Accomack County Shoreline Situation Report

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Supported By:
The Virginia Institute of Marine Science,
Comprehensive Coastal Inventory Program, and
the United States Environmental Protection Agency

Special Report in Applied Marine Science and Ocean Engineering
SRAMSOE No.374
April, 2002

Comprehensive Coastal Inventory
Center for Coastal Resources Management
Virginia Institute of Marine Science

William & Mary
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Accomack County

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Supported by the Virginia Institute of Marine Science, Comprehensive Coastal Inventory Program and the United States Environmental Protection Agency (assistance number CD-983204-01).

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Special Report in Applied Marine Science and Ocean Engineering No. 374 of the Virginia Institute of Marine Science

April, 2002

Cover Design by Harold Burrell

CHAPTER I - Introduction

1.1 Background

In the 1970s, the Virginia Institute of Marine Science (VIMS) received a grant through the National Science Foundation's Research Applied to National Needs Program to develop a series of reports which would describe the condition of tidal shorelines in the Commonwealth of Virginia. These reports became known as the Shoreline Situation Reports. They were published on a county by county basis with additional resources provided by the National Oceanic and Atmospheric Administration's Office of Coastal Zone Management (Hobbs et.al., 1975).

The Shoreline Situation Reports quickly became a common desktop reference for nearly all shoreline managers, regulators, and planners within the Tidewater region. They provided useful information to address the common management questions and dilemmas of the time. Despite their age, these reports remain a desk top reference.

The Comprehensive Coastal Inventory Program (CCI) is committed to developing a revised series of Shoreline Situation Reports which address the management questions of today. The series reports shoreline conditions on a county by county basis. New techniques integrate a combination of Geographic Information Systems (GIS), Global Positioning System (GPS) and remote sensing technology. Reports are distributed in hardcopy. The digital GIS coverages developed for the report are available on the web at *www.vims.edu/ccrm/gis/gisdata.html* . CCI is exploring techniques for serving the publications online. Those interested should check the CCI web site periodically at *www.vims.edu/ccrm/publications.html.*

1.2 Description of the Locality

Accomack County is approximately 476 square miles of land area, with 126 square miles of major surface water (Figure 1). The county is the northern locality on Virginia's Eastern Shore. The south end borders Northampton County, while the northern border forms the boundary between Virginia and Maryland. The county has shoreline on both the Chesapeake Bay and the Atlantic Ocean. The bay side is characterized by a number of tributaries which drain into the bay. Tributaries on the seaside discharge into a vast back barrier system formed between the mainland and the extensive network of barrier islands, which the Eastern Shore is noted for. Major tributaries discharging into the Bay include Occohannock, Craddock, Nadua, Pungoteague, Onancock, and Pocomoke. Smaller tributaries include Chesconessex, Deep Creek, Doe Creek, Hunting Creek, Guilford Creek, Muddy Creek, Catail Creek, and Messongo Creek. Within the bay, the marsh complexes south of Smith Island, and the islands of Tangier, Fishbone, and Goose also falls within the jurisdictional boundary of Accomack County. These islands were not surveyed as part of this study.

On the seaside, the Machipongo River, Folly Creek, Whites Creek, Gargathy Creek, Assawoman Creek, and Mosquito Creek are perhaps the most significant. The seaside of Accomack County includes an intricate network of bays and tidal marsh systems which link the fastland with the barrier islands seaward of the lagoon. There are six major islands along the Atlantic: Chincoteague, Wallops, Assawoman, Metompkin, Cedar, and Parramore Islands. Many of these are privately owned by the Nature Conservancy and are preserved as wildlife refuges.

Accomack County is a rural agricultural community with a population density that has been declining over the years. Residential land use makes up less than 6% of the total land area. Cropland and forest cover dominate the county landscape at 36.8% and 42.5% cover, respectively (Accomack County Planning Planning Commission, 1997). While there is extensive linear footage of waterfront on both sides, waterfront communities are not well developed, and a significant portion of waterfront property is still undeveloped. Commercial enterprises in the county are limited. The poultry industry dominates here and continues to expand. Aquaculture is an important industry use of the waterfront and shallow water habitat.

Accomack County's most recent comprehensive plan was completed in 1997 (Accomack County Planning Commission, 1997). The plan recognizes several important considerations for future development. First, the issue of water supply and groundwater management. The majority of drinking water within the county is supplied through groundwater. The Eastern Shore is a designated Ground Water Management Area. The plan also recognizes the potential for water quality problems as a result of the agricultural practices on the landscape.

Tidal shoreline protection is recognized to constrain and guide development activities at the shore. Regulations established through the Clean Water Act, and the Chesapeake Bay Preservation Act are discussed in the Comprehensive Plan. An Overlay District has been established within which Resource Management and Resource Protection Areas are designated. (Accomack County Planning Commission, 1997).

1.3 Purpose and Goals

This shoreline inventory is developed as a tool for assessing conditions along the tidal shoreline in Accomack County. Field data were collected between April and May, 2000. Conditions are reported for three zones within the immediate riparian river area: riparian land use, bank and buffers, and the shoreline. A series of maps and tabular data are published to illustrate and quantify results of an extensive shoreline survey. On the bay side, the survey extends from the northern limit of Accomack County (south shore of the Pocomoke River) south to the border with Northampton County (north shore of the Occohannock River). While the inventories traditionally did not target the seaside rivers, several have been surveyed here. Staff of the Accomack County Planning Department helped identify which creeks on the seaside were high priorities. Ultimately, access and navigability determined which of these were surveyed (Figure 1).

1.4 Report Organization

This report is divided into several sections. Chapter 2 describes methods used to develop this inventory, along with conditions and attributes considered in the survey. Chapter 3 identifies potential applications for the data, with a focus on current management issues. From existing literature and the current survey, Chapter 4 reports the general state of the county's shoreline, and integrates a series of maps which illustrate current conditions.

1.5 Acknowledgments

This report has been funded by the U.S. Environmental Protection Agency, Region 3 (CD-983204-01), and the Comprehensive Coastal Inventory Program (CCI) with money appropriated by the General Assembly.

This work was completed entirely with staff support and management from the Virginia Institute of Marine Science's CCI Program. A host of individuals are acknowledged. In addition to those listed as preparers, the project directors would like to thank Dave Weiss of CCI, the VIMS Vessel Center, and the VIMS Publication Center for their support.

CHAPTER 2 - The Shoreline Assessment: Approach and Considerations

2.1 Introduction

The data inventory developed for the Shoreline Situation Report is based on a three-tiered shoreline assessment approach. This assessment characterizes conditions in the shorezone, which extends from a narrow portion of the riparian zone seaward to the shoreline.   This assessment approach was developed to use observations which could be made from a moving boat. To that end, the survey is a collection of descriptive measurements which characterize conditions. GPS units log location of conditions observed from a boat. No other field measurements are performed.

The three tiered shoreline assessment approach divides the shorezone into three regions: 1) the immediate riparian zone, evaluated for land use; 2) the bank, evaluated for height, stability, cover, and natural protection; and 3) the shoreline, describing the presence of shoreline structures for shore protection and recreational purposes. Each tier is described in detail below.

2.2 Assessment

2.2a) Riparian Land Use: Land use adjacent to the bank is classified into one of eight categories (Table 1). The categories provide a simple assessment of land use, and give rise to land management practices which could be anticipated. GPS is used to measure the linear extent along shore where the practice is observed. The width of this zone is not measured. Riparian forest buffers are considered the primary land use if the buffer width equals or exceeds 30 feet. This width is calculated from digital imagery as part of the quality control in data processing.

