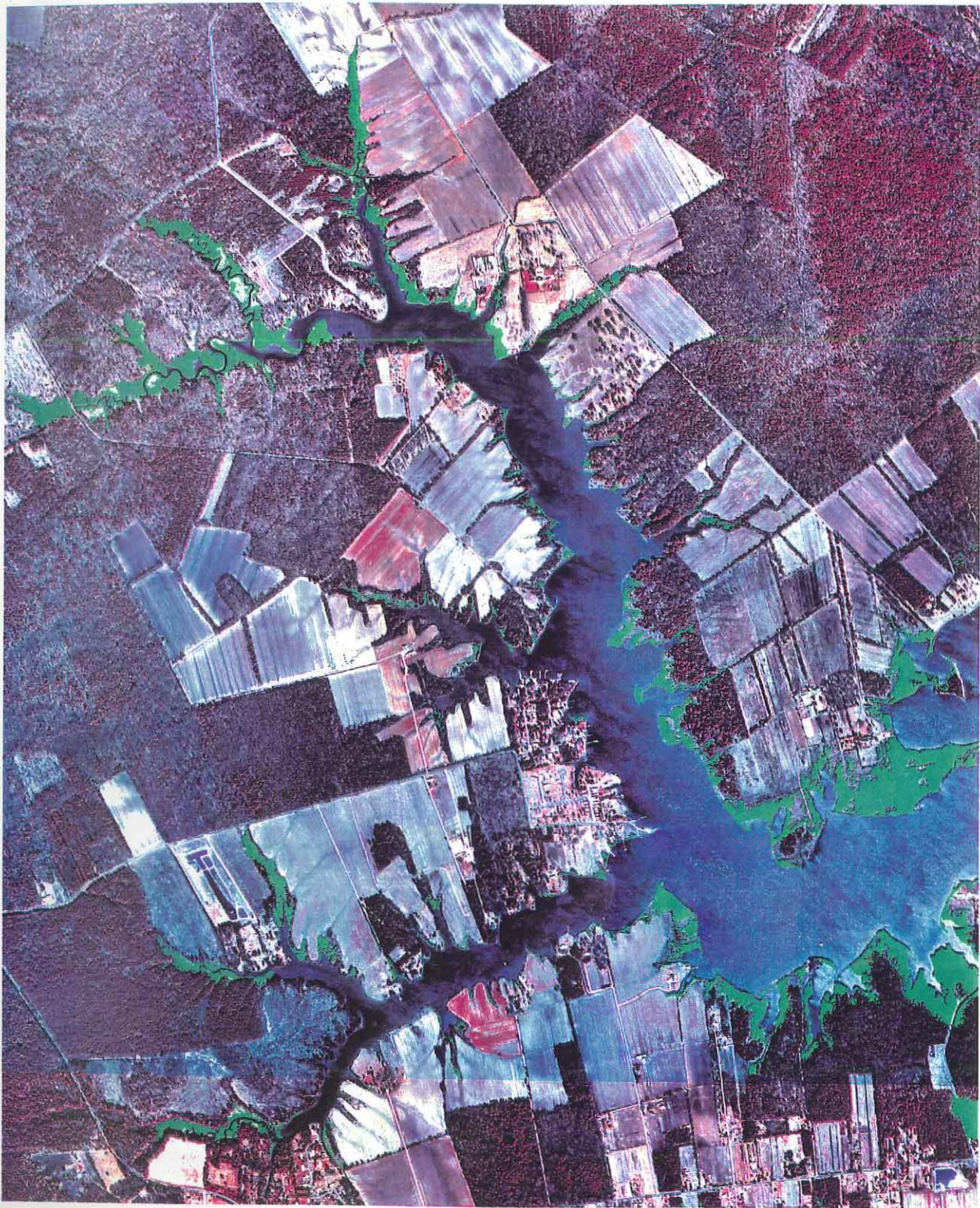
TIDAL MARSHES Gloucester County VA

SEVERN RIVER



Compiled from NAPP photos
 Index No: 7686-22 7686-23 7686-24
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Scale



1 : 24000

 tidal marsh



Compiled from NAPP photos
Index No: 7686-23 7686-24
Dated: 3/94

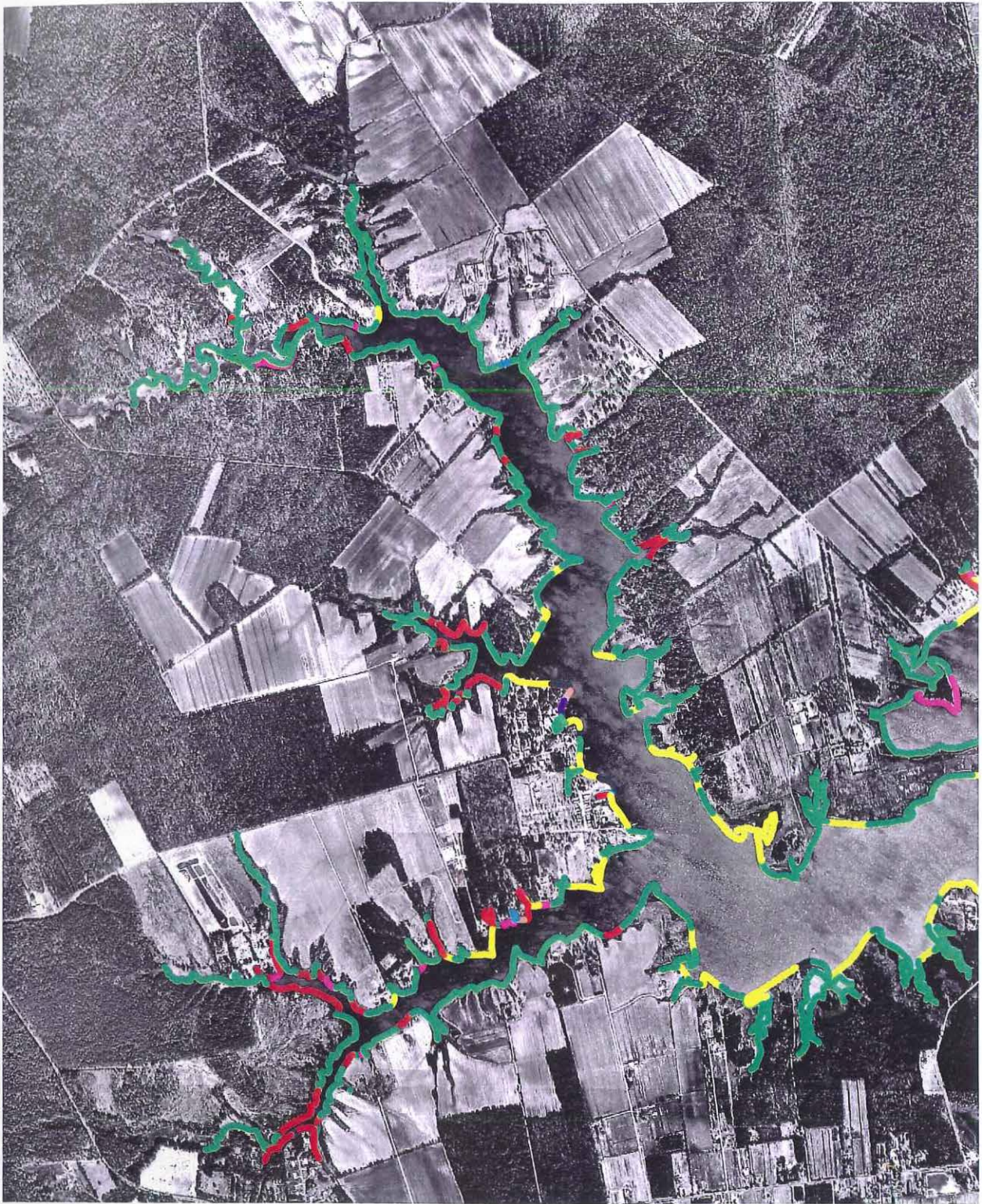
TIDAL MARSHES

Gloucester County VA

SEVERN RIVER (A)

Comprehensive Coastal Inventory





Legend

- | | | | |
|--|-------------------------|--|---------------------------------|
| | Riprap | | Groinfield, Bulkhead and Riprap |
| | Bulkhead | | Bulkhead and Riprap |
| | Jetty | | Upland, No structures, Unstable |
| | Groins | | Miscellaneous |
| | Breakwaters | | Upland, No structures, Stable |
| | Groinfield and Bulkhead | | Marsh, Unstable |
| | Groinfield and Riprap | | Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

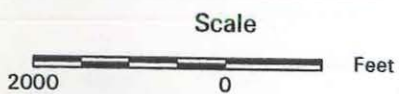
SEVERN RIVER (A)

1:24000




Comprehensive Coastal Inventory





1 : 24000

 tidal marsh



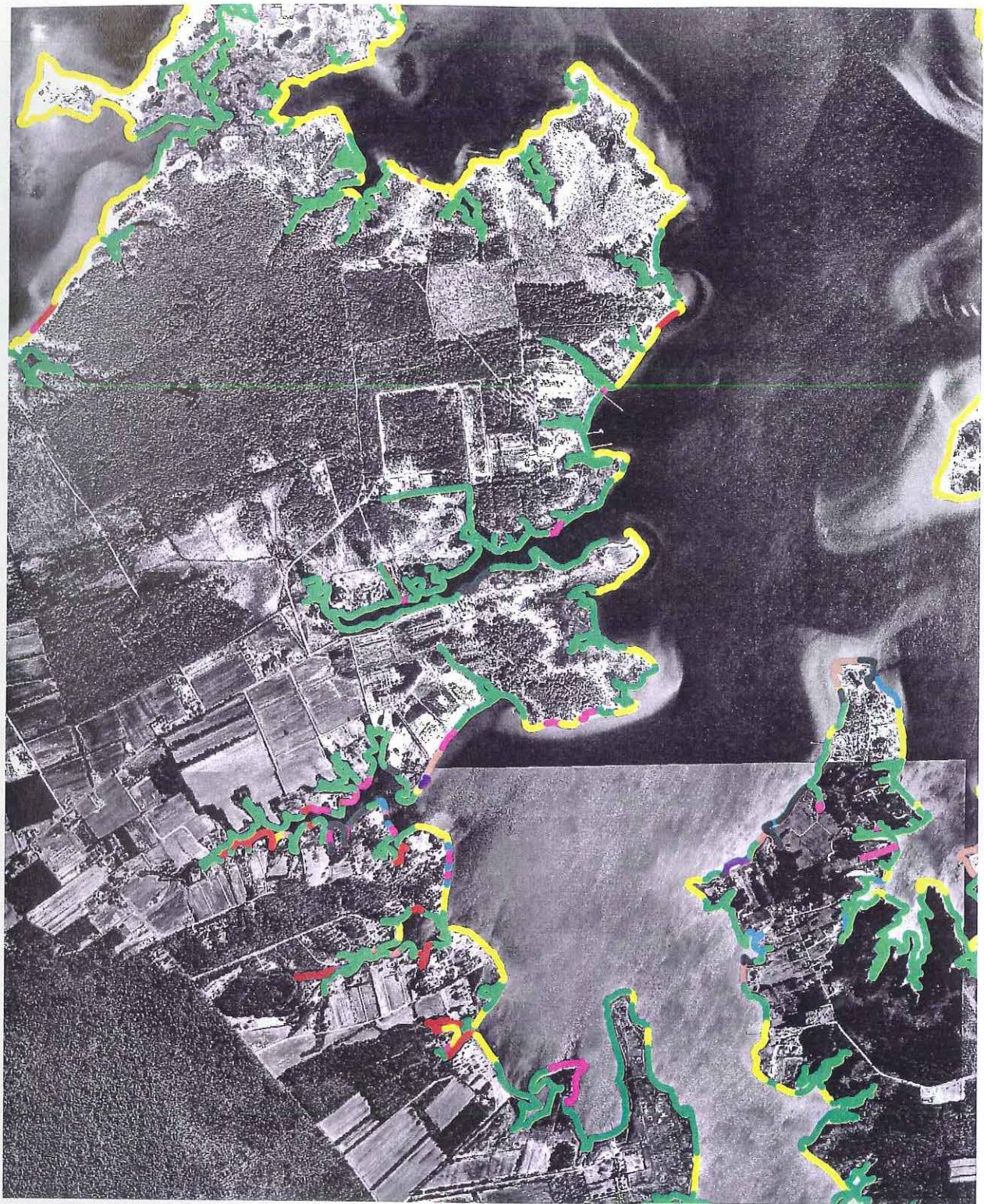
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 Dated: 3/94

TIDAL MARSHES Gloucester County VA

SEVERN RIVER (B)

Comprehensive Coastal Inventory





Legend

- | | |
|---|---|
|  Riprap |  Groinfield, Bulkhead and Riprap |
|  Bulkhead |  Bulkhead and Riprap |
|  Jetty |  Upland, No structures, Unstable |
|  Groins |  Miscellaneous |
|  Breakwaters |  Upland, No structures, Stable |
|  Groinfield and Bulkhead |  Marsh, Unstable |
|  Groinfield and Riprap |  Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

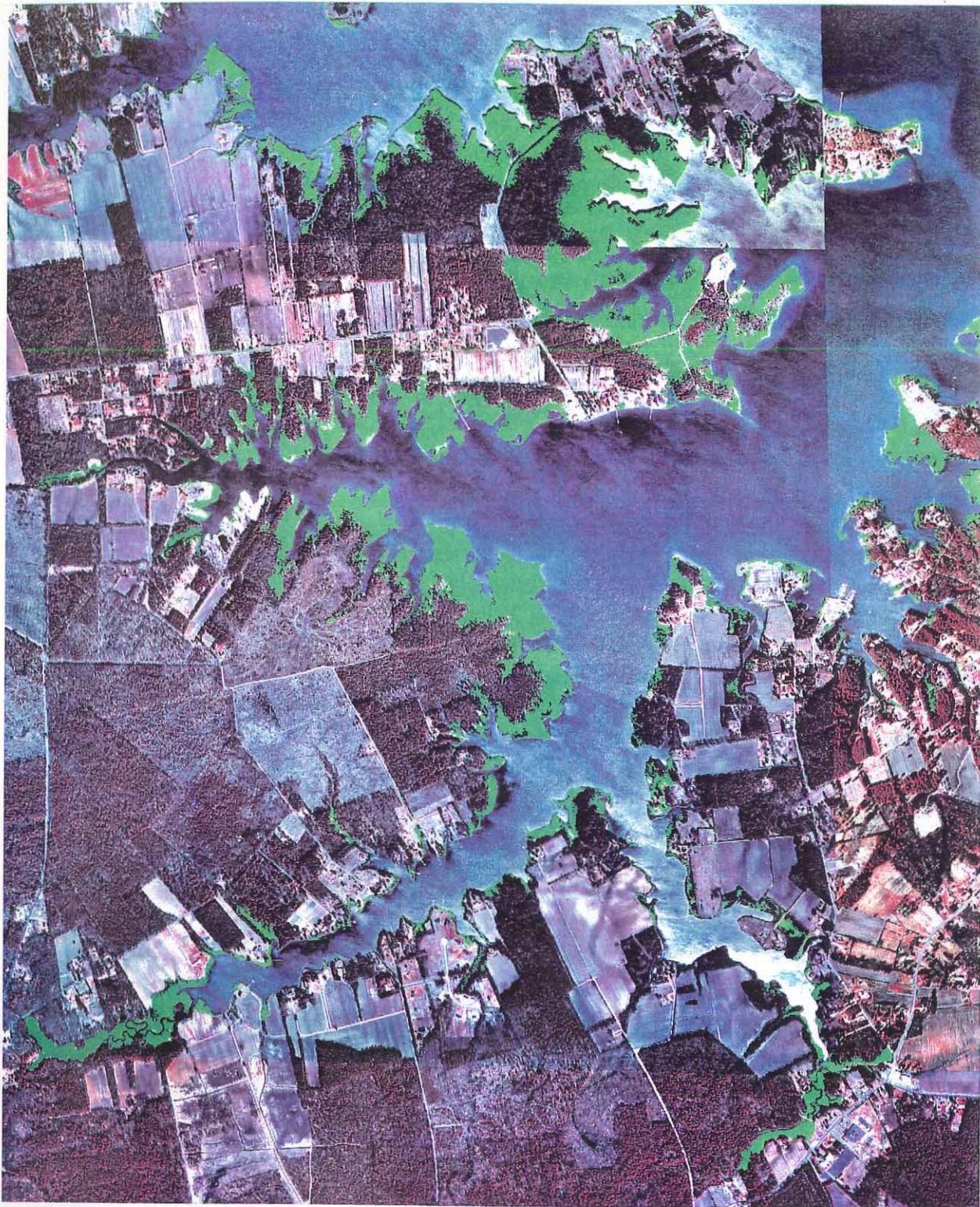
SEVERN RIVER (B)