2.2b) Bank Condition: The bank extends off the fastland, and serves as an interface between the upland and the shore. It is a source of sediment and nutrient fluxes from the fastland, and bears many of the upland soil characteristics which determine water quality in receiving waters. Bank stability is important for several reasons. The bank protects the upland from wave energy during storm activity. The faster the bank erodes, the sooner the upland will be at risk. Bank erosion can contribute high sediment loads to the receiving waters. Stability of the bank depends on several factors: height, slope, sediment composition, vegetative cover, and the presence of buffers to absorb energy impact to the bank itself.

The bank assessment in this inventory addresses four major bank characteristics: bank height, bank cover, bank stability, and the presence of stable or unstable natural buffers at the bank toe (Table 2). Conditions are recorded continuously using GPS as the boat moves along the shoreline. The GPS log reflects any changes in conditions observed.

Bank height is described as a range, measured from the toe of the bank to the top. Bank cover is an assessment of the percent of either vegetative or structural cover in place on the bank face. Natural vegetation, as well as rip rap are considered as cover. The assessment is qualitative (Table 2). Bank stability characterizes the condition of the bank face. Banks which are undercut, have exposed root systems, down vegetation, or exhibit slumping of material qualify as a "high erosion." At the toe of the bank, natural marsh vegetation and/or beach material may be present. These features offer protection to the bank and enhance water quality. Their presence is noted in the field, and a general assessment (low erosion/high erosion) describes whether they are experiencing any erosion. Sediment composition and bank slope cannot be surveyed from a boat, and are not included.

A GPS operator observes shoreline conditions from a shoal draft boat.

Table 1. Tier One - Riparian Land Use Classes

Forest	stands greater than 18 feet / width greater than 30 feet
Scrub-shrub	stands less than 18 feet
Grass	includes grass fields, and pasture land
Agriculture	includes cropland
Residential	includes single or multi family dwellings
Commercial	includes small and moderate business operations, recreational facilities
Industrial	includes large industry and manufacturing operations
Bare	lot cleared to bare soil
Timbered	clear-cuts
Paved	areas where roads or parking areas are adjacent to the shore
Unknown	land use undetectable from the vessel

2.2c) Shoreline Features: Features added to the shoreline by property owners are recorded as a combination of points or lines. These features include defense structures, which are constructed to protect shorelines from erosion; offense structures, designed to accumulate sand in longshore transport; and recreational structures, built to enhance recreational use of the water. The location of these features along the shore are surveyed with a GPS unit. Linear features are surveyed without stopping the boat. Structures such as docks, and boat ramps are point features, and a static ten-second GPS observation is collected at the site. Table 3 summarizes shoreline features surveyed. Linear features are denoted with an "L" and point features are denoted by a "P." The glossary describes these features, and their functional utility along a shore.

2.3 Data Collection/Survey Techniques

Data collection is performed in the field, from a small, shoal draft vessel, navigating at slow speeds parallel to the shoreline. To the extent possible, surveys take place on a rising tide, allowing the boat to be as close to shore as possible. The field crew consists of a boat operator, and two data surveyors. The boat operator navigates the boat to follow the shoreline geometry. One surveyor collects information pertinent to land use and bank condition. The second surveyor logs information relevant to shoreline structures.

Data is logged using the handheld Trimble GeoExplorer GPS unit. GeoExplorers are accurate to within 4 inches of true position with extended observations, and differential correction. Both static and kinematic data collection is performed. Kinematic data collection is a collection technique where data is collected continuously along a pathway (in this case along the shoreline). GPS units are programmed to collect information at a rate sufficient to compute a position anywhere along the course. The shoreline data is collected at a rate of one observation every five seconds. Land use, bank condition, and linear shoreline structures are collected using this technique.

Static surveys pin-point fixed locations which occur at very short intervals. The boat actually stops to collect these data, and the boat operator must hold the boat against tidal current, and surface wind waves. Static surveys log 10 GPS observations at a rate of one observation per second at the fixed

Table 2. Tier 2 - Bank Conditions

Bank Attribute	Range	Description
bank height	0-5 ft	from the toe to the edge of the fastland
	5-10 ft	from the toe to the edge of the fastland
	10-30 ft	from the toe to the edge of the fastland
	>30 ft	from the toe to the edge of the fastland
bank stability	low erosion	minimal erosion on bank face or toe
	high erosion	includes slumping, scarps, exposed roots
	undercut	erosion at toe of bank
bank cover	bare	<25% cover; vegetation or structural cover
	partial	25-75% cover; vegetation or structural
	total	>75% cover; vegetation or structural
marsh buffer	no	no marsh vegetation along the bank toe
	yes	fringe or pocket marsh present at bank toe
marsh stability (if present)	low erosion	no obvious signs of erosion
	high erosion	marsh edge is eroding or vegetation loss
beach buffer	no	no sand beach present
	yes	sand beach present
beach stability (if present)	low erosion	accreting beach
	high erosion	eroding beach or non emergent at low tide

Table 3. Tier 3 - Shoreline Features

Feature	Feature Type	Comments
Control Structures		
riprap	L	
bulkhead	L	
breakwaters	L	first and last of a series is surveyed
groinfield	L	first and last of a series is surveyed
jetty	P	
miscellaneous	L	can include tires, rubble, tubes, etc.
Recreational Structures		
pier/wharf	P	includes private and public
boat ramp	P	distinguishes private vs. public landings
boat house	P	all covered structures, assumes a pier
marina	L	includes piers, bulkheads, wharfs

station. The GPS receiver uses an averaging technique to compute one position based on the10 static observations. Static surveys are used to position point features like piers, boat ramps, and boat houses.

Trimble GeoExplorer GPS receivers include a function that allows a user to pre-program the complete set of features they are surveying in a "data dictionary." The data dictionary prepared for this Shoreline Situation Report includes all features described in section 2.2. As features are observed in the field, surveyors use scroll down menus to continuously tag each geographic coordinate pair with a suite of characteristics which describe the shoreland's land use, bank condition, and shoreline features present. The survey, therefore, is a complete suite of geographically referenced shoreline data.

2.4 Data Processing

Data processing occurs in two parts. Part one processes the raw GPS field data, and converts the data to GIS coverages (section 2.4a). Part two corrects the GIS coverages to reflect true shoreline geometry (section 2.4b).

2.4a.) GPS Processing: Differential correction improves the accuracy of GPS data by including other A\"known" locations to refine geographic position. Any GPS base station within 124 miles of the field site can serve as one additional location. A base station operated by the National Geodetic Survey in Driver, Virginia was used for most of the data processing in Accomack County.

Differential correction is the first step to processing GPS data. Trimble's Pathfinder Office GPS software is used. The software processes time synchronized GPS signals from field data and the selected base station. Differential correction improves the position of the GPS field data based on the known location of the base station, the satellites, and the satellite geometry. When Selective Availability was turned off in late Spring, 2000, the need to post process data has nearly been eliminated for the level of accuracy being sought in this project.

Although the Trimble GeoExplorers are capable of decimeter accuracy (~ 4 inches), the short occupation of sites in the field reduces the accuracy to 5 meters (~16 feet). In many cases the accuracy achieved is better, but the overall limits established by the CCI program are set at 5 meters. This means that features are registered to within 5 meters (~16 feet) (or better) of their true position on the earth's surface. In this case, positioning refers to the boat position during data collection.

A hand-held Trimble GeoExplorer logs field data observed from the boat.

An editing function is used to clean the GPS data. Cleaning corrects for breaks in the data which occur when satellite lock is lost during data collection. Editing also eliminates erroneous data collected when the boat circles off track, and the GPS unit is not switched to "pause" mode.

The final step in GPS processing converts the files to three separate ArcInfo GIS coverages. The three coverages are: a land use and bank condition coverage (acco_lubc), a shoreline structure coverage (lines only) (acco_sstruc), and a shoreline structure coverage (points only) (acco_astruc).

2.4b.) GIS Processing: GIS processing includes two major steps. Both use ESRI's ArcInfo® GIS software, and ERDAS' Imagine® software. Several data sets are integrated to develop the final inventory products. These include the shoreline situation data are derived from the GPS field data, and the three coverages discussed above. The attributes are summarized in Tables 1, 2, and 3. A digital shoreline is used as a digital basemap, and digital imagery provides a backdrop for quality control and image analysis. Digital Ortho Quarter Quadrangles (DOQQs) are fully rectified digital imagery representing one quarter of a USGS 7.5 minute quadrangle. They were released by USGS in 1997, and use imagery flown in 1994. This imagery is the basis for the development of the digital base shoreline, and all background imagery used during data processing and map production. They are an important quality control tool for verifying the location of certain landscape attributes, and provide users with additional information about the coastal landscape.

In step one, the basemap coverage is derived from a digitized record of the land water interface observed on 1994 DOQQs. Since existing shoreline coverages were considerably out of date and proved to be quite inaccurate, a new digital shoreline record was generated using photo-interpretation techniques and DOQQ imagery. While this process does not attempt to re-compute a shoreline position relative to a vertical tidal datum, it adjusts the horizontal geographic position to reflect the present shoreline geometry. Using ERDAS® Imagine software, the 1994 DOQQ imagery is displayed onscreen, and an operator digitizes the land water interface using photo-interpretation techniques. This new basemap does not represent a tidally corrected shoreline like other available datasets, however, the improved accuracy of the land water interface more than justifies the integration of this product for this project.

Step two in GIS processing corrects the coverages generated from the GPS field data to the shoreline record. These coverages, having been processed through GPS software, are geographically coincident with the path of the boat, from where observations are made. They are, therefore, located somewhere in the waterway. Step two transfers these data back to the corrected shoreline record so the data more precisely reflects the location being described along the shore.

The majority of data processing takes place in step two, which uses all three data sets simultaneously. The new shoreline record, and the processed GPS field data are displayed onscreen at the same time as ArcInfo coverages. The imagery is used in the background for reference. With the new shoreline as base coverage, the remaining processing re-codes the base shoreline attributes mapped along the boat track. Each time the boat track data (i.e GPS data) indicates a change in attribute type or condition, the digital shoreline arc is split, and coded appropriately for the attributes using ArcInfo techniques.

This step endures a rigorous sequence of checks to insure the positional translation is as accurate as possible. Each field coverage; land use, bank condition, and shoreline condition, is processed separately. The final products are three new coded shoreline coverages. Each coverage has been checked twice onscreen by different GIS personnel. A final review is done on draft hardcopy printouts.

2.4c.) Maps and Tables: Large format, color maps are generated to illustrate the attributes surveyed along the shore. A three-part map series has been designed to illustrate the three tiers individually. Plate A describes the riparian land use as color coded bars along the shore. A legend keys the color to the type of land use.

Plate B depicts the condition of the bank and any natural buffers present. Three lines, and a combination of color and pattern symbology gives rise to a vast amount of bank and natural buffer information. One line depicts bank cover (inland line), a second line illustrates bank height and stability (middle line), and a third line describes any natural buffers present (channelward line). Erosional conditions are illustrated in red for both bank and buffer. Stable or low erosion conditions are illustrated in green. Bank height varies with the thickness of the line; where the thickest lines designate the highest banks (> 30 feet). Bank cover is distinguished by colors. Bare banks (<25% cover) are illustrated in pale pink, partial cover (25-75%) is illustrated by a pale orange line, and total cover (>75%) is indicated by a pale blue line. Natural buffers, when present, are described by small circles parallel to the shore. Open circles just seaward of the line indicate a natural fringe marsh along the base of the bank. Solid circles indicate a sand beach buffer at the base of the bank. It is possible to have both. The length of the symbology along the shore reflects the length alongshore that the features persist. The symbology changes as conditions change.

Plate C combines recreational and shoreline protection structures in a composition called Shoreline Features. Linear features, described previously, are mapped using color coded bar symbols which follow the orientation of the shoreline. Point features use a combination of colors and symbols to plot the positions on the map.

DOQQ imagery are used as a backdrop, upon which all shoreline data are superimposed. The imagery was collected in 1994. The color infra red image is used as a backdrop to Plate A. A gray-scale version of this same image is used for Plates B and C.

For publication purposes the county is divided into a series of plates. Most plates are printed at a scale of 1:12,000. Plates 1, 11, and 17 are published at 1:24,000. The number of plates is determined by the geographic size and shape of Accomack County. An index is provided in Chapter 4 which illustrates the orientation of plates to each other. The county was divided into 46 plates (plate 1a, 1b, 1c, etc.), for a total of 138 map compositions.

Workboats on Guilford Creek.

Chapter 3. Applications for Management

3.1 Introduction

There are a number of different management applications for which the Shoreline Situation Reports (SSRs) support. This section discusses four of them which are currently high profile issues within the Commonwealth or Chesapeake Bay watershed. The SSRs are data reports, and do not necessarily provide interpretation beyond the characteristics of the nearshore landscape. However, the ability to interpret and integrate these data into other programs is key to gleaming the full benefits of the product. This chapter offers some examples for how data within the SSRs can be integrated and synthesized to support current state management programs.

3.2 Shoreline Management

The first uses for SSRs were to prepare decision makers to bring about well informed decisions regarding shoreline management. This need continues today, and perhaps with more urgency. In many areas, undisturbed shoreline miles are almost nonexistent. Development continues to encroach on remaining pristine reaches, and threatens the natural ecosystems which have prevailed. At the same time, the value of waterfront property has escalated, and the exigency to protect shorelines through stabilization has increased. Generally speaking, this has been an accepted management practice. However, protection of tidal shorelines does not occur without incidence.

Management decisions must consider the current state of the shoreline, and understand what actions and processes have occurred to bring the shoreline to its current state. This includes evaluating existing management practices, assessing shore stability in an area, and determining future uses of the shore. The SSRs provide data to perform these evaluations.

Plate A defines the land use adjacent to the shoreline. To the extent that land use directs the type of management practices found, these maps can predict shoreline strategies which may be expected in the future. Residential areas are prone to shoreline alterations. Commercial areas may require structures along the shore for their daily operations. Others frequently seek structural alternatives to address shoreline stability problems. Forested riparian zones, and large tracts of grass or agricultural areas are frequently unmanaged even if chronic erosion problems exist.

Stability at the shore is described in Plate B. The bank is characterized by its height, its state of erosion, and the presence or absence of natural buffers at the bank toe. Upland adjacent to high, stable banks with a stable natural buffer at the base are less prone to flooding or erosion problems resulting from storm activity. Upland adjacent to banks of lesser height (< 5feet) are at greater risk of flooding, but if banks are stable with marshes or beaches present, erosion may not be as significant a concern. Survey data reveals a strong correlation between banks of high erosion, and the absence of natural buffers. Conversely, the association between stable banks and the presence of marsh or beach is also well established. This suggests that natural buffers such as beaches and fringe marshes play an important role in bank protection. This is illustrated on the maps. Banks without natural buffers, yet classified as low erosion, are often structurally controlled with rip rap or bulkheads.

Plate C delineates structures installed along the shoreline. These include erosion control structures, and structures to enhance recreational use of the waterway. This map is particularly useful for evaluating requests from property owners seeking structural methods for controlling shoreline erosion problems. Shoreline managers can evaluate the current situation of the surrounding shore including: impacts of earlier structural decisions, proximity to structures on neighboring parcels, and the vicinity to undisturbed lots. Alternative methods such as vegetative control may be evaluated by assessing the energy or fetch environment from the images. Use this plate in combination with Plate B to evaluate the condition of the bank proposed for protection.