1:24000



Comprehensive Coastal Inventory





Scale




2000

0

Feet

1 : 24000

 tidal marsh



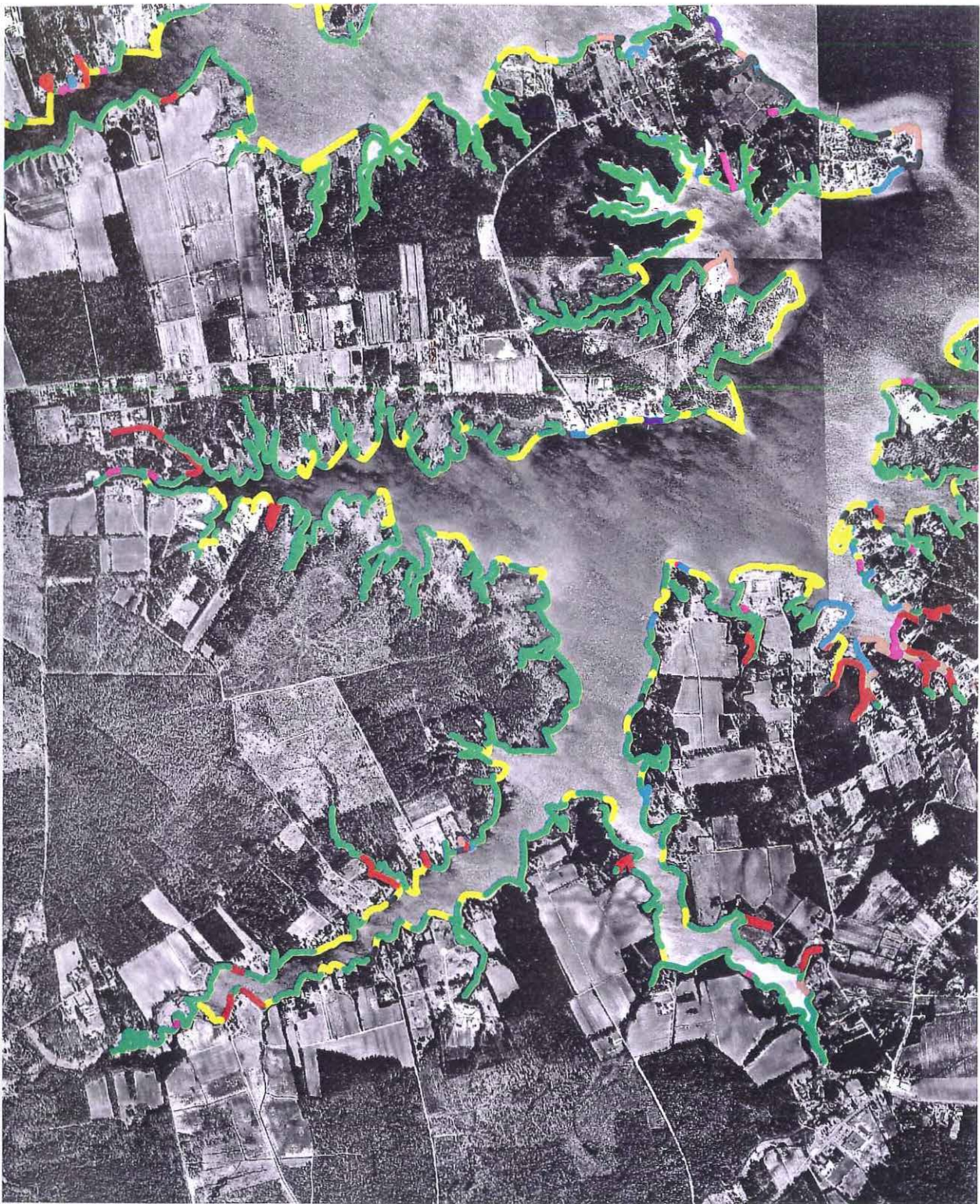
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 7686-24 7688-161
 Dated: 3/94

TIDAL MARSHES Gloucester County VA

SEVERN RIVER (C)

Comprehensive Coastal Inventory





Legend

- | | | | |
|--|-------------------------|--|---------------------------------|
| | Riprap | | Groinfield, Bulkhead and Riprap |
| | Bulkhead | | Bulkhead and Riprap |
| | Jetty | | Upland, No structures, Unstable |
| | Groins | | Miscellaneous |
| | Breakwaters | | Upland, No structures, Stable |
| | Groinfield and Bulkhead | | Marsh, Unstable |
| | Groinfield and Riprap | | Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

SEVERN RIVER (C)

1:24000

Comprehensive Coastal Inventory






Scale



1 : 24000

 tidal marsh



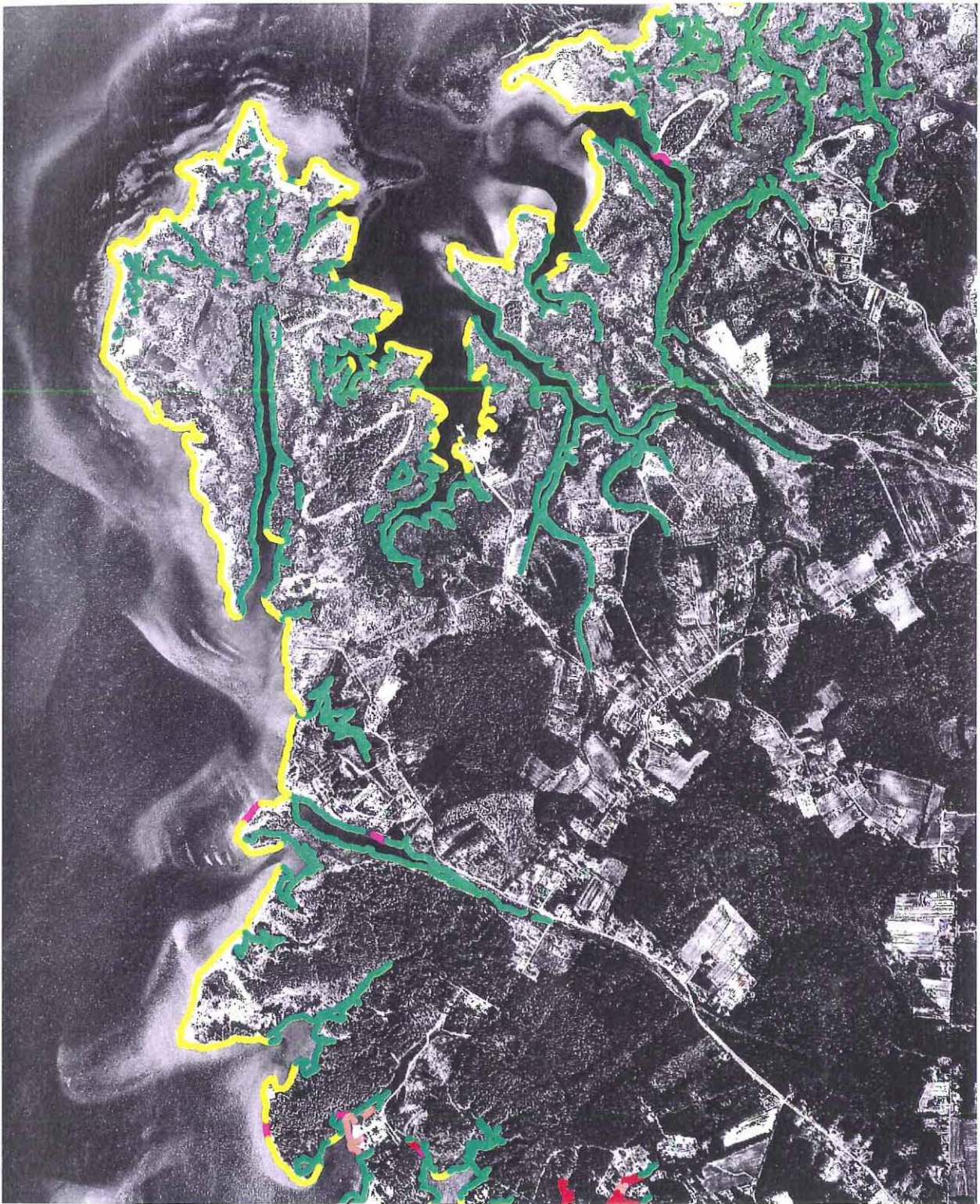
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Index No: 7688-161
Dated: 3/94

TIDAL MARSHES Gloucester County VA

SEVERN RIVER (D)

Comprehensive Coastal Inventory





Legend

- | | |
|---|---|
|  Riprap |  Groinfield, Bulkhead and Riprap |
|  Bulkhead |  Bulkhead and Riprap |
|  Jetty |  Upland, No structures, Unstable |
|  Groins |  Miscellaneous |
|  Breakwaters |  Upland, No structures, Stable |
|  Groinfield and Bulkhead |  Marsh, Unstable |
|  Groinfield and Riprap |  Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

SEVERN RIVER (D)

1:24000



Comprehensive Coastal Inventory



Ware River

The marshes found along the Ware River are similar in species and importance to those found along the Severn River and North River. They have a variety of plant community types (I, II, III, IV, V, VI, XII) including such species as saltmeadow hay, saltgrass, big cordgrass, black needlerush, cattails, and saltbush. Many of these marshes are small pocket or narrow fringe marshes. The pocket marshes are characteristically dominated by saltmarsh cordgrass with interior sections slightly higher in elevation, vegetated with saltmeadow grass and saltbush. In areas where fresh water enters from springs or creeks, cattails occur. The narrow fringe marshes are mostly saltmarsh cordgrass and black needlerush. The upper portion of the Ware River contains extensive creek marsh areas. These creek marshes are dominated by saltmarsh cordgrass (type I) in their downstream region while the reduced salinity upstream supports big cordgrass (type V).

One hundred and fifty seven km (97.50 miles) of shoreline were surveyed along the Ware River and its tributaries. This is a relatively well developed waterway which drains into Mobjack Bay. The headwaters of the river is dominated by stable marshes. The primary waterway includes a host of shoreline protection structures, which are interspersed among sections of shoreline with varying degrees of stability. The remaining untouched areas include some short sandy beaches, and stable and unstable fringe marshes. Tables 7a-7e report the linear lengths of shoreline features surveyed for each plate.

Ware River (Aerial Photo A)

Photograph A, from Cow Creek to Bailey's, includes types I, II, IV, V, and XI marshes, largely cordgrass dominated with black needlerush, behind which is high marsh meadow and saltbush in areas grading toward upland. Included are cove, fringe, pocket, spit, and extensive marshes. Some fringing marshes have cordgrass along the water with high marsh behind. The creek marshes at the headwaters of the Ware River are saltmarsh cordgrass downstream, grading to big cordgrass upstream.

Table 7a. Plate A - Shoreline Attributes Ware River

<u>Structure</u>	<u>Length(m)</u>	<u>Length(miles)</u>
Riprap	352.0	0.22
Bulkhead	474.9	0.29
Upland, No structures-erosional or unstable	2423.9	1.49
Miscellaneous	340.0	0.21
Upland, No structures-stable or accretionary	681.4	0.42
Unstable marsh	8047.9	4.96
Stable marsh	32621.0	20.11

Ware River (Aerial Photo B)

Aerial Photo B includes Ware Neck, from Hockley to Horse Point. These are types I, II, III, IV, and XI marshes, cordgrass and black needlerush in low areas, high marsh meadow and saltbush in upland areas. A few marshes include sea lavender and sea oxeye in the higher areas. Cove, fringe, island, pocket, spit, and extensive marshes can all be found.

Table 7b. Plate B - Shoreline Attributes Ware River

<u>Structure</u>	<u>Length (m)</u>	<u>Length(miles)</u>
Riprap	1552.0	0.96
Bulkhead	1567.1	0.97
Groin field	88.3	1.03
Breakwater	254.7	0.16
Groin field and bulkhead	76.5	0.05
Groin field and riprap	253.7	0.16
Groin field, bulkhead, and riprap	64.0	0.04
Bulkhead and riprap	845.6	0.53
Upland, No structures-erosional or unstable	1766.9	1.10
Miscellaneous	260.6	0.16
Upland, No structures-stable or accretionary	757.9	0.47
Unstable marsh	8162.0	5.07
Stable marsh	22449.0	13.95

Ware River (Aerial Photo C)

This area, from Wilson Creek to Bailey's, includes creek, cove, fringe, pocket and extensive marshes (types I, II, IV, and X). The vegetation is cordgrass dominated, with black needlerush, and high marsh meadow and saltbush in higher areas.

Table 7c. Plate C - Shoreline Attributes Ware River

<u>Structure</u>	<u>Length(m)</u>	<u>Length(miles)</u>
Riprap	1012.8	0.63
Bulkhead	2141.3	1.33
Breakwaters	92.6	0.06
Groin field and bulkhead	177.5	0.11
Bulkhead and riprap	104.0	0.06
Upland, No structures-erosional or unstable	1872.2	1.16
Miscellaneous	297.0	0.18
Upland, No structures-stable or accretionary	2692.8	1.67
Unstable marsh	4153.4	2.58
Stable marsh	22376.2	13.90

Ware River (Aerial Photo D)

This photograph of the area from Jarvis Point to Page Creek illustrates cove, fringe, pocket, spit, and extensive marshes (types I, II, and XI). They are dominated by cordgrass with black needlerush, behind which is high marsh meadow and saltbush in areas grading toward upland. Areas of extensive high marsh have channels adjacent to them.