A close examination of shore conditions may suggest whether certain structural choices have been effective. Success of groin field and breakwater systems is confirmed when sediment accretion is observed. Low erosion conditions surveyed along segments with bulkheads and riprap indicate structures have controlled the erosion problem. The width of the shorezone, estimated from the background image, also speaks to the success of structures as a method of controlling erosion. A very narrow shorezone implies that as bulkheads or riprap have secured the erosion problem at the bank, they have also deflated the supply of sediment available to nourish a healthy beach. This is a typical shore response, and remains an unresolved management problem.

Shoreline managers are encouraged to use all three plates together when developing management strategies or making regulatory decisions. Each plate provides important information independent of the others, but collectively the plates become a more valuable management tool.

3.3 Non-Point Source Targeting

The identification of potential problem areas for non-point source pollution is a focal point of water quality improvement efforts throughout the Commonwealth. The three tiered approach provides a collection of data which, when combined, can allow for an assessment of potential non-point source pollution problems in a waterway.

Grass land and agricultural land, which includes pasture land and cropland, respectively, have the highest potential for nutrient runoff. These areas are also prone to high sediment loads since the adjacent banks are seldom restored when erosion problems persist. Residential, bare, and commercial land uses also have the potential to contribute to the non-point source pollution problem due to the types of practices which prevail, and large impervious surface areas.

The highest potential for non-point source pollution combines these land uses with “high” bank erosion conditions, bare or nearly bare bank cover, and no marsh buffer protection. The potential for non-point source pollution moderates as the condition of the bank changes from “high” bank erosion to “low” bank erosion, or with the presence or absence of stable marsh vegetation to function as a nutrient sink for runoff. Where defense structures occur in conjunction with “low” bank erosion, the structures are effectively controlling erosion at this time, and the potential for non-point source pollution is reduced. If the following characteristics are delineated: low bank erosion, stable marsh buffer, riprap or bulkhead; the potential for non-point source pollution from any land use class can be lowered.

At the other end of the spectrum, forested and scrub-shrub sites do not contribute significant amounts of non-point source pollution to the receiving waterway. Forest buffers, in particular, are noted for their ability to uptake nutrients running off the upland. Forested areas with stable or defended banks, a stable fringe marsh, and a beach would have the lowest potential as a source of non-point pollution. Scrub-shrub with similar bank and buffer characteristics would also be very low.

A quick search for potential non-point source sites would begin on Plate A. Identify the "grass" or "agricultural" areas. Locate these areas on Plate B, and find those which have eroding banks (in red) without any marsh protection. The hot spots are these sites where the banks are highest (thick red line), so the potential sediment volume introduced to the water is greatest. Finally check plate C to determine if any artificial stabilization to protect the bank has occurred. If these areas are without stabilizing structures, they indicate the hottest spots for the introduction of non-point source pollution.

3.4 Designating Areas of Concern (AOC) for Best Management Practice (BMP) Sites

Sediment load and nutrient management programs at the shore are largely based on installation of Best Management Practices (BMPs). Among other things, these practices include fencing to remove livestock from the water, installing erosion control structures, and bank re-vegetation programs. Installation of BMPs is costly. Cost share programs provide relief for property owners, but funds are scarce in comparison to the capacious number of waterway miles needing attention. Targeting Areas of Concern (AOC) can prioritize spending programs, and direct funds where most needed.

Data collected for the SSR can assist with targeting efforts for designating AOCs. AOCs can be areas where riparian buffers are fragmented, and could be restored. Use Plate A to identify forested upland. Breaks in the continuity of the riparian forest can be easily observed in the line segments, and background image. Land use between the breaks relates to potential opportunity for restoring the buffer where fragmentation has occurred. Agricultural tracts which breach forest buffers are more logical targets for restoration than developed residential or commercial stretches. Agricultural areas, therefore, offer the highest opportunity for conversion. Priority sites for riparian forest restoration should target forested tracts breached by "agriculture" or "grass" land (green-fuscia-green line pattern; green-blue-green line pattern, respectively).

Plate B can be used to identify sites for BMPs. Look for where "red" (i.e. eroding) bank conditions persist. The thickness of the line tells something about the bank height. The fetch, or the distance of exposure across the water, can offer some insight into the type of BMP which might be most appropriate. Re-vegetation may be difficult to establish at the toe of a bank with high exposure to wave conditions. Plate C should be checked for existing shoreline erosion structures in place.

Tippett et.al.(2000) used similar stream side assessment data to target areas for bank and riparian corridor restoration. These data followed a comparable three tier approach and combine data regarding land use and bank stability to define specific reaches along the stream bank where AOCs have been noted. Protocols for determining AOCs are based on the data collected in the field.

3.5 Targeting for Total Maximum Daily Load (TMDL) Modeling

As the TMDL program in Virginia evolves, the importance of shoreline erosion in the lower tidal tributaries will become evident. Total maximum daily loads are defined as a threshold value for a pollutant, which when exceeded, impedes the quality of water for specific uses (e.g. swimming, fishing). Among the pollutants to be considered are: fecal coliform, pathogens, nitrogen, phosphorous, and sediment load.

Messongo Creek.

Chapter 4. The Shoreline Situation

The shoreline situation is described for conditions in Accomack County along the bayside primary and secondary shoreline, selected seaside creeks, and Chincoteague Island. Characteristics are described for all navigable tidal waterways contiguous to these shorelines. A total of 882.53 miles of shoreline are described. Just over 193 miles were surveyed in the field. The majority of the shoreline (= 689 miles) is described using image interpretation techniques and ancillary data sources. These areas are mainly tidal creeks with restricted openings at the mouth, or headwater channels of secondary creeks without sufficient water depth to permit navigation. For remotely sensed areas, photo interpretation was made using DOQQs to detect land use, natural buffers, and shoreline structures where possible. Along these tidal channels, upland banks are assumed to be well protected by vegetation, and erosion low. It is possible, however, for these banks to experience undercutting from tidal currents. This could not be verified since field visits were not performed. Bank height conditions along reaches characterized using remote sensing techniques were estimated from USGS 1:24,000 topographic maps.

Virginia-Maryland border on the Pocomoke River.

Brief descriptions of the county are provided on the basis of river segments, the boundaries of which are geographically determined. These descriptions summarize tabular data (Tables 5 and 6) and notable features present. Three segments are defined. Segment 1 includes plates 1-37; all shoreline that drains into the Chesapeake Bay. Segment 2 includes plates 38-40 and 45-46. These represent the selected creeks surveyed along the seaside of Accomack County. Segment 3 describes plates 41- 44, for Chincoteague Island. An index preceding the map compositions illustrates the plate boundaries. Important documentation pertaining to each plate follows the segment description below.

Segment 1 (Plates 1-37)

Description: Segment 1 includes plates with rivers that drain into the Chesapeake Bay. The segment extends from the border with Maryland on the Pocomoke River, south to Occohannock Creek that divides Accomack from Northampton County. A total of 771.94 miles of shoreline is described. The majority of these shoreline miles (621.18 miles) constitute small tidal creeks and channels at the headwaters of creeks and around large marsh complexes. These miles were surveyed remotely. Winds from the west, northwest or southeast can generate the largest waves in this region.

Land Use: Sixty-four percent of the riparian area is scrub-shrub. The riparian area is restricted to the first 100 feet of upland immediately adjacent to the shore. The extensive scrub-shrub is not untypical along the inland margins of expansive marshes. Grass cover constitutes 21% of the remaining adjacent land use. These parcels characterize the rural residential landscape of the Eastern Shore. Some, however, may represent agricultural tracks, where farming practices could not be confirmed. In 4% of this segment, agriculture could be confirmed. The earlier Shoreline Situation Report for Accomack County evaluated roughly 195 miles of shore in this area (Hobbs et.al., 1975). They identify “unmanaged” land as the predominant fastland use. Scrub shrub would be considered unmanaged land under their classification. Agricultural use was nearly equal with unmanaged use in 1975. Since there are major discrepancies between these surveys, it is difficult to draw a conclusion regarding these land uses or land use change. However, a comparison of residential use suggests it has increased significantly from a mere 8.5 miles to more than 50 miles of shore. Again, the absolute numbers probably do not lend well to an accurate comparison, but the trends are probably realistic.

New bulkhead construction on Occanhannock Creek.

Sandy beach in Craddock Creek.

Bank Condition: Bank heights in segment one were observed between <5-30 feet. Nintey-seven percent of all bank heights along this segment are below 5 feet, and these are considered to be experiencing low erosion. Since a large component of these miles were surveyed remotely, several assumptions are made for these areas. First, USGS topographic maps were used to determine bank height at the shore. Therefore, the accuracy of these maps must be considered. Second, since most of these remote locations are along small tidal creeks, exposure to high wave energy is considered to be low, and therefore bank erosion minimal. This assumption does not, however, consider that tidal currents can be responsible for significant undercutting in these settings, so this assumption may not be accurate. Low bank erosion is often reflective of bank cover. Banks surveyed remotely were all assumed to be "total" cover. No banks exceeded a range of 10-30 feet. According to Hobbs et.al. (1975), flood hazard potential ranges between high to low, non-critical. Generally, the Bay shoreline and the lower reaches of larger creeks were designated a high potential for flooding, middle creek reaches as moderate, and upper reaches as low. Data collected from this survey indicates that a significant amount of shoreline at the upper reaches of creeks are at or below 5 feet. These areas, therefore, are prone to flooding during high water.

Shore Condition: While Segment one includes nearly 772 miles of surveyed shoreline, the 621 miles surveyed remotely does not survey erosion control structures. Private piers or boat houses can be included if detected in the imagery. The field survey, which covered more than 150 miles of shoreline, reveals 6 percent of this shore was bulkheaded, and 2 percent riprapped. There were 11 marina type facilities, which include community/workboat slips in addition to commercial facilities. Six public boat ramps were located, and 38 private ramps found. There are more than 550 private piers and 10 boathouses. Historic erosion rates for the Bay side of Accomack county were evaluated by Byrne and Anderson (1983). Rates range from 0.0 to 4.9 feet per year. The highest rates were found in the vicinity of Saxis (reach 46, Figure 2A).

Segment 2 (Plates 38-40; 45-46)

Description: Segment 2 includes several areas on the seaside of the county. The creeks were identified by county staff as important areas to survey. Folly, Gargathy, and Assawoman Creeks were surveyed in May, 2000. The mainland shoreline along the western shore of Chincoteague Bay is also part of this segment. These surveys were also conducted in May, 2000. Actual dates are reported in the plate descriptions found later in this chapter.

Most creeks along the seaside of Accomack county are afforded protection from wave activities due to an extensive back barrier lagoon system of marshes, islands, and tidal creeks. The entrances to Folly, Gargathy, and Assawoman Creeks are flanked by large intertidal marshes. While Chincoteague Bay can experience significant wave action from northly winds, Chincoteague and Assateague Islands offer major protection from northeast storms. Segment 2 covers 53.80 miles of shoreline. Twenty-seven miles were surveyed remotely due to shallow, non-navigable waters.

Land Use: Land use along the shoreline is dominated by unmanaged forest cover. Fifty-one percent of the land cover is forested. The remaining riparian upland is mixed among agriculture, residential, and scrub-shrub cover.

Bank Condition: Nearly all banks measured are at or below 5 feet in height. Erosion is low, and a minimum amount of undercutting was observed. This may be a function of tide level during surveys. High tide conditions, frequently required to maintain navigability, also mask the presence of undercutting at the bank toe. Also, erosion is assumed to be low along all remotely sensed stretches of shoreline. Fringe and embayed marshes offer protection as well to the bank, and perhaps better explains the stability of the banks observed. The presence of marsh vegetation was noted along 50.11 miles of shoreline (93%). Almost 15 miles of these marshes did show signs of erosion or undercutting. Thirty five miles of marsh appeared relatively stable. A total of 2.36 miles of sand beaches also offer protection for the banks.

Shore Condition: Fringe marshes occur along more than 50 miles of shore in this segment. Beaches were surveyed along only 2.36 miles of shoreline. A very small percent of the shore has erosion control structures like rip rap or bulkheads (2.42 miles). Eight breakwater sets and one groin field were found. Private access is gained via 66 piers, and approximately 2 private ramps. Seven public ramps were located. Historic erosion rates were not computed for the seaside of the Eastern Shore.

Segment 3 (Plates 41-44)

Description: Segment 3 describes conditions along the shoreline of Chincoteague Island. Unlike Assateague Island, afforded protection as a wildlife refuge, Chincoteague includes a small thriving community which boasts an active tourism industry during summer months. Infrastructure along the shore and within the immediate riparian area was surveyed to establish a basis for monitoring change and risk of coastal resources into the future. Shallow water at the nearshore, and wave conditions in Chincoteague Bay made surveying by boat difficult. The majority of the shoreline was surveyed using remote sensing techniques previously described. Along more developed and accessible shores (including 14.91 miles), surveys were performed by boat, on foot, and in a vehicle.

Land Use: Riparian land use is mixed around the island. Scrub-shrub dominates (25.32 miles) along undeveloped stretches adjacent to fringe marshes and along tidal channels. Residential land use accounts for 16.74 miles of the shoreline, nearly 31%. There are a number of commercial businesses along the shore, occupying almost 5 miles. Most of these businesses are related either to tourism or to the fishing industry. There are no industrial operations noted. Forest cover extends along 6.85 miles of the riparian zone. No agriculture was noted.

Old oyster flats on Chincoteague.

Shore Condition: Erosion control structures extend 8.01 miles along the Chincoteague Island shore. This figure applies to reaches surveyed in the field. Erosion control structures can not be observed using the imagery applied to remote sensing mapping. Therefore, it is conceivable that more structures like riprap or bulkheads are in place. Chincoteague has 4 areas classified as either marinas or community boat slips. Public access to the water can be gained from one of three public landings. Private piers number approximately 120. This does not include piers and slips associated with the marinas or community facilities.

Bank Condition: Bank heights along Chincoteague Island are all less than or equal to 5 feet. Remotely sensed areas use USGS topographic maps to determine bank height at the shore. Erosion is considered low, but undercutting may not be accurately interpreted if water levels were high. All remotely sensed shoreline is assumed to be low erosion. More than half the shoreline surveyed in the field has been stabilized with shore protection structures. The presence of marshes also offers natural protection to the bank. Most of the banks evaluated both in the field and remotely are considered fully covered. This includes vegetative and structural, and can explain the high degree of stability as well.

Commercial marina on Chincoteague Island.

Map Compositions

Accomack County

Plate 1

Location: East shore of Pocomoke River from Virginia state boundary to Line Gut.

Major River: Pocomoke River

Reach(s): 43 (partial)

Total Shoreline Miles: 58.09

Shoreline Miles Surveyed: 58.09

Survey Date(s): 5/8/2000

Plate Rotation: 0 degrees

Scale: 1:24,000

Plate 2

Location: East shore of Pocomoke River from Line Gut to Shad Landing.