Table 7d. Plate D - Shoreline Attributes Ware River

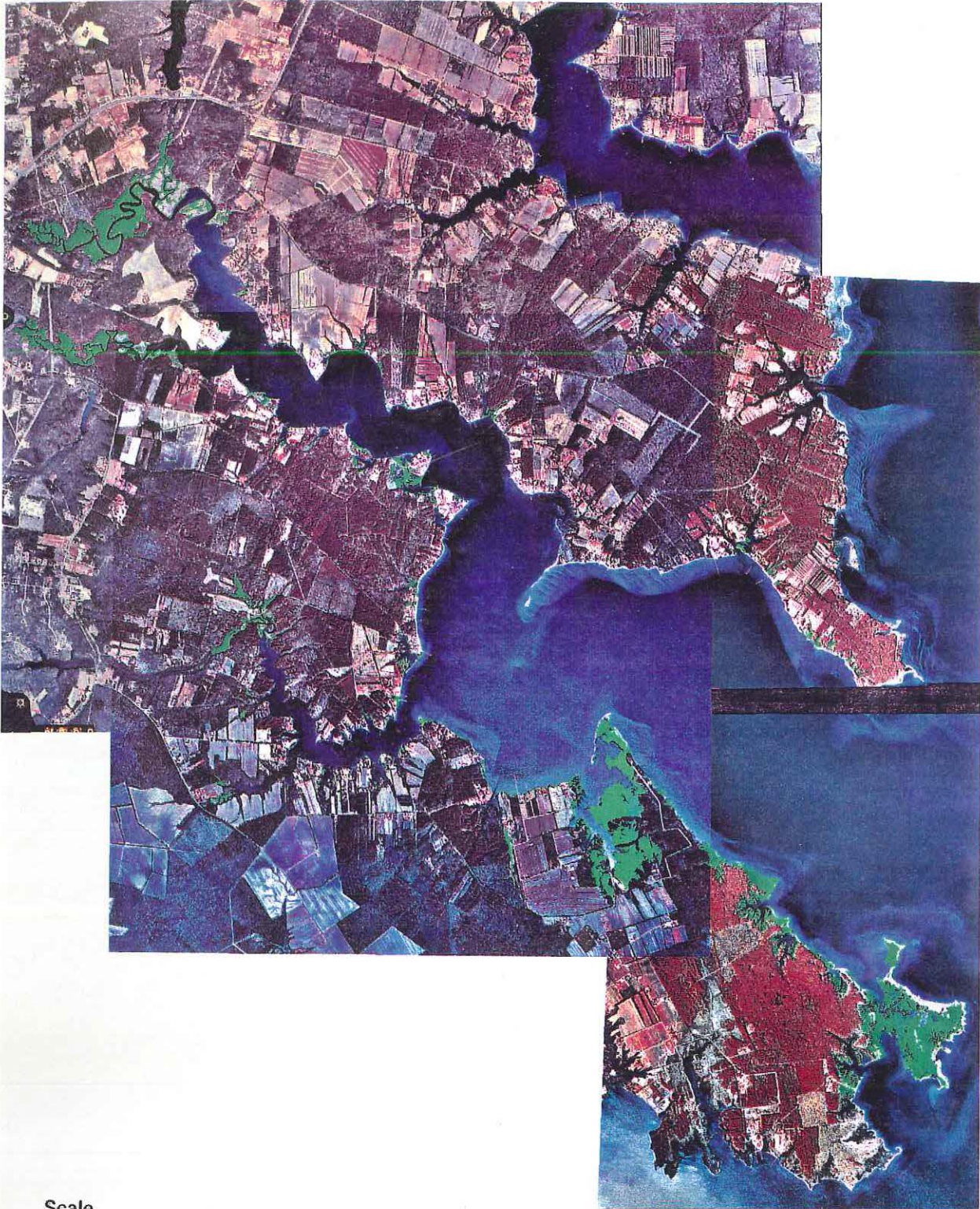
<u>Structure</u>	<u>Length(m)</u>	<u>Length (miles)</u>
Riprap	1008.6	0.63
Bulkhead	1283.5	0.80
Groin field and bulkhead	253.9	0.16
Groin field and riprap	62.5	0.04
Groin field, bulkhead, and riprap	64.0	0.04
Bulkhead and riprap	176.5	0.11
Upland, No structures-erosional or unstable	1995.4	1.24
Miscellaneous	166.2	0.10
Upland, No structures-stable or accretionary	1135.3	0.71
Unstable marsh	6997.1	4.35
Stable marsh	18840.5	11.70

Ware River (Aerial Photo E)

Aerial photo E, Windmill Point to Caucus Bay, pictures types I, II, and XI marshes, largely cordgrass dominated with black needlerush. Upland of the cordgrass is high marsh meadow and saltbush. These marshes include cove, fringe, pocket and extensive marshes.

Table 7e. Plate E - Shoreline Attributes Ware River

<u>Structure</u>	<u>Length(m)</u>	<u>Length(miles)</u>
Riprap	384.8	0.24
Bulkhead	335.2	0.21
Groin fields	14.6	0.01
Bulkhead and riprap	116.9	0.07
Upland, No structure-erosional or unstable	1109.6	0.69
Miscellaneous	53.9	0.03
Upland, No structure-stable or accretionary	801.5	0.50
Unstable marsh	12072.3	7.50
Stable marsh	34405.2	21.37



Scale



Legend

Class_Names	Area
tidal marsh	636.822

TIDAL MARSHES Gloucester County VA

WARE RIVER



Compiled from NAPP photos
 Index No: 7686-25 7686-26
 7688-162 7688-163
 Dated: 3/94


Comprehensive Coastal Inventory



Scale



1 : 24000

 tidal marsh

TIDAL MARSHES

Gloucester County VA

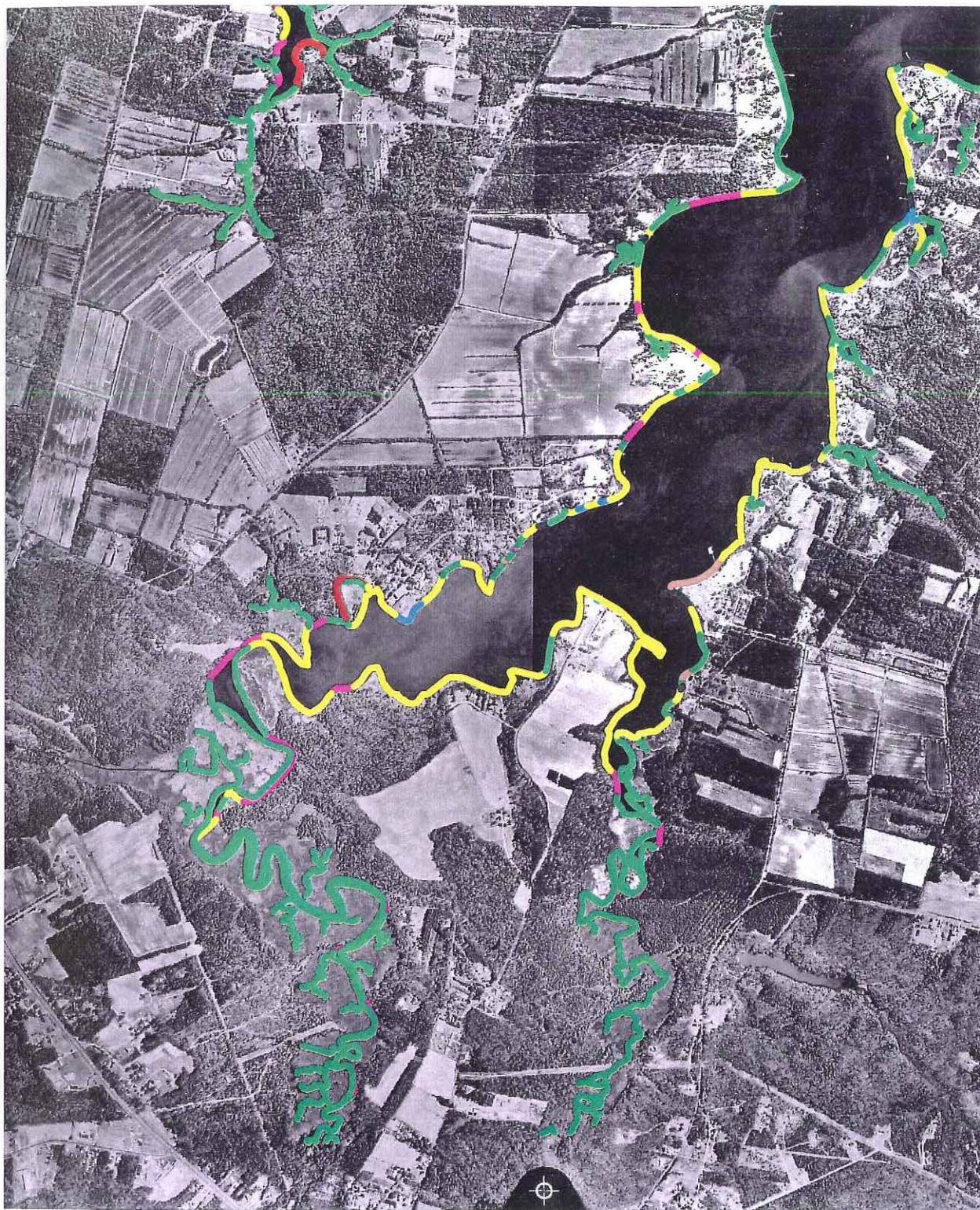
WARE RIVER (A)



Compiled from NAPP photos
Index No: 7686-25 7686-26
Dated: 3/94

Comprehensive Coastal Inventory





Legend

- | | | | |
|--|-------------------------|--|---------------------------------|
| | Riprap | | Groinfield, Bulkhead and Riprap |
| | Bulkhead | | Bulkhead and Riprap |
| | Jetty | | Upland, No structures, Unstable |
| | Groins | | Miscellaneous |
| | Breakwaters | | Upland, No structures, Stable |
| | Groinfield and Bulkhead | | Marsh, Unstable |
| | Groinfield and Riprap | | Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

WARE RIVER (A)

1:24000



Comprehensive Coastal Inventory






Scale



1 : 24000

 tidal marsh



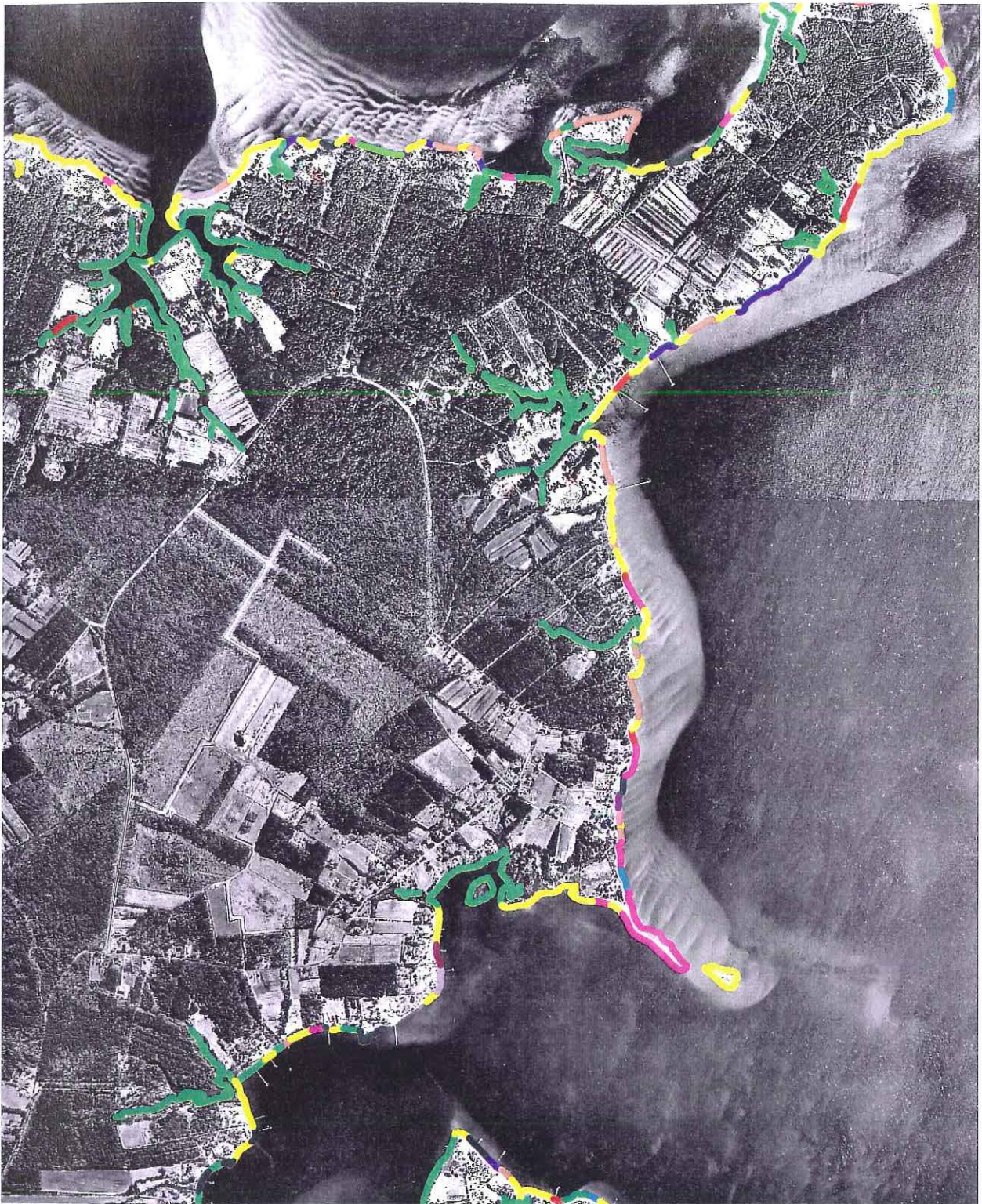
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TIDAL MARSHES Gloucester County VA

WARE RIVER (B)

Comprehensive Coastal Inventory





Legend

- | | |
|---|---|
|  Riprap |  Groinfield, Bulkhead and Riprap |
|  Bulkhead |  Bulkhead and Riprap |
|  Jetty |  Upland, No structures, Unstable |
|  Groins |  Miscellaneous |
|  Breakwaters |  Upland, No structures, Stable |
|  Groinfield and Bulkhead |  Marsh, Unstable |
|  Groinfield and Riprap |  Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

WARE RIVER (B)