Major River: Pocomoke River

Reach(s): 43 (partial)

Total Shoreline Miles: 11.38

Shoreline Miles Surveyed: 11.38

Survey Date(s): 5/8/2000

Plate Rotation: 0 degrees

Scale: 1:12,000

Plate 3

Location: Holdens Creek

Major River: Pocomoke River

Reach(s): 43 (partial)

Total Shoreline Miles: 11.08

Shoreline Miles Surveyed: 11.08

Survey Date(s): remote survey

Plate Rotation: 0 degrees

Scale: 1:12,000

Plate 4

Location: From 0.22 mile east of Shad Landing to 0.5 mile southwest of the mouth of Jacks Creek.

Major River: Robin Hood Bay

Reach(s): 43 (partial), 44 (partial), 44a (partial), 58 (partial)

Total Shoreline Miles: 20.66

Shoreline Miles Surveyed: 20.66

Survey Date(s): 5/8/2000

Plate Rotation: 90 degrees W

Scale: 1:12,000

Plate 5

Location: Portion of Robin Hood Bay, Saxis, and portion of Starling Creek.

Major River: Pocomoke Sound

Reach(s): 44 (partial), 44a (partial), 45, 46, 47 (partial), 48 (partial), 49 (partial), 57 (partial)

Total Shoreline Miles: 22.90

Shoreline Miles Surveyed: 22.90

Survey Date(s): 5/8/2000

Plate Rotation: 0 degrees

Scale: 1:12,000

Plate 6

Location: From Starling Creek, around Long Point and Tunnels Island, to Back Creek.

Major River: Chesapeake Bay

Reach(s): 47 (partial), 48 (partial), 49 (partial), 50, 51, 52, 53, 54, 55, 56, 57 (partial)

Total Shoreline Miles: 33.69

Shoreline Miles Surveyed: 33.69

Survey Date(s): remote survey

Plate Rotation: 0 degrees

Scale: 1:12,000

Residential housing on Guilford Creek.

Plate 7

Location:	Confluence of Messongo Creek to just east of Green Point.
Major River:	Messongo Creek
Reach(s):	44a (partial), 49 (partial), 57 (partial), 58 (partial), 59 (partial).
Total Shoreline Miles:	19.99
Shoreline Miles Surveyed:	19.99
Survey Date(s):	5/17/2000
Plate Rotation:	0 degrees
Scale:	1:12,000

Plate 8

Location:	Middle section of Messongo Creek.
Major River:	Messongo Creek
Reach(s):	58 (partial)
Total Shoreline Miles:	18.55
Shoreline Miles Surveyed:	18.55
Survey Date(s):	remote survey
Plate Rotation:	25 degrees W
Scale:	1:12,000

Plate 9

Location:	South Point, through Cattail Creek, to .19 mile north of Great Gut.
Major River:	Beasley Bay
Reach(s):	58 (partial), 59, 60, 61 (partial), 62, 62a, 63a (partial), 64a (partial)
Total Shoreline Miles:	38.50
Shoreline Miles Surveyed:	38.50
Survey Date(s):	remote survey
Plate Rotation:	0 degrees
Scale:	1:12,000

Plate 10

Location:	Headwaters of Messongo Creek and Cattail Creek.
Major River:	Cattail Creek
Reach(s):	58 (partial), 61 (partial)
Total Shoreline Miles:	13.12
Shoreline Miles Surveyed:	13.12
Survey Date(s):	remote survey
Plate Rotation:	0 degrees
Scale:	1:12,000

Plate 11

Location:	Great Gut through Guilford Creek to France Creek.
Major River:	Beasley Bay
Reach(s):	61 (partial), 62a (partial), 63a (partial), 64, 64a, 65, 65a, 66, 66a (partial), 67, 68, 68a, 69, 70 (partial), 72, 73 (partial)
Total Shoreline Miles:	86.68
Shoreline Miles Surveyed:	86.68
Survey Date(s):	5/18/2000, 5/10/2000, and 5/17/2000
Plate Rotation:	0 degrees
Scale:	1:24,000

Plate 12

Location: Young Creek; France Creek to Sandy Point

Major River: Beasley Bay

Reach(s): 66a (partial), 67 (partial), 70 (partial), 72, 73 (partial), 74, 75 (partial), 76 (partial). 77 (partial)

Total Shoreline Miles: 36.18

Shoreline Miles Surveyed: 36.18

Survey Date(s): remote survey

Plate Rotation: 0 degrees

Scale: 1:12,000

Plate 13

Location: Webb Island, Zare Point, Sandy Point, and Flannegan Point

Major River: The Thorofare

Reach(s): 73 (partial), 74, 75 (partial), 76 (partial), 78, 79, 80, 81 (partial), 82 (partial)

Total Shoreline Miles: 13.10

Shoreline Miles Surveyed: 13.10

Survey Date(s): 4/28/2000

Plate Rotation: 90 degrees W

Scale: 1:12,000

Plate 14

Location: Tip of Sandy Point through Bagwell Creek and portion of Hunting Creek.

Major River: Hunting Creek

Reach(s): 73 (partial), 76 (partial), 77, 81 (partial)

Total Shoreline Miles: 21.57

Shoreline Miles Surveyed: 21.57

Survey Date(s): 4/28/2000

Plate Rotation: 0 degrees

Scale: 1:12,000

Plate 15

Location: Headwaters of Hunting Creek; headwaters of Doe Creek.

Major River: Hunting Creek

Reach(s): 76 (partial), 81 (partial), 83 (partial)

Total Shoreline Miles: 14.41

Shoreline Miles Surveyed: 14.41

Survey Date(s): 4/28/2000 and 5/16/2000

Plate Rotation: 0 degrees

Scale: 1:12,000

Plate 16

Location: Deep Creek and portion of Rock Gut.

Major River: Deep Creek

Reach(s): 81 (partial), 82 (partial), 83, 84, 85, 85a, 86, 86a (partial), 87 (partial), 88 (partial), 109 (partial)

Total Shoreline Miles: 27.50

Shoreline Miles Surveyed: 27.50

Survey Date(s): 4/27/2000 and 4/28/2000

Plate Rotation: 90 degrees W

Scale: 1:12,000

Stabilization along Doe Creek.

Plate 17

Location: Big Marsh, Savage Island, and Tobacco Island

Major River: Chesapeake Bay

Reach(s): 85a, (partial) 86, 86a, 87, 88, 88a, 89, 90, 98, 99, 99a,100, 100a, 101, 102, 103, 104, 107, 108, 108a, 109 (partial)

Total Shoreline Miles: 141.63

Shoreline Miles Surveyed: 141.63

Survey Date(s): 4/27/2000 and 4/28/2000

Plate Rotation: 0 degrees

Scale: 1:24,000

Plate 18

Location: Chesconessex Creek

Major River: Chesconessex Creek

Reach(s): 85a, (partial) 109 (partial), 110 (partial)

Total Shoreline Miles: 15.44

Shoreline Miles Surveyed: 15.44

Survey Date(s): 4/27/2000 and 4/28/2000

Plate Rotation: 0 degrees

Scale: 1:12,000

Plate 19

Location: Back Creek and Parkers Marsh.

Major River: Chesapeake Bay

Reach(s): 109 (partial), 110 (partial), 111, 112, 113 (partial)

Total Shoreline Miles: 25.93

Shoreline Miles Surveyed: 25.93

Survey Date(s): 4/24/2000

Plate Rotation: 14 degrees E

Scale: 1:12,000

Plate 20

Location: Onancock Creek from Poplar Cove to Finneys Wharf, Finneys Creek and eastern shore of Parkers Creek.

Major River: Onancock Creek

Reach(s): 113 (partial)

Total Shoreline Miles: 19.43

Shoreline Miles Surveyed: 19.43

Survey Date(s): 4/24/2000

Plate Rotation: 14 degrees E

Scale: 1:12,000

Plate 21

Location: Headwaters of Onancock Creek to Cedar Creek.