1:24000



Comprehensive Coastal Inventory






Scale



1 : 24000

 tidal marsh



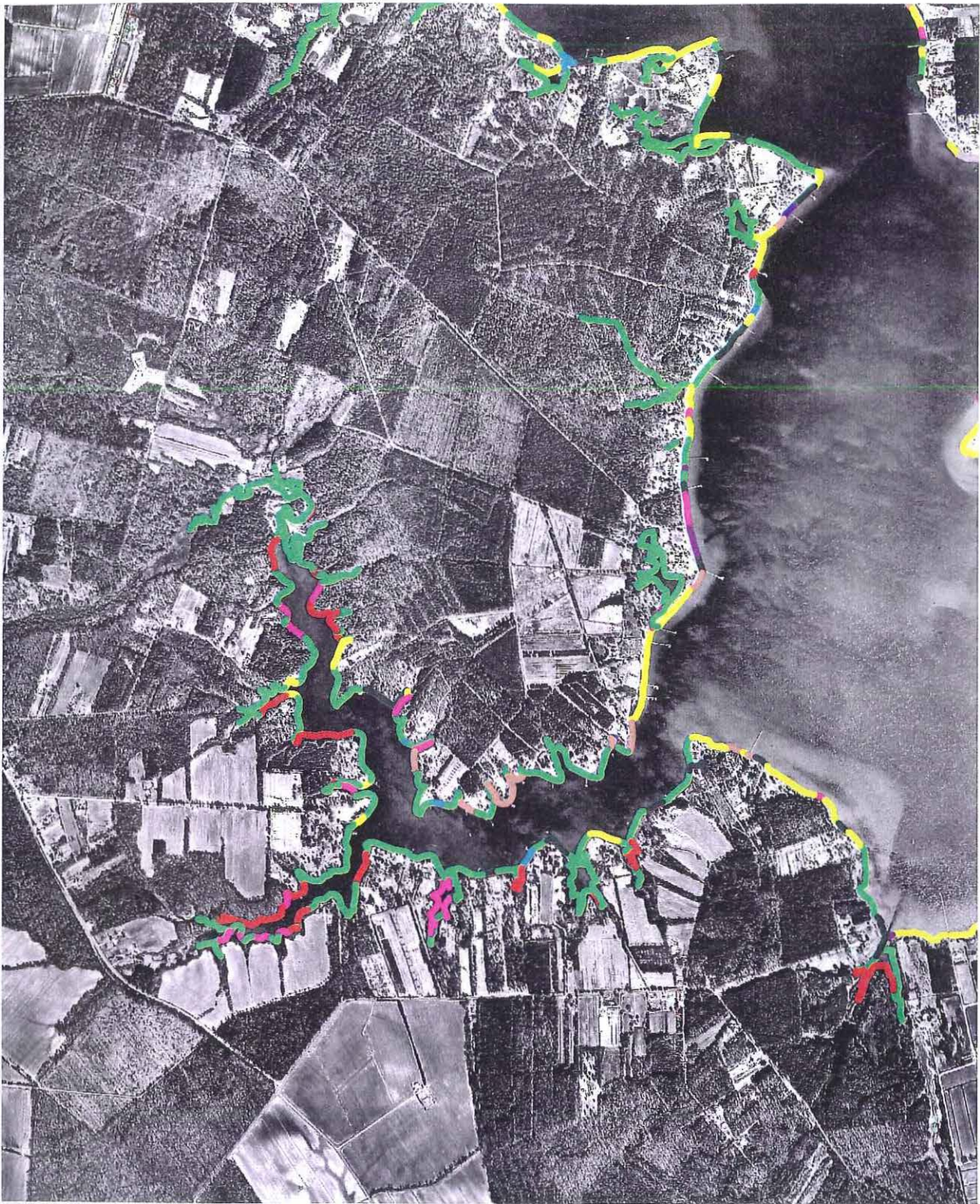
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TIDAL MARSHES Gloucester County VA

WARE RIVER (C)

Comprehensive Coastal Inventory





Legend

- | | |
|---|---|
|  Riprap |  Groinfield, Bulkhead and Riprap |
|  Bulkhead |  Bulkhead and Riprap |
|  Jetty |  Upland, No structures, Unstable |
|  Groins |  Miscellaneous |
|  Breakwaters |  Upland, No structures, Stable |
|  Groinfield and Bulkhead |  Marsh, Unstable |
|  Groinfield and Riprap |  Marsh, Stable |

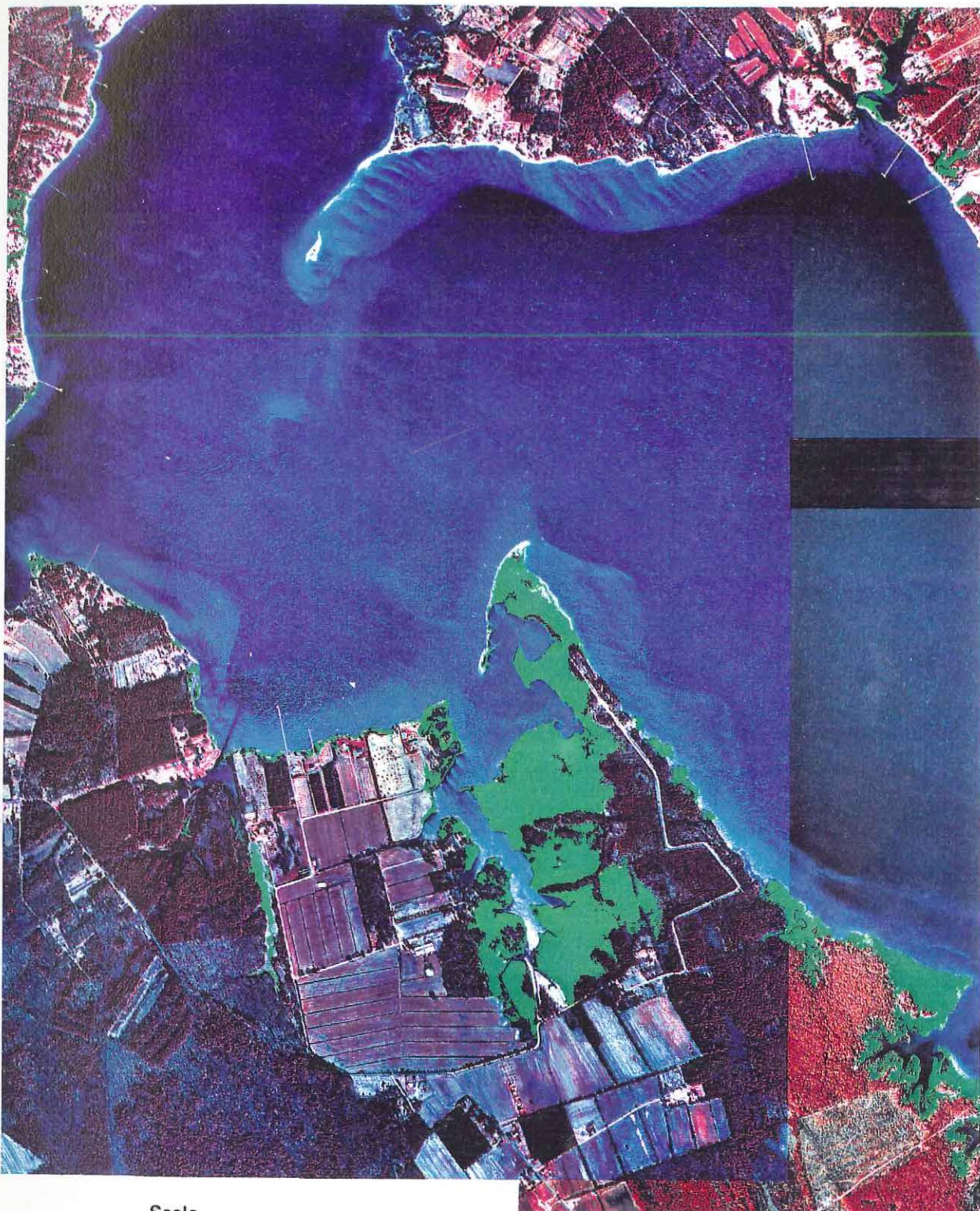
SHORELINE FEATURES Gloucester County VA

WARE RIVER (C)

1:24000

Comprehensive Coastal Inventory






Scale



1 : 24000

 tidal marsh

TIDAL MARSHES Gloucester County VA

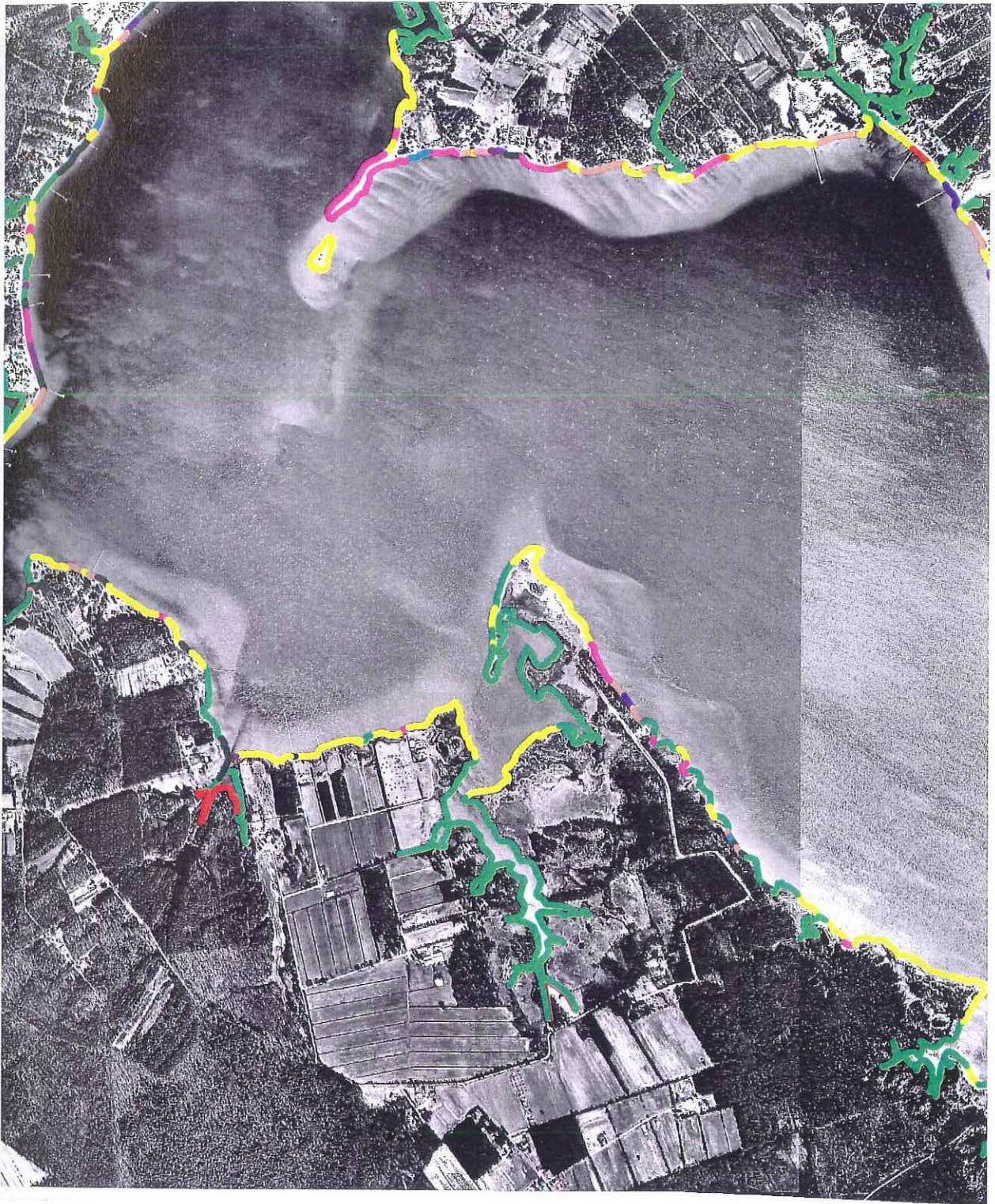
WARE RIVER (D)



Compiled from NAPP photos
Index No: 7686-25 7688-162 7688-163
Dated: 3/94

Comprehensive Coastal Inventory





Legend

- | | |
|---|---|
|  Riprap |  Groinfield, Bulkhead and Riprap |
|  Bulkhead |  Bulkhead and Riprap |
|  Jetty |  Upland, No structures, Unstable |
|  Groins |  Miscellaneous |
|  Breakwaters |  Upland, No structures, Stable |
|  Groinfield and Bulkhead |  Marsh, Unstable |
|  Groinfield and Riprap |  Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

WARE RIVER (D)

1:24000



Comprehensive Coastal Inventory






Scale



1 : 24000

 tidal marsh



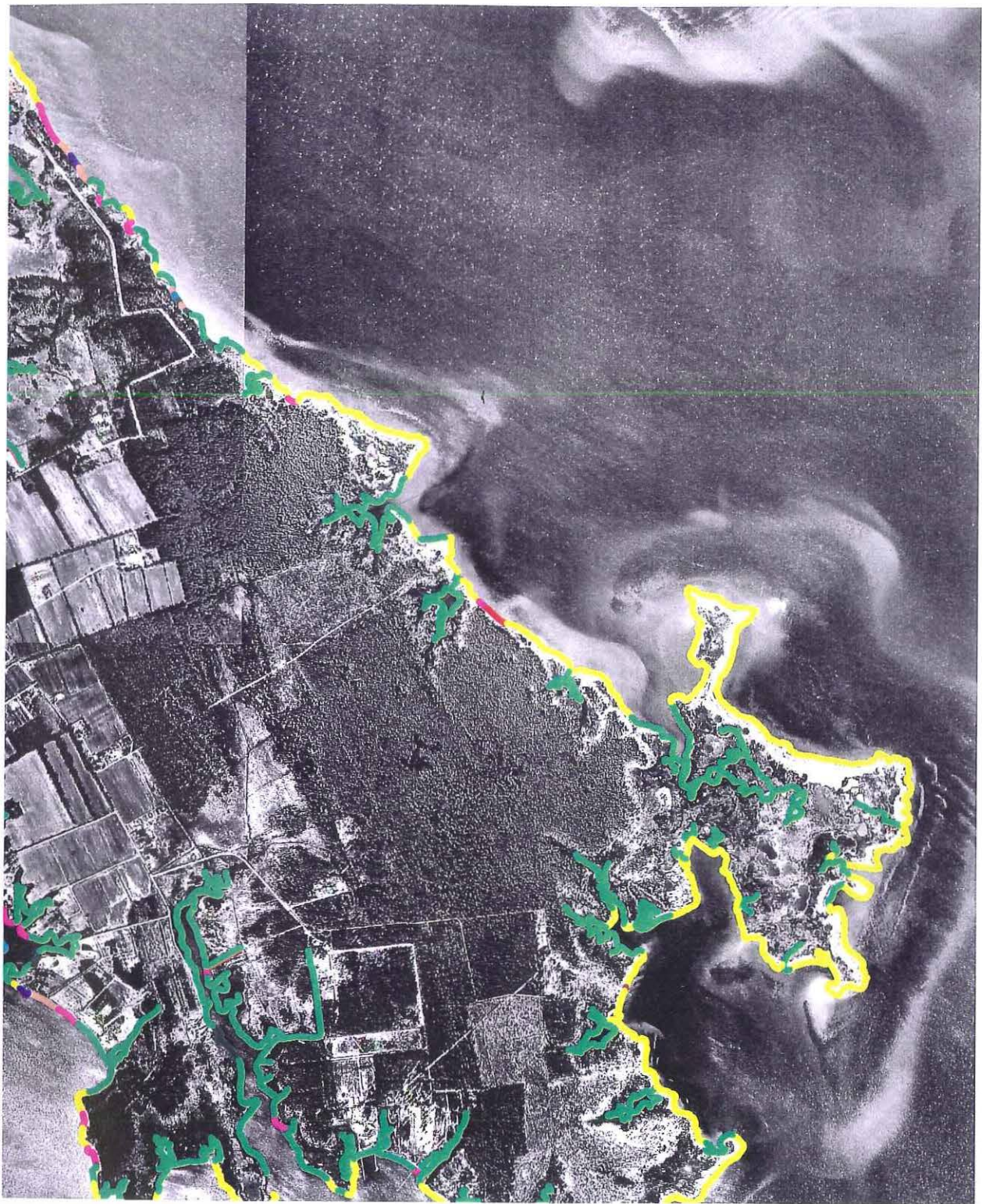
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TIDAL MARSHES Gloucester County VA

WARE RIVER (E)

Comprehensive Coastal Inventory





Legend

- | | |
|---|---|
|  Riprap |  Groinfield, Bulkhead and Riprap |
|  Bulkhead |  Bulkhead and Riprap |
|  Jetty |  Upland, No structures, Unstable |
|  Groins |  Miscellaneous |
|  Breakwaters |  Upland, No structures, Stable |
|  Groinfield and Bulkhead |  Marsh, Unstable |
|  Groinfield and Riprap |  Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

WARE RIVER (E)
1:24000



Comprehensive Coastal Inventory



North River

The centerline of the North River marks the boundary between Gloucester and Mathews counties. Therefore, only the western shore of the river has been surveyed for wetland and shoreline attributes. Conditions along the eastern shore will be described in the Mathews County Inventory when available.

The marshes found along the North River are similar in species and importance to those found along the Ware and Severn River. These type I, II, III, IV, V, VI, XII marshes include saltmeadow hay, saltgrass, big cordgrass, black needlerush, cattails, and saltbush. Narrow fringe marshes are saltmarsh cordgrass and black needlerush while pocket marshes are usually saltmarsh cordgrass with slightly higher elevation vegetated by saltmeadow grass and saltbush. The upper portion of the North River contains extensive creek-marsh areas. These systems are dominated by saltmarsh cordgrass (type I) in the lower reaches of the creeks, while the reduced salinity further up the creek allows big cordgrass (type V) to grow.

The North River segment in Gloucester County includes the shoreline of the North River, and the promontory known as Ware Neck Point. The segment covers almost 66 km (40.99 miles) of shoreline. Nearly 90 percent of the shoreline is classified as either stable or unstable marsh. Shoreline protection structures line approximately 4.5 km (2.79 miles) of the shoreline. These are most prevalent along Ware Neck Point where exposure is greatest. Tables 8a-8c describe the shoreline attributes illustrated.

North River (Aerial Photo A)

Photograph A, from Fort Nonsense to Elmington Creek, shows types I, II, V and XI creek, fringe, and pocket marshes. They are vegetated with cordgrass and black needlerush grading to high marsh meadow and saltbush toward upland areas. The creek-marsh systems change with salinity as described above.

Table 8a. Plate A - Shoreline Attributes North River

<u>Structure</u>	<u>Length(m)</u>	<u>Length(miles)</u>
Riprap	60.1	0.04
Bulkhead	116.4	0.08
Upland, No structures-erosional or unstable	314.8	0.19
Miscellaneous	65.6	0.04
Unstable marsh	1242.6	0.77
Stable marsh	12700.6	7.89

North River (Aerial Photo B)

This photo covers the portion of the river from Elmington Creek to Lone Point. Cove, fringe, pocket, spit, and extensive marshes of types I, II, and XI can be found here. The plant community is cordgrass and black needlerush in lower areas, with high marsh meadow containing saltbush in elevated areas.

Table 8b. Plate B - Shoreline Attributes North River

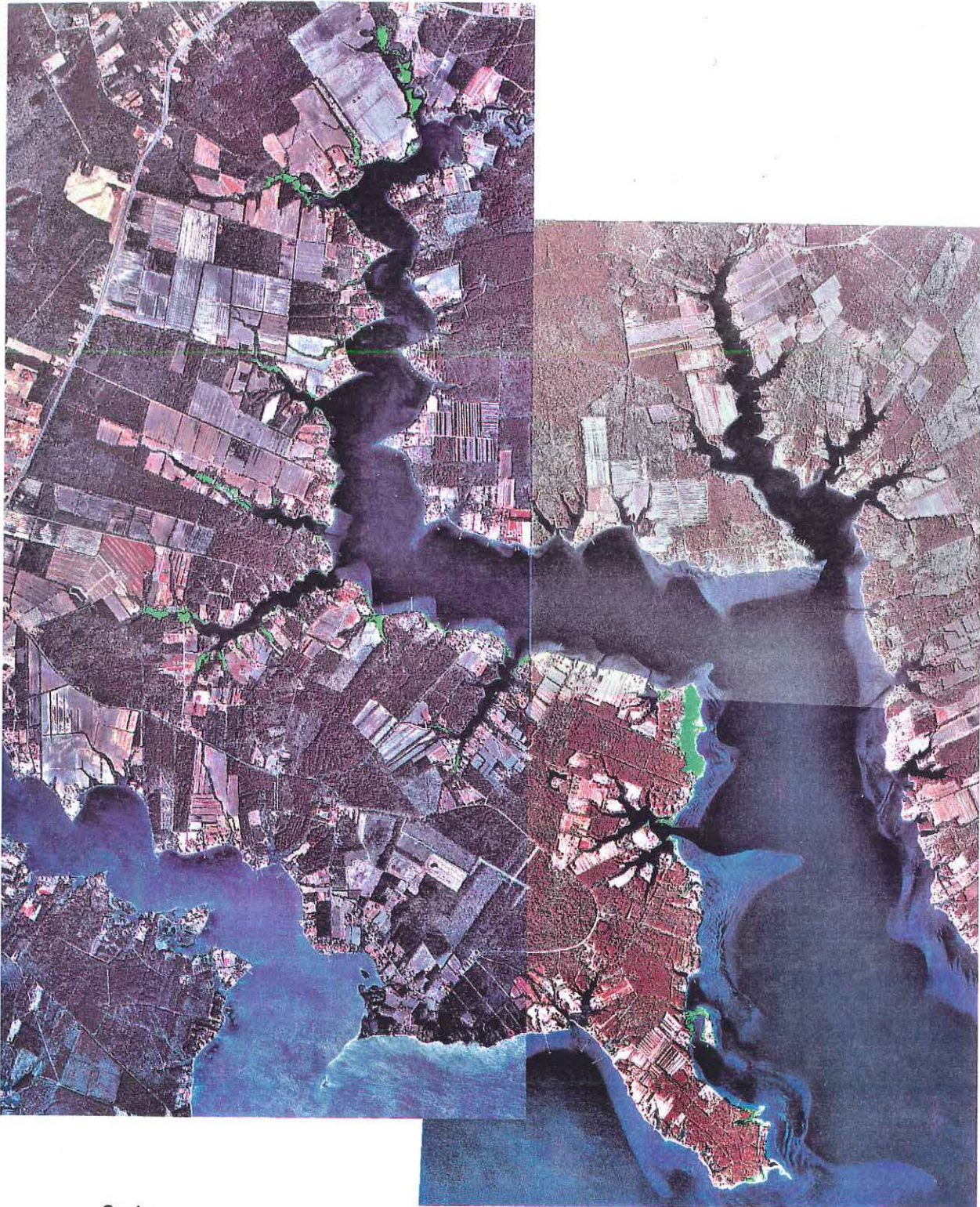
<u>Structure</u>	<u>Length(m)</u>	<u>Length(miles)</u>
Riprap	587.3	0.36
Bulkhead	868.5	0.54
Breakwaters	147.9	0.09
Bulkhead and riprap	187.0	0.12
Upland, No structures-erosional or unstable	879.6	0.55
Miscellaneous	121.4	0.07
Upland, No structures-stable or accretionary	631.9	0.39
Unstable marsh	6151.6	3.82
Stable marsh	25445.3	15.81

North River (Aerial Photo C)

From Lone Point to Ware Neck Point, this photograph shows types I, II, and XI cove, fringe, pocket, spit, and extensive marshes, dominated with cordgrass and black needlerush, high marsh meadow and saltbush.

Table 8c. Plate C - Shoreline Attributes North River

<u>Structure</u>	<u>Length(m)</u>	<u>Length(miles)</u>
Riprap	1431.1	0.89
Bulkhead	748.9	0.47
Breakwater	147.9	0.09
Groin field and riprap	253.7	0.16
Bulkhead and riprap	964.9	0.60
No structures-erosional or unstable	769.5	0.48
Miscellaneous	244.0	0.15
No structures-stable or accretionary	734.5	0.46
Unstable marsh	7079.1	4.40
Stable marsh	21027.0	13.06




Scale



Feet

Legend

Class_Names	Area
 tidal marsh	123.03

TIDAL MARSHES Gloucester County VA

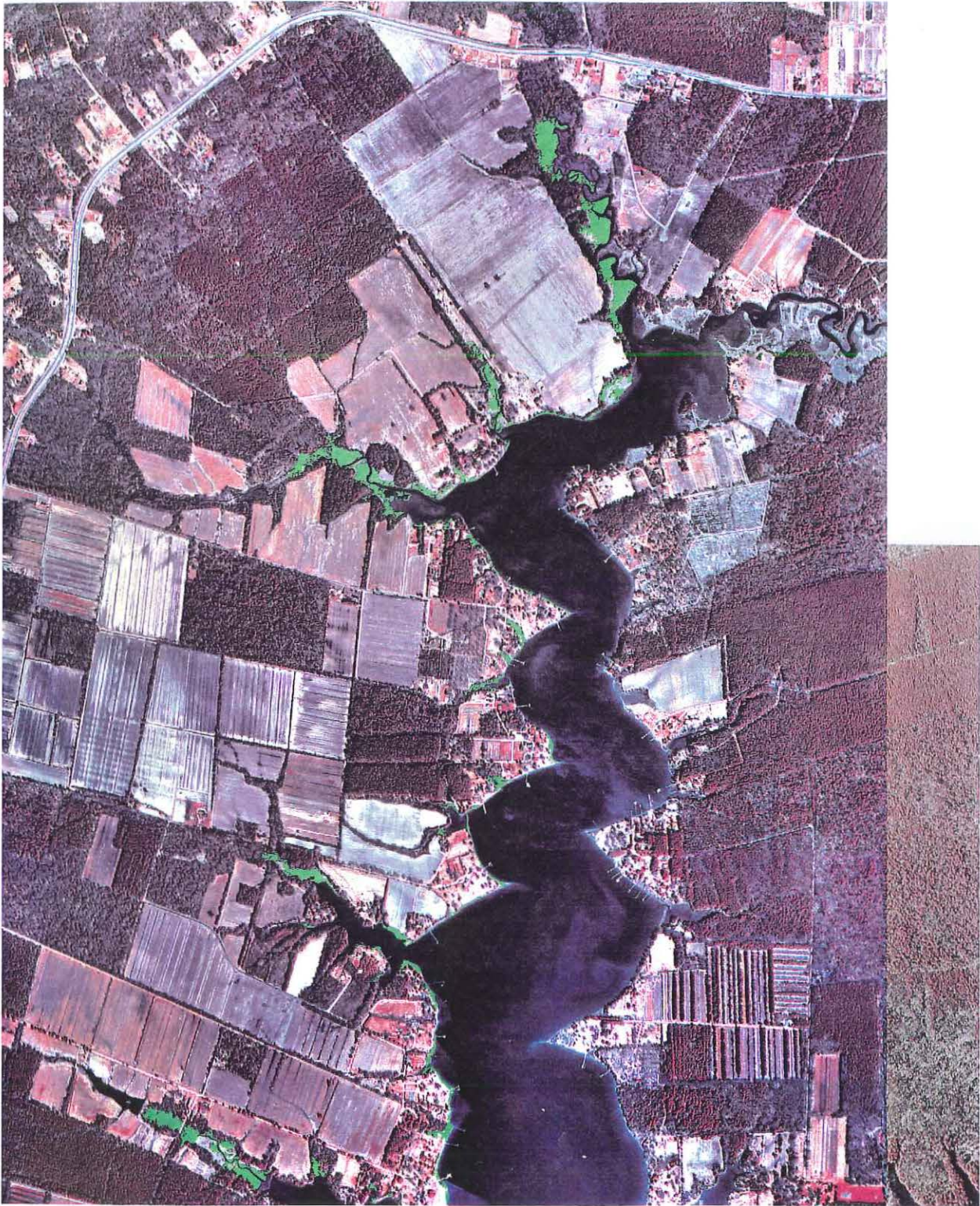
NORTH RIVER



Compiled from NAPP photos
 Index No: 7686-26 7686-27
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Comprehensive Coastal Inventory






Scale



1 : 24000

 tidal marsh

TIDAL MARSHES Gloucester County VA

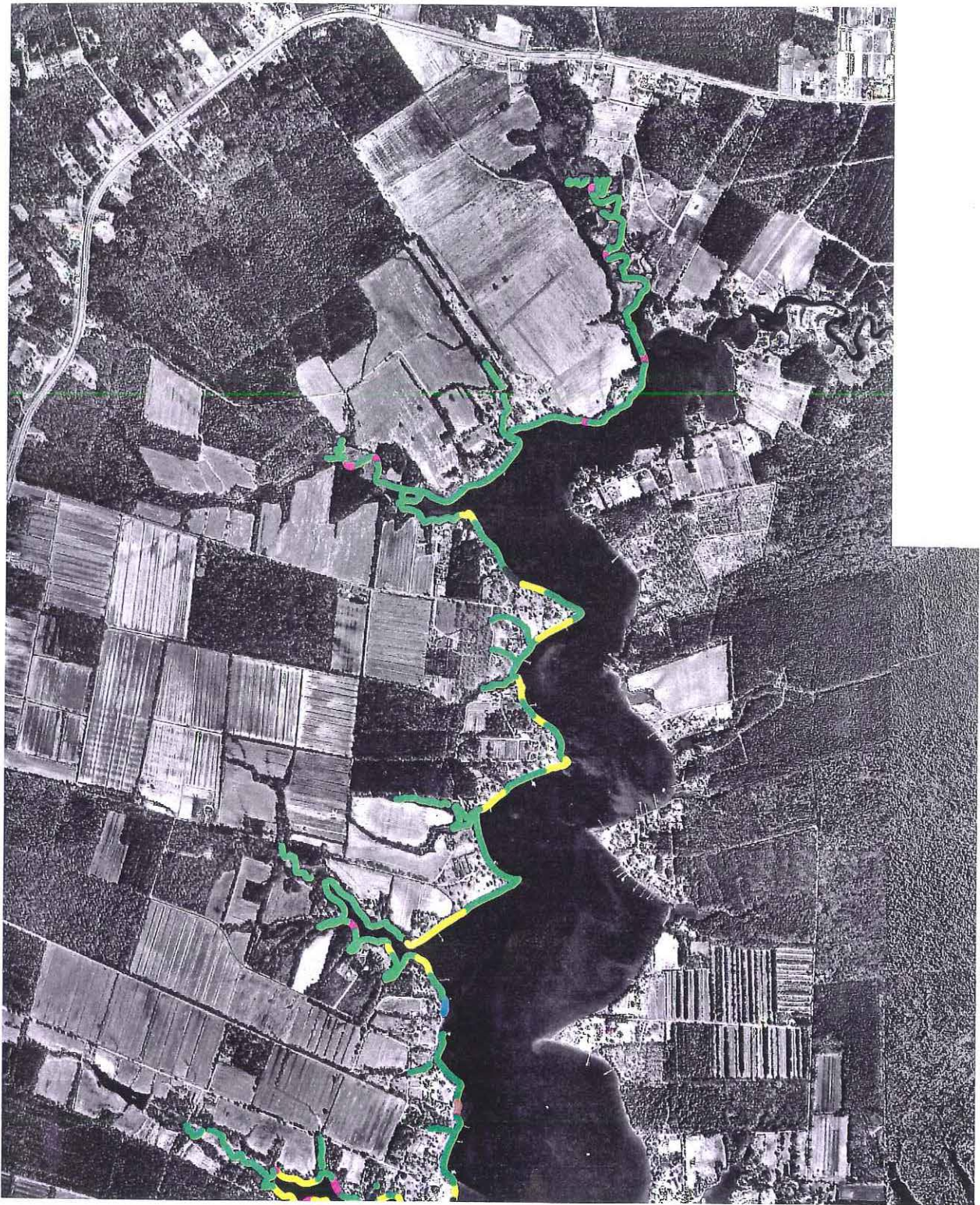
NORTH RIVER (A)