Major River: Onancock Creek

Reach(s): 113 (partial), 114, 115 (partial), 116 (partial), 119 (partial)

Total Shoreline Miles: 15.19

Shoreline Miles Surveyed: 15.19

Survey Date(s): 4/24/2000

Plate Rotation: 0 degrees

Scale: 1:12,000

Chesconessex Creek.

Plate 22

Location: South shore of Onancock Creek from Parkers Creek to Parkers Island.

Major River: Onancock Creek

Reach(s): 113 (partial), 114, 115 (partial), 116 (partial), 119 (partial)

Total Shoreline Miles: 17.68

Shoreline Miles Surveyed: 17.68

Survey Date(s): 4/24/2000 and 5/16/2000

Plate Rotation: 0 degrees

Scale: 1:12,000

Plate 23

Location: Marshes of Sluitkill Neck, Parkers Island, and Finney Island.

Major River: Chesapeake Bay

Reach(s): 116, 119 (partial), 121, 123, 124, 125 (partial), 126, 127 (partial)

Total Shoreline Miles: 22.31

Shoreline Miles Surveyed: 22.31

Survey Date(s): 4/25/2000 and 4/26/2000

Plate Rotation: 90 degrees W

Scale: 1:12,000

Plate 24

Location: Headwaters of Matchotank Creek, headwaters of Tarkill Creek, midsection of Pungoteague Creek from Warehouse Point to Evans Wharf.

Major River: Pungoteague Creek

Reach(s): 115 (partial), 119 (partial), 125 (partial), 127 (partial)

Total Shoreline Miles: 21.81

Shoreline Miles Surveyed: 21.81

Survey Date(s): 4/24/2000, 4/25/2000, and 5/16/2000

Plate Rotation: 90 degrees W

Scale: 1:12,000

Plate 25

Location: Headwaters of Pungoteague Creek.

Major River: Pungoteague Creek

Reach(s): 127 (partial)

Total Shoreline Miles: 14.21

Shoreline Miles Surveyed: 14.21

Survey Date(s): 4/24/2000

Plate Rotation: 0 degrees

Scale: 1:12,000

Plate 26

Location: Taylor Creek and Warehouse Prong

Major River: Pungoteague Creek

Reach(s): 127 (partial)

Total Shoreline Miles: 14.04

Shoreline Miles Surveyed: 14.04

Survey Date(s): 4/24/2000

Plate Rotation: 0 degrees

Scale: 1:12,000

Plate 27

Location: Pungoteague Creek from Warehouse Point through Butcher Creek.

Major River: Pungoteague Creek

Reach(s): 127 (partial), 128, 129, 129a (partial), 130 (partial), 132 (partial)

Total Shoreline Miles: 19.01

Shoreline Miles Surveyed: 19.01

Survey Date(s): 4/25/2000 and 4/26/2000

Plate Rotation: 0 degrees

Scale: 1:12,000

Plate 28

Location: Butcher Creek to Back Creek in Nandua Creek.

Major River: Chesapeake Bay

Reach(s): 129a, 130, 131, 132, 133, 134, 135 (partial), 136 (partial), 136a (partial)

Total Shoreline Miles: 21.45

Shoreline Miles Surveyed: 21.45

Survey Date(s): 4/26/2000

Plate Rotation: 0 degrees

Scale: 1:12,000

Plate 29

Location: Portion of Nandua Creek from Cedar View to Nandua.

Major River: Nandua Creek

Reach(s): 135 (partial), 136, 136a (partial)

Total Shoreline Miles: 16.12

Shoreline Miles Surveyed: 16.12

Survey Date(s): 4/26/2000 and 5/15/2000

Plate Rotation: 0 degrees

Scale: 1:12,000

Plate 30

Location: Upper reaches or Nandua Creek.

Major River: Nandua Creek

Reach(s): 136a (partial)

Total Shoreline Miles: 12.48

Shoreline Miles Surveyed: 12.48

Survey Date(s): 4/26/2000

Plate Rotation: 90 degrees W

Scale: 1:12,000

Plate 31

Location: South shore of Nadua Creek along Cradock Neck including Curratuck Creek and upper reach of McClean Gut.

Major River: Nandua Creek

Reach(s): 136a (partial), 138 (partial), 142 (partial)

Total Shoreline Miles: 11.22

Shoreline Miles Surveyed: 11.22

Survey Date(s): 4/26/2000 and 5/15/2000

Plate Rotation: 0 degrees

Scale: 1:12,000

Plate 32

Location: Hyslop Marsh

Major River: Chesapeake Bay

Reach(s): 137, 138 (partial), 139, 140, 141, 142 (partial)

Total Shoreline Miles: 17.77

Shoreline Miles Surveyed: 17.77

Survey Date(s): 4/26/2000 and 5/15/2000

Plate Rotation: 90 degrees W

Scale: 1:12,000

Tower at entrance to Craddock Creek.

Plate 33

Location: Craddock Creek and Bull Cove.

Major River: Craddock Creek

Reach(s): 142 (partial), 143 (partial)

Total Shoreline Miles: 16.66

Shoreline Miles Surveyed: 16.66

Survey Date(s): 5/15/2000

Plate Rotation: 0 degrees

Scale: 1:12,000

Plate 34

Location: Scarborough Neck from Bull Cove to 0.41 mile east of Tawes Creek.

Major River: Occohannock Creek

Reach(s): 142 (partial), 143, 144, 145 (partial)

Total Shoreline Miles: 12.90

Shoreline Miles Surveyed: 12.90

Survey Date(s): 4/26/2000, 4/27/2000, and 5/15/2000

Plate Rotation: 90 degrees W

Scale: 1:12,000

Plate 35

Location: Occohannock Creek from 0.41 mile west of Pons Point to 0.35 mile east of Davis Wharf.

Major River: Occohannock Creek

Reach(s): 145 (partial), 145a (partial)

Total Shoreline Miles: 4.91

Shoreline Miles Surveyed: 4.91

Survey Date(s): 4/27/2000

Plate Rotation: 0 degrees

Scale: 1:12,000

Plate 36

Location: Occohannock Creek from Shields Cove to 1 mile northeast of Route 178 bridge.

Major River: Occohannock Creek

Reach(s): 145a (partial)

Total Shoreline Miles: 8.59

Shoreline Miles Surveyed: 8.59

Survey Date(s): 4/27/2000 and 5/15/2000

Plate Rotation: 0 degrees

Scale: 1:12,000

Plate 37

Location: Upper reaches of Occohannock Creek.

Major River: Occohannock Creek

Reach(s): 145a (partial)

Total Shoreline Miles: 7.60

Shoreline Miles Surveyed: 7.60

Survey Date(s): 5/15/2000

Plate Rotation: 0 degrees

Scale: 1:12,000

Plate 38

Location: Folly Creek

Major River: Folly Creek

Reach(s): none

Total Shoreline Miles: 17.16

Shoreline Miles Surveyed: 16.95

Survey Date(s): 5/18/2000

Plate Rotation: 0 degrees

Scale: 1:12,000

Plate 39

Location: Gargathy Creek

Major River: Gargathy Creek

Reach(s): none

Total Shoreline Miles: 36.77

Shoreline Miles Surveyed: 13.40

Survey Date(s): 5/18/2000

Plate Rotation: 90 degrees W

Scale: 1:12,000

Plate 40

Location: Assawoman Creek

Major River: Assawoman Creek

Reach(s): none

Total Shoreline Miles: 13.42

Shoreline Miles Surveyed: 10.88

Survey Date(s): 5/18/2000

Plate Rotation: 60 degrees W

Scale: 1:12,000

Plate 41

Location: Southwestern portion of Chincoteague Island

Major River: Chincoteague Channel

Reach(s): none

Total Shoreline Miles: 16.35

Shoreline Miles Surveyed: 14.55

Survey Date(s): 5/17/2000

Plate Rotation: 45 degrees E

Scale: 1:12,000

Plate 42

Location: Middle section of Chincoteague Island including Piney Island and Little Oyster Bay.