Compiled from NAPP photos
Index No: 7686-26 7686-27 7688-164
Dated: 3/94

Comprehensive Coastal Inventory





Legend

- | | | | |
|---|-------------------------|---|---------------------------------|
|  | Riprap |  | Groinfield, Bulkhead and Riprap |
|  | Bulkhead |  | Bulkhead and Riprap |
|  | Jetty |  | Upland, No structures, Unstable |
|  | Groins |  | Miscellaneous |
|  | Breakwaters |  | Upland, No structures, Stable |
|  | Groinfield and Bulkhead |  | Marsh, Unstable |
|  | Groinfield and Riprap |  | Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

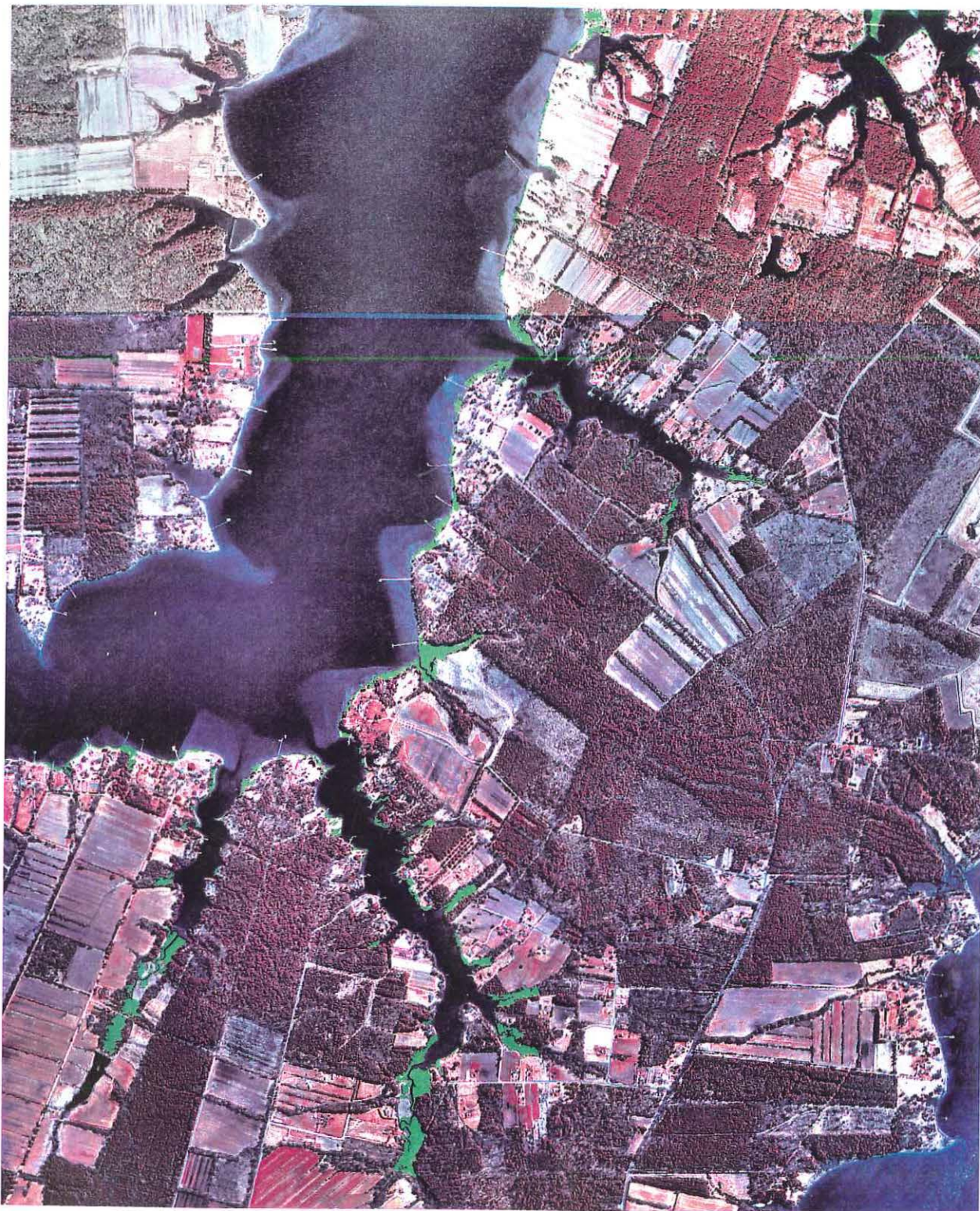
NORTH RIVER (A)

1:24000



Comprehensive Coastal Inventory





Scale



1 : 24000

■ tidal marsh



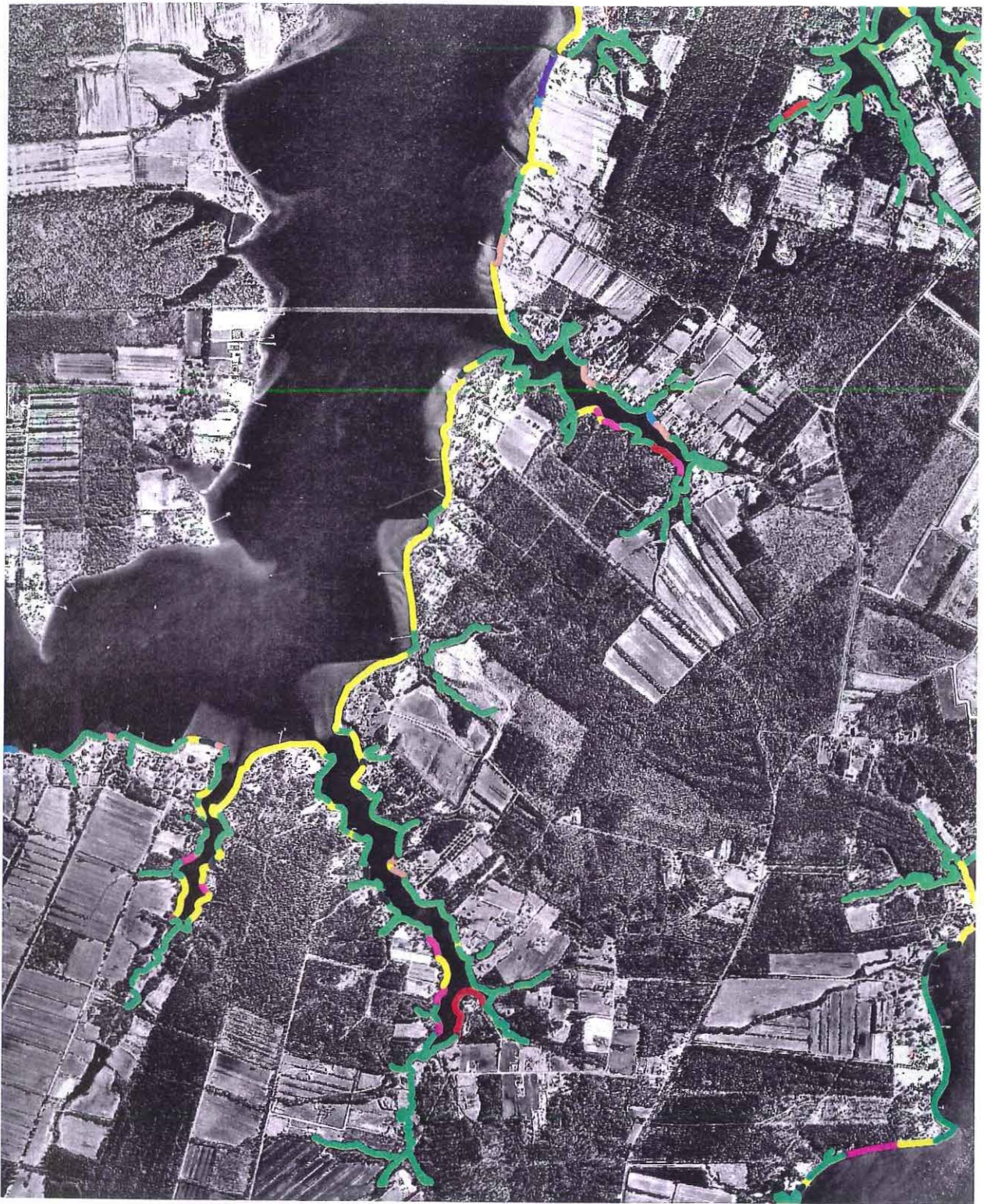
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TIDAL MARSHES Gloucester County VA

NORTH RIVER (B)

Comprehensive Coastal Inventory





Legend

- | | | | |
|--|-------------------------|--|---------------------------------|
| | Riprap | | Groinfield, Bulkhead and Riprap |
| | Bulkhead | | Bulkhead and Riprap |
| | Jetty | | Upland, No structures, Unstable |
| | Groins | | Miscellaneous |
| | Breakwaters | | Upland, No structures, Stable |
| | Groinfield and Bulkhead | | Marsh, Unstable |
| | Groinfield and Riprap | | Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

NORTH RIVER (B)

1:24000



Comprehensive Coastal Inventory






Scale



1 : 24000

 tidal marsh



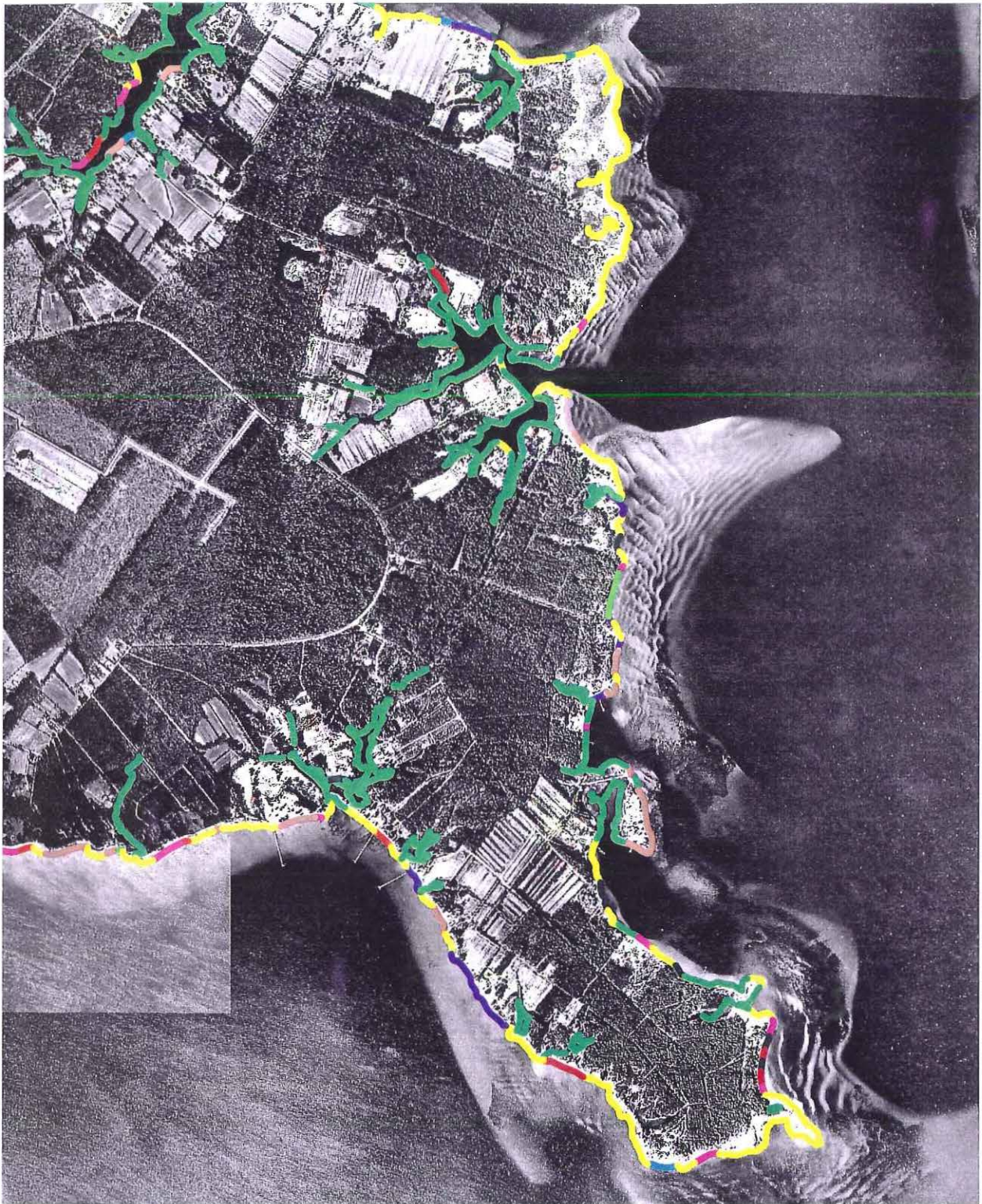
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Dated: 3/94

TIDAL MARSHES Gloucester County VA

NORTH RIVER (C)

Comprehensive Coastal Inventory





Legend

- | | |
|---|---|
|  Riprap |  Groinfield, Bulkhead and Riprap |
|  Bulkhead |  Bulkhead and Riprap |
|  Jetty |  Upland, No structures, Unstable |
|  Groins |  Miscellaneous |
|  Breakwaters |  Upland, No structures, Stable |
|  Groinfield and Bulkhead |  Marsh, Unstable |
|  Groinfield and Riprap |  Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

NORTH RIVER (C)

1:24000



Comprehensive Coastal Inventory



Piankatank River

The Piankatank River marks the northern border of Gloucester County. Only a portion of the Piankatank River is located within the county of Gloucester. The southern shore of the upper portion of the river actually forms the northern limit of the county. The lower portion of the river is located within the counties of Mathews and Middlesex. These areas are not covered in this inventory.

The marsh species found within the wetlands of this section vary with distance upstream. The downstream marshes are dominated by brackish water plants which include saltmarsh cordgrass, saltmeadow hay, saltgrass, big cordgrass, black needlerush, and saltbush. The most upstream marshes have reduced salinity, and are dominated by freshwater plant species including wild rice, pickerelweed, softstem bulrush, and smartweeds. The only other area of Gloucester County where these types of vegetation communities are found is on the Poropotank River.

The upper portion of the Piankatank River eventually grades into the woody swamp known as "Dragon's Run". Tidal influence is evident past the upper limits of the open freshwater marsh. The extent of this tidal effect is determined to some extent by the season and local weather.

The shoreline of the Gloucester portion of the Piankatank measures approximately 59 km (36.6 miles) in length. Ninety three percent, or 55 km (34.1 miles) remain in a natural state, excluding the presence or absence of piers, which were not surveyed. Much of this is classified as stable. Intermittent construction of shoreline defense structures is much more notable along the stretch between Harpers Creek and Dancing Creek. Tables 9a-9c document the longshore lengths of shoreline attributes characterized.

Piankatank River (Aerial Photo A)

The headwaters of the Piankatank River include creek-marsh, cove, extensive, fringe, spit, and pocket marshes (types V, XI, and XII) dominated by freshwater plant species (type XI marsh). Previous surveys of vegetation show that these marsh communities contain mainly beggar ticks and wild rice, with smaller percentages of pickerelweed, saltmarsh cordgrass, water-hemp, smartweeds, jewel weed, tearthumb, marsh-fleabane, rice cut grass, softstem bulrush, arrowhead, water dock, yellow pond lily, and trace amounts of cattails, saltmarsh aster, royal fern, and spikerush. The downstream segment of the river shown in this photograph, near Carver's Creek, has plant communities of saltmarsh cordgrass and some big cordgrass, with the upstream areas of the creek-marshes changing to saltgrass, saltmeadow hay, saltmarsh bulrush, cattails, marsh hibiscus, water-hemp, saltbush, and switchgrass.

Table 9a. Plate A - Shoreline Attributes Piankatank River

<u>Structure</u>	<u>Length(m)</u>	<u>Length(miles)</u>
Riprap	648.7	4.03
Bulkhead	519.8	0.32
Upland, No structure-erosional or unstable	841.5	0.52
Upland, No structure-stable or accretionary	7934.9	4.93
Unstable marsh	2136.7	1.33
Stable marsh	21260.6	13.21

Piankatank River (Aerial Photo B)

This photo covers the portion of the river from Carver's Creek to Deep Point Landing. These are cove, spit, and pocket marsh systems (types IV, V, and XII) in which the lower elevations are dominated by saltmarsh cordgrass and some big cordgrass; upstream, at slightly higher elevation, it changes to saltgrass, saltmeadow hay, saltmarsh bulrush, cattails, marsh hibiscus, water-hemp, saltbush, and switchgrass.

Table 9b. Plate B - Shoreline Attributes Piankatank River

<u>Structure</u>	<u>Length(m)</u>	<u>Length(miles)</u>
Riprap	212.0	0.13
Bulkhead	1318.2	0.82
Groin field	52.8	0.03
Breakwater	119.7	0.07
No structures-erosional or unstable	2361.1	1.47
No structures-stable or accretionary	2004.7	1.25
Unstable marsh	1826.1	1.13
Stable marsh	5483.1	3.41

Piankatank River (Aerial Photo C)

Aerial Photo C, from Deep Point Landing to Dancing Creek, shows creek-marsh systems (types I, IV, and XII) dominated by saltmarsh cordgrass and some big cordgrass; upstream are saltgrass, saltmeadow hay, saltmarsh bulrush, cattails, marsh mallow, marsh hibiscus, water-hemp, saltbush, and saltmarsh aster. There are also some pocket marshes, fringing marshes and a spit marsh which are cordgrass dominated.


Table 9c. Plate C - Shoreline Attributes Piankatank River

<u>Structure</u>	<u>Length(m)</u>	<u>Length(miles)</u>
Riprap	699.3	0.43
Bulkhead	885.0	0.55
Groin field and bulkhead	45.4	0.03
Bulkhead and riprap	34.4	0.02
Upland, No structure-erosional or unstable	2851.2	1.77
Miscellaneous	263.7	0.16
Upland, No structure-stable or accretionary	4085.4	2.54
Unstable marsh	2719.0	1.69
Stable marsh	8887.7	5.52



Scale



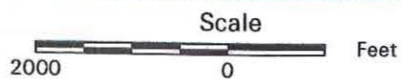
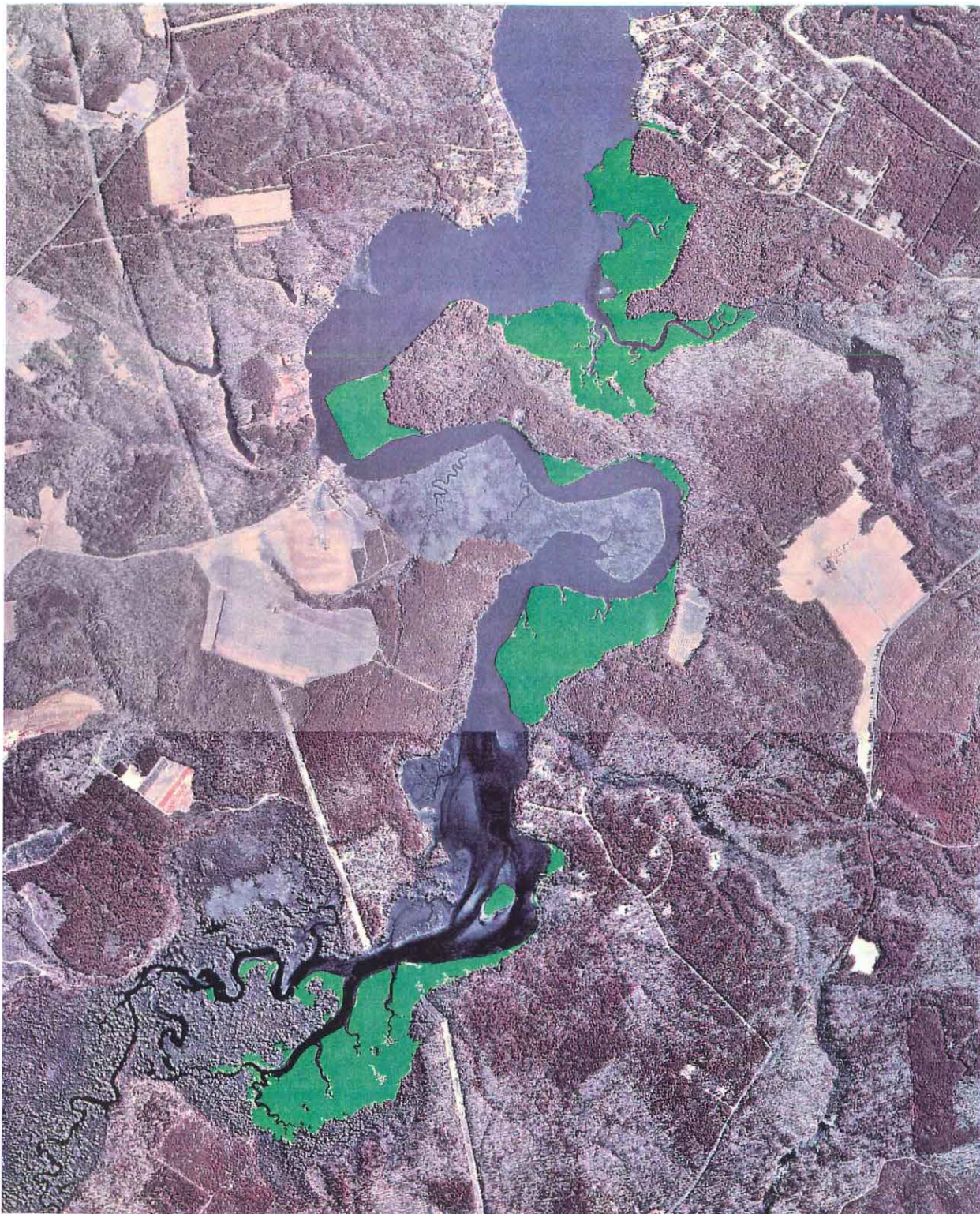
 = tidal marsh

TIDAL MARSHES Gloucester County VA


PIANKATANK RIVER



Compiled from NAPP photos
 Index No: 7683-86 7683-87 7686-29
 7686-30 7686-46
 Dated: 3/94



1 : 24000

 = tidal marsh

TIDAL MARSHES Gloucester County VA

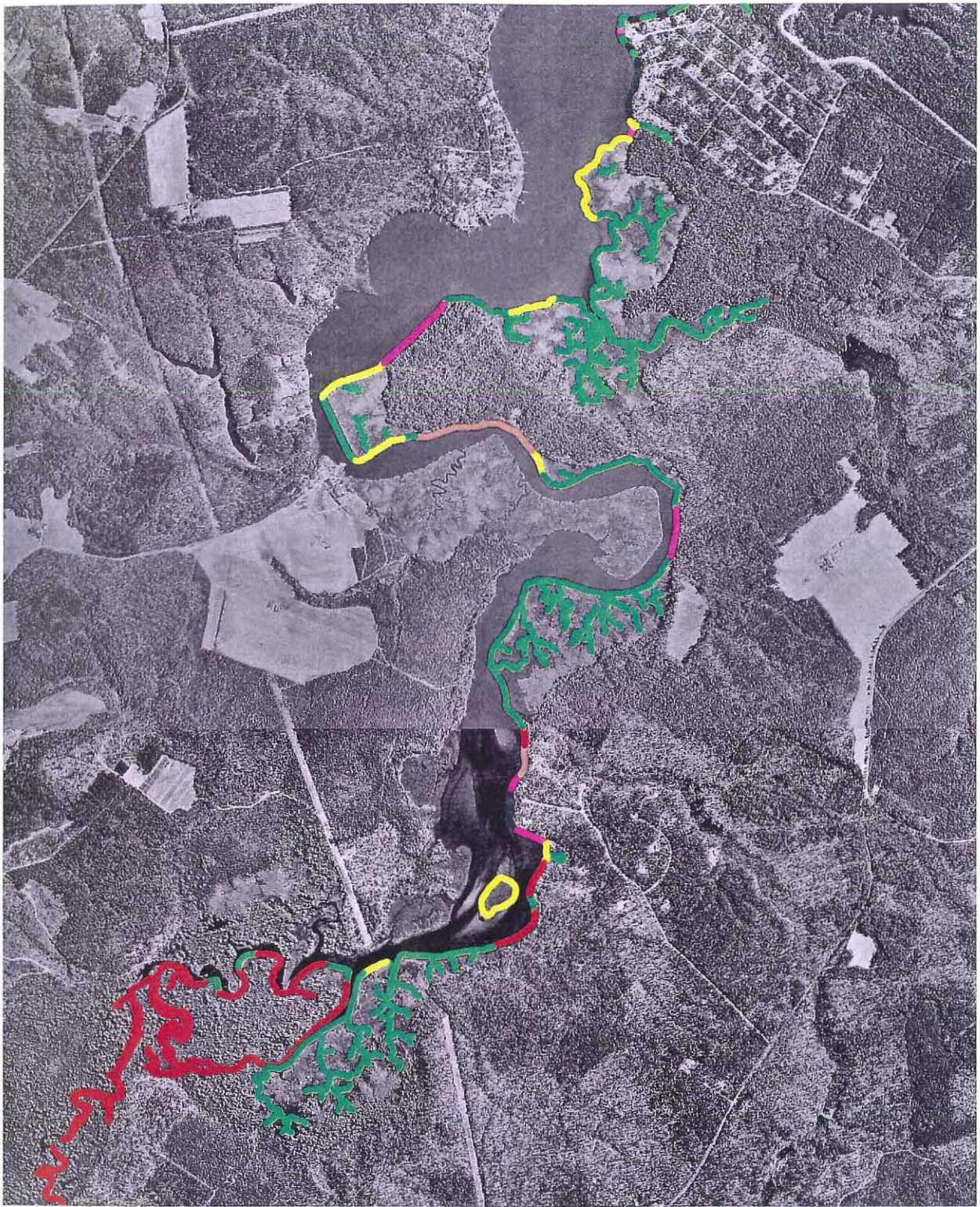
PIANKATANK RIVER (A)



Compiled from NAPP photos
Index No: 7683-87 7686-46
Dated: 3/94

Comprehensive Coastal Inventory





Legend

- | | |
|---|---|
|  Riprap |  Groinfield, Bulkhead and Riprap |
|  Bulkhead |  Bulkhead and Riprap |
|  Jetty |  Upland, No structures, Unstable |
|  Groins |  Miscellaneous |
|  Breakwaters |  Upland, No structures, Stable |
|  Groinfield and Bulkhead |  Marsh, Unstable |
|  Groinfield and Riprap |  Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

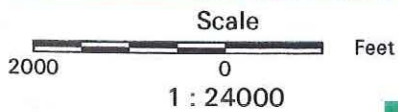
PIANKATANK RIVER (A)


1:24000



Comprehensive Coastal Inventory





 = tidal marsh

TIDAL MARSHES Gloucester County VA

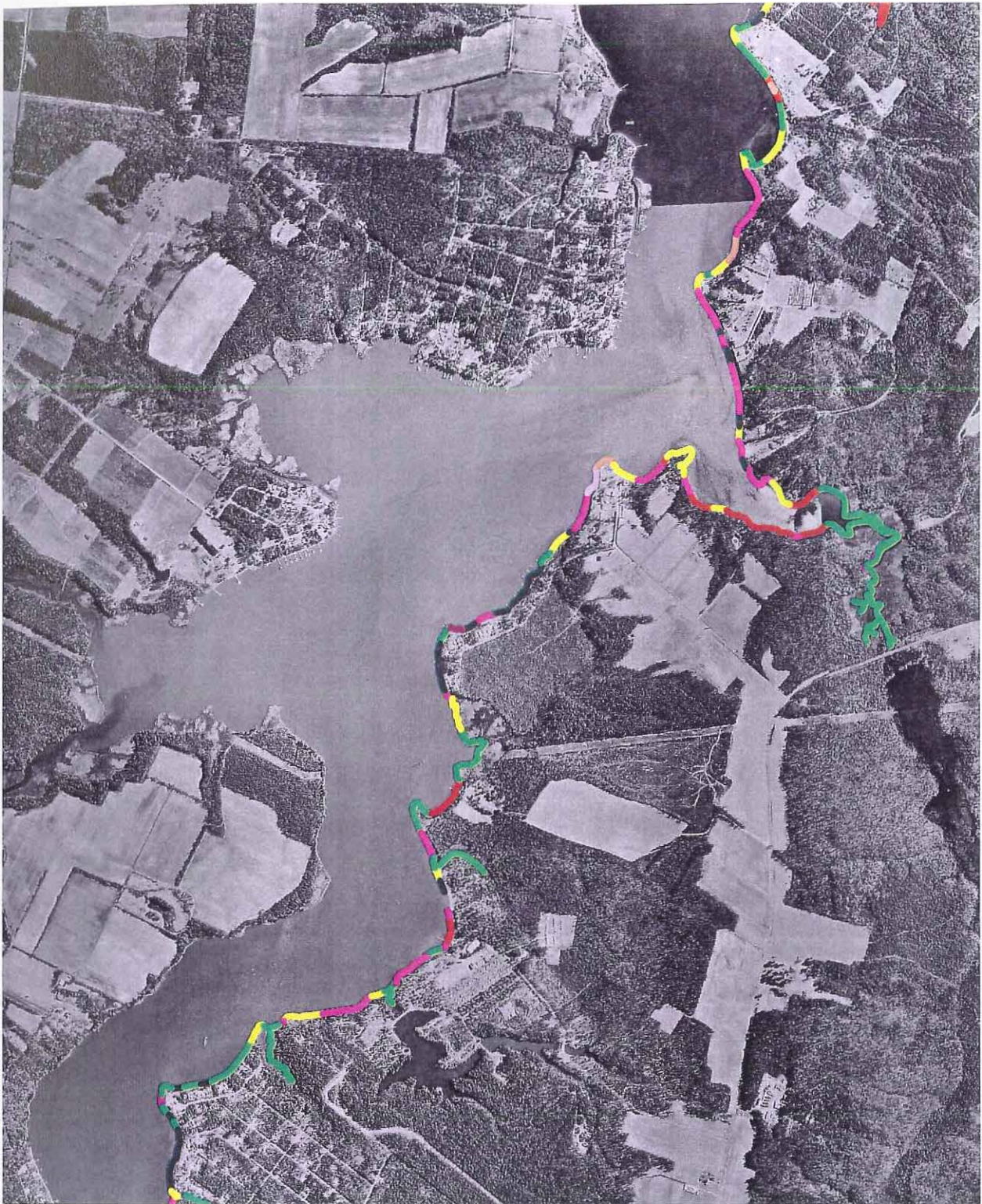
PIANKATANK RIVER (B)



Compiled from NAPP photos
Index No: 7683-86 7683-87 7686-30
Dated: 3/94

Comprehensive Coastal Inventory





Legend

- | | |
|---|---|
|  Riprap |  Groinfield, Bulkhead and Riprap |
|  Bulkhead |  Bulkhead and Riprap |
|  Jetty |  Upland, No structures, Unstable |
|  Groins |  Miscellaneous |
|  Breakwaters |  Upland, No structures, Stable |
|  Groinfield and Bulkhead |  Marsh, Unstable |
|  Groinfield and Riprap |  Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

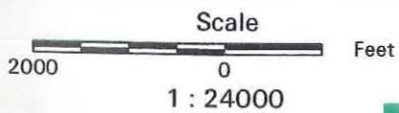
PIANKATANK RIVER (B)


1:24000



Comprehensive Coastal Inventory



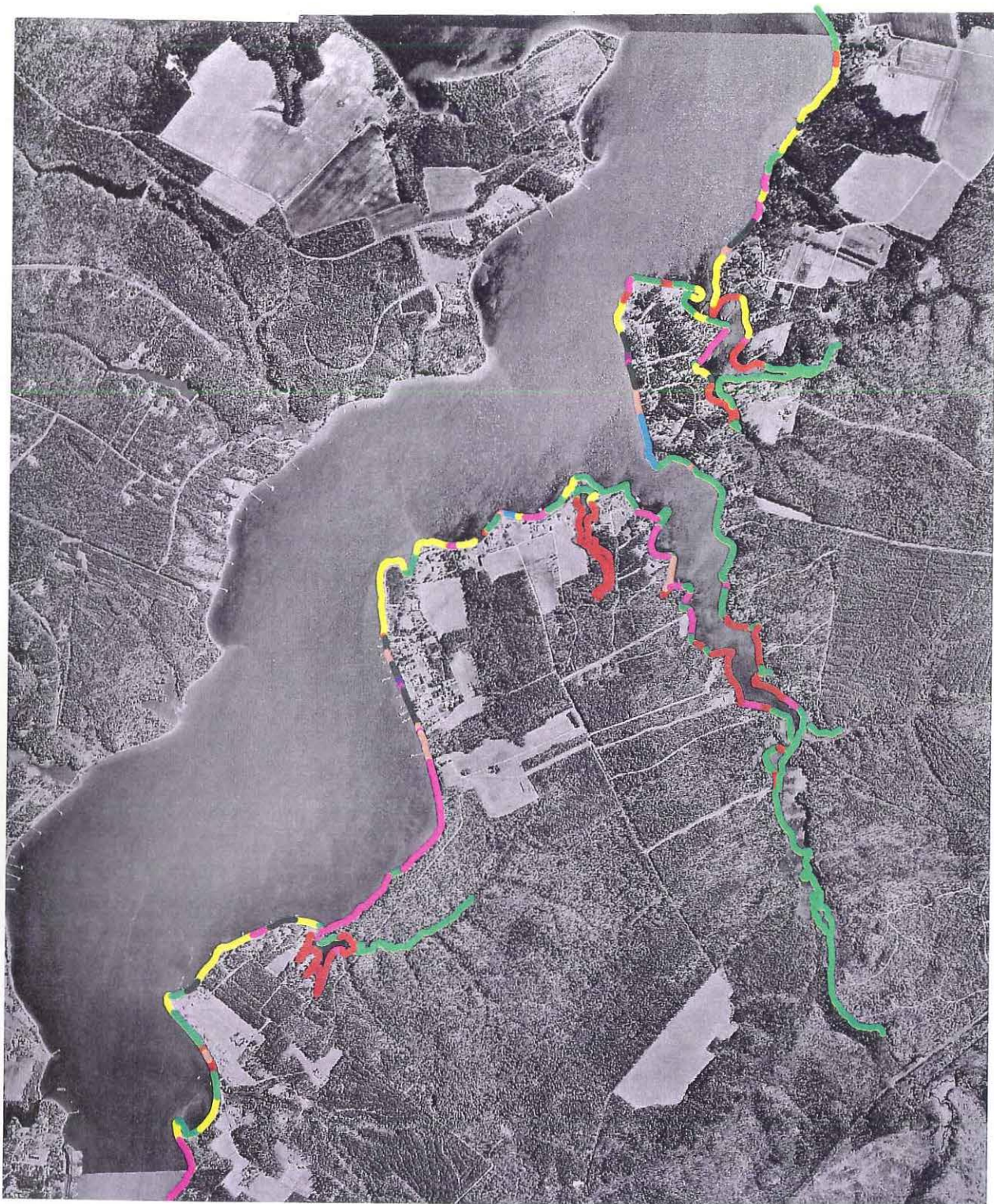


 = tidal marsh

TIDAL MARSHES Gloucester County VA PIANKATANK RIVER (C)



Compiled from NAPP photos
Index No: 7683-87 7686-29 7686-30
Dated: 3/94



Legend

- | | |
|---|---|
|  Riprap |  Groinfield, Bulkhead and Riprap |
|  Bulkhead |  Bulkhead and Riprap |
|  Jetty |  Upland, No structures, Unstable |
|  Groins |  Miscellaneous |
|  Breakwaters |  Upland, No structures, Stable |
|  Groinfield and Bulkhead |  Marsh, Unstable |
|  Groinfield and Riprap |  Marsh, Stable |

SHORELINE FEATURES Gloucester County VA

PIANKATANK RIVER (C)

1:24000



Comprehensive Coastal Inventory



Appendix 1

Marsh Types and Their Environmental Contributions

Type I Saltmarsh Cordgrass Community

- a. Average yield 4 tons per acre per annum. (Optimum growth 10 tons per acre.)
- b. Optimum availability of detritus to the marine environment.
- c. Roots and rhizomes eaten by waterfowl and stems used in muskrat lodge construction. Also serves as nesting material for various birds.
- d. Deterrent to shoreline erosion.
- e. Serves as sediment trap and assimilates flood waters.

Type II Saltmeadow Community

- a. 1 - 3 tons per acre per annum.
- b. Food (seeds) and nesting area for birds.
- c. Effective erosion deterrent.
- d. Assimilates flood waters.
- e. Filters sediments and waste material.

Type III Black Needlerush Community

- a. 3 - 5 tons per acre per annum.
- b. Highly resistant to erosion.
- c. Traps suspended sediments but not as effective as Type II.
- d. Somewhat effective in absorbing flood waters.

Type IV Saltbush Community

- a. 2 tons per acre per annum.
- b. Nesting area for small birds and habitat for a variety of wildlife.
- c. Effective trap for flotsam.

Type V Big Cordgrass Community

- a. 3 - 6 tons per acre per annum.
- b. Detritus less available than from Type I.
- c. Habitat for small animals and used for muskrat lodges.
- d. Effective erosion buffer.
- e. Flood water assimilation.

Type VI Cattail Community

- a. 2 - 4 tons per acre per annum.
- b. Habitat for birds and utilized by muskrats.
- c. Traps upland sediments.

Type VII Pickerelweed Community

- a. 2 - 4 tons per acre per annum.
- b. Detritus readily available to marine environment.
- c. Seeds eaten by wood ducks.
- d. Susceptible to erosion from wave action and boat wakes, particularly in winter.

Type VII

Reed Grass Community

- a. 4 - 6 tons per acre per annum.
- b. Little value to wildlife except for cover.
- c. Invades marshes and competes with more desirable species.
- d. Deters erosion on disturbed sites.

Type IX

Yellow Pond Lily Community

- a. Less than 1 ton per acre per annum.
- b. Cover and attachment sites for aquatic animals and algae.
- c. Feeding territory for fish.

Type X

Saltwort Community

- a. Less than 0.5 tons per acre per annum.
- b. Little value to aquatic or marsh animals.

Type XI

Freshwater Mixed Community

- a. 3 - 5 tons per acre per annum.
- b. High diversity of wildlife.
- c. High diversity of wildlife foods.
- d. Often associated with fish spawning and nursery grounds.
- e. Ranks high as a sediment trap and nursery grounds.

Type XII

Brackish Water Mixed Community

- a. 3 - 4 tons per acre per annum.
- b. Wide variety of wildlife foods and habitat.
- c. Deterrent to shoreline erosion.
- d. Serves as sediment trap and assimilates flood waters.
- e. Known spawning and nursery grounds for fish.

Appendix 2

Descriptive Marsh Terms

Cove marsh: a marsh contained within a concavity or recessed area on a shoreline. The vegetation is usually found surrounding a central open-water pond with tidal flushing permitted through the inlet.

Creek marsh: a marsh occupying a drowned creek valley. In many large creek marshes the salinity decreases headward. Plant community changes occur may along its length.

Delta marsh: a marsh found on sediment deposited at the mouth of a tidal creek. Tidal exchange through the creek mouth is usually restricted to narrow channels by the marsh.

Extensive marsh: a large marsh where the length and depth or width are roughly comparable. Most extensive marshes are drained by many tidal channels and creeks which have little freshwater input.

Fringe marsh: a marsh which borders along a section of shoreline and generally has a much greater length than width or depth.

High marsh: the marsh surface is at an elevation of mean high water or above. It is usually inundated less than twice daily by tidal action.

Low marsh: the marsh surface is at an elevation below mean high water and is usually inundated twice daily by tidal action.

Marsh island: an isolated marsh surrounded on all sides by open water. Interior portions of the marsh may contain trees scattered at highest elevations.

Pocket marsh: a marsh contained within a small, semi-circular area on a shoreline.

Spit marsh: a marsh which extends from the uplands in the form of a point or spit; its development is usually influenced by tidal currents that form a sand berm behind which the marsh forms.

Descriptive Shoreline Attribute Terms

Riprap - Generally composed of large rock to withstand wave energy, riprap revetments are constructed along shores to protect eroding fastland. Revetments today are preferred over bulkhead construction. They reduce wave reflection which causes scouring at the base of the structure, and are known to provide some habitat for aquatic and terrestrial species. Most revetments are constructed with a fine mesh cloth placed between the ground and the rock. The filter cloth permits water to permeate through, but not allow sediment behind the cloth to be removed, which would cause the rock to settle. Revetments can be massive structures, extending along extensive stretches of shore, and up well graded banks. They can also, however, be short structures which are placed at the base of a failing bulkhead or eroding marsh to offer protection at the base. These structures are known as "toe protection" or sometimes "marsh toe revetments" depending on their use. This inventory does not distinguish among the various types of revetments found. However, in a number of cases, riprap is found in combination with bulkheads or miscellaneous material. In these cases, many times the revetment has been constructed for this very purpose.

Bulkhead - Bulkheads are traditionally treated wooden or steel "walls" constructed to offer protection from waves attack. More recently, plastics are now being used as a substitute. Bulkheads are vertical structures generally constructed slightly seaward of the problem area and backfilled with suitable fill material. They function like a retaining wall, as they are designed to retain upland soil from impinging waves. Bulkheads are found in all types of environments, but they generally perform best in low to moderate energy conditions. In high energy situations, the erosive power of reflecting waves off the bulkhead can scour material from the base, and cause eventual failure of the structure. Bulkheads are mapped as linear features running alongshore.

Jetty - Jetties are often confused with groins, but they perform very different functions. Jetties are designed to keep the longshore sediment load from entering an area. They are typically found at the entrance to navigation channels and waterways. Constructed perpendicular to the shore, they trap sediment on the updrift side of the structure (like a groin), and prevent deposition in the inlet. Often small recreational beaches may form in these areas. Jetties can be constructed of timbers or can be massive rock structures depending on the location and need. As a secondary effect, jetties stabilize the bank along the inlet entrance.

Groinfield - Groins are low profile timber structures that sit perpendicular to the shore. They are generally positioned at or slightly above the mean low water line. Groins are constructed in a series known as a groin field which may extend along a stretch of shoreline for some distance. The purpose of a groin is to trap sediment moving along shore in the littoral current. Sediment is deposited on the updrift side of the structure and can, if enough sediment is available in the system, accrete a small beach area. Groin fields, however, can starve property downdrift of littoral sediments, and accelerate erosion there. The concept of the low profile groin was intended to allow some sediment to pass over the structure during intermediate and high tide stages. Some groin fields are immediately nourished with beach fill material when constructed. This approach does not diminish the supply of sediment available downdrift, and offers immediate protection to the fastland behind the groin field. This survey does not map individual

groins in a groin field. Rather, the line feature represents the linear extent along the shore encompassed by a field of groins.

Breakwater - Like groins, breakwaters generally occur in a series along the shore. In contrast, though, breakwaters are structures which sit parallel to the shore. Their purpose is to attenuate incoming wave energy, and maintain a healthy beach behind the structure. The position of the breakwater offshore, the number of breakwaters in a series, and their length depends on the size of the beach which must be maintained for shoreline protection. Most breakwater systems sit with the top at or near MHW and are partially exposed during low water. Breakwaters can be composed of a variety of materials. Popular today are rock breakwaters, or breakwaters constructed of gabion baskets filled with stone. In this survey, individual breakwaters are not mapped. Instead, the survey depicts the extent along the shore where the breakwater series is located.

Groinfield/Bulkhead - In their independent descriptions above, these two structures are performing very different functions even when occurring together at a site. Bulkheads are defensive structures which protect the fastland; groin fields are offensive structures and are present to trap and retain sediment for beach development. Since bulkheads prevent sediment from entering the system through bank protection, beaches tend to be very narrow or absent along reaches with extensive bulkheading. Property owners may construct groin fields in the nearshore zone to trap sediment which is transported in the littoral drift. The map compositions illustrate the combined presence of these two structures as one color coded line segment parallel to the shore.

Groinfield/Riprap - It is possible to find stretches of shore where property owners have constructed riprap to protect the bank, and groin fields to trap sediment. These are mapped as color coded linear features parallel to the shoreline.

Groinfield/Bulkhead/and Riprap - On rare occasions, a combination of these three structures make be present along a stretch of shoreline. The bulkhead offers protection from erosion of the bank or fastland. If it fails, a property owner might be more likely to install a riprap revetment in front of the failed structure. The groins act offensively to trap any sediment transported downdrift in littoral currents.

Bulkhead/Riprap - Bulkheads can be found in conjunction with riprap, particularly when failure of the bulkhead wall has occurred. Both structures perform the same basic function. Use of bulkheading preceded riprap construction. Today, however, riprap is preferred. Therefore, when bulkheads fail, riprap may be constructed in front of, or in place of the failed structure.

Upland, No Structure-Unstable - These linear stretches of shoreline represent places where no defense (or offensive) structures have been constructed for any purpose. These shores exclude marsh fronted shoreline which are listed separately (marsh, unstable) below. They include shorelines with beaches or those where the fastland bank has no buffer to wave action. without. They are classified as "unstable" because some appreciable amount of undercutting, scarps, or slumping was observed, to suggest the shore is in a state of erosion or instability.

Miscellaneous - It is possible to find miscellaneous material deposited along a shore to help stabilize an eroding bank. Tires, concrete block, and railroad ties are a few examples of what constitutes a miscellaneous linear feature.

Upland, No Structures-Stable - Stretches of shoreline which remain unaltered by protection structures and appear to be stable are characterized as "No Structures-Stable". This excludes areas which are buffered by marshes. Stability is an observed phenomenon in this case. Shoreline considered stable are those where there is no signs of undercutting by waves, no slumping along the bank, or no scarps along the shore edge.

Marsh, Unstable- These shorelines have either fringe, embayed, or extensive cove marshes which act as a buffer to wave energy. They are classified as unstable if the marsh edge exhibits undercutting, slumping or scarps.

Marsh, Stable - These shorelines have either fringe, embayed or extensive cove marshes which serve to buffer wave energy. They are classified as stable because no signs of erosion are detected.