Major River: Chincoteague Channel

Reach(s): none

Total Shoreline Miles: 17.85

Shoreline Miles Surveyed: 15.31

Survey Date(s): 5/17/2000

Plate Rotation: 0 degrees

Scale: 1:12,000

Plate 43

Location: Chincoteague Island from Route 2113 to just southwest of Archie Cove.

Major River: Chincoteague Bay

Reach(s): none

Total Shoreline Miles: 17.44

Shoreline Miles Surveyed: 17.23

Survey Date(s): 5/17/2000

Plate Rotation: 45 degrees E

Scale: 1:12,000

Fringe marshes along Gargathy Creek

Plate 44

Location:	Northeastern end of Chincoteague Island
Major River:	Chincoteague Bay
Reach(s):	none
Total Shoreline Miles:	22.14
Shoreline Miles Surveyed:	17.43
Survey Date(s):	remote survey
Plate Rotation:	90 degrees E
Scale:	1:12,000

Plate 45

Location:	Mouth of Swans Gut Creek to just west of Cockle Point
Major River:	Chincoteague Bay
Reach(s):	none
Total Shoreline Miles:	12.94
Shoreline Miles Surveyed:	6.14
Survey Date(s):	5/11/2000
Plate Rotation:	90 degrees E
Scale:	1:12,000

Plate 46

Location:	Cockle Point to Long Point
Major River:	Chincoteague Bay
Reach(s):	none
Total Shoreline Miles:	8.56
Shoreline Miles Surveyed:	8.28
Survey Date(s):	5/11/2000
Plate Rotation:	45 degrees E
Scale:	1:12,000

Glossary of Shoreline Features Defined

Agricultural - Land use defined as agricultural includes farm tracts which are cultivated and crop producing. This designation is not applicable for pasture land.

Bare - Land use defined as bare includes areas void of any vegetation or obvious land use. Bare areas include those which have been cleared for construction.

Beaches - Beaches are sandy shores which are subaerial during mean high water. These features can be thick and persistent, or very thin lenses of sand.

Boat house - A boathouse is considered any covered structure alongside a dock or pier built to cover a boat. They include true "houses" for boats with roof and siding, as well as awnings which offer only overhead protection. Since nearly all boat houses have adjoining piers, piers are not surveyed separately, but are assumed. Boat houses may be difficult to see in aerial photography. On the maps they are denoted with a blue triangle.

Boat Ramp - Boat ramps provide vessels access to the waterway. They are usually constructed of concrete, but wood and gravel ramps are also found. Point identification of boat ramps does not discriminate based on type, size, material, or quality of the launch. Access at these sites is not guaranteed, as many may be located on private property. The location of these ramps was determined from static ten second GPS observations. Ramps are illustrated as purple squares on the maps.

Breakwaters - Breakwaters are structures which sit parallel to the shore, and generally occur in a series along the shore. Their purpose is to attenuate and deflect incoming wave energy, protecting the fastland behind the structure. In doing so, a beach may naturally accrete behind the structures if sediment is available. A beach nourishment program is frequently part of the construction plan.

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. Large rock breakwaters, or breakwaters constructed of gabion baskets filled with smaller stone are popular today. Breakwaters are not easily observed from aerial imagery. However, the symmetrical cuspate sand bodies which may accumulate behind the structures can be. In this survey, individual breakwaters are not mapped. The first and last breakwater in the series are surveyed as a ten-second static GPS observation. The system is delineated on the maps as a line paralleling the linear extent of the breakwater series along the shore.

Bulkhead - Bulkheads are traditionally treated wood or steel "walls" constructed to offer protection from wave attack. More recently, plastics are being used in the construction. Bulkheads are vertical structures built 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, and prevent erosion of the bank from impinging waves. The recent proliferation of vertical concrete cylinders, stacked side by side along an eroding stretch of shore offer similar level of protection as bulkheads, and include some of the same considerations for placement and success. These structures are also included in the bulkhead inventory.

Bulkheads are found in all types of environments, but they perform best in low to moderate energy conditions. Under high energy situations, the erosive power of reflective waves off bulkheads can scour material from the base, and cause eventual failure of the structure.

Bulkheads are common along residential and commercially developed shores. From aerial photography, long stretches of bulkheaded shoreline may be observed as an unnaturally straight or angular coast. In this inventory, they are mapped using kinematic GPS techniques. The data are displayed as linear features on the maps.

Commercial - Commercial zones include small commercial operations and larger industrial facilities. These operations are not necessarily water dependent businesses.

Dock/Pier - In this survey, a dock or pier is a structure, generally constructed of wood, which is built perpendicular or parallel to the shore. These are typical on private property, particularly residential areas. They provide access to the water, usually for recreational purposes. Docks and piers are mapped as point features on the shore. Pier length is not surveyed. In the map compositions, docks are denoted by a small green dot. Depending on resolution, docks can be observed in aerial imagery, and may be seen in the maps if the structure was built prior to 1994, when the photography was taken.

Forest Land Use - Forest cover includes deciduous, evergreen, and mixed forest stands greater than 18 feet high. The riparian zone is classified as forested if the tree stand extends at least 33 feet inland of the seaward limit of the riparian zone.

Grass - Grass lands include large unmanaged fields, managed grasslands adjacent to large estates, agriculture tracts reserved for pasture, and grazing.

Groinfield - Groins are low profile structures that sit perpendicular to the shore. They are generally positioned at, or slightly above, the mean low water line. They can be constructed of rock, timber, or concrete. They are frequently set in a series known as a groinfield, 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, when sufficient sediment is available in the system, accrete a small beach area. Some fields are nourished immediately after construction with suitable beach fill material. This approach does not deplete the longshore sediment supply, and offers immediate protection to the fastland behind the system.

For groins to be effective there needs to be a regular supply of sediment in the littoral system. In sediment starved areas, groin fields will not be particularly effective. In addition they can accelerate erosion on the downdrift side of the groin. The design of "low profile" groins was intended to allow some sediment to pass over the structure during intermediate and high tide stages, reducing the risk of down drift erosion.

From aerial imagery, most groins cannot be observed. However, effective groin fields appear as asymmetrical cusps where sediment has accumulated on the updrift side of the groin. The direction of net sediment drift is also evident.

This inventory does not delineate individual groins. In the field, the first and last groin of a series is surveyed. Others between them are assumed to be evenly spaced. On the map composition, the groin field is designated as a linear feature extending along the shore.

Industrial - Industrial operations are larger commercial businesses.

Marina - Marinas are denoted as line features in this survey. They are a collection of docks and wharfs which can extend along an appreciable length of shore. Frequently they are associated with extensive bulkheading. Structures associated with a marina are not identified individually. This means any docks, wharfs, and bulkheads would not be delineated separately. Marinas are generally commercial operations. Community docks offering slips and launches for community residents are becoming more popular. They are usually smaller in scale than a commercial operation. To distinguish these facilities from commercial marinas, the riparian land use map (Plate A) will denote the use of the land at the site as residential for a community facility, rather than commercial.

Marshes - Marshes can be extensive embayed marshes, or narrow, fragmented fringe marshes. The vegetation must be relatively well established, although not necessarily healthy.

Miscellaneous - Miscellaneous point features represent short isolated segments along the shore where material has been dumped to protect a section of shore undergoing chronic erosion. Longer sections of shore are illustrated as line features. They can include tires, bricks, broken concrete rubble, and railroad ties as examples.

Paved - Paved areas represent roads which run along the shore and generally are located at the top of the banks. Paved also includes parking areas such as parking at boat landing, or commercial facilities.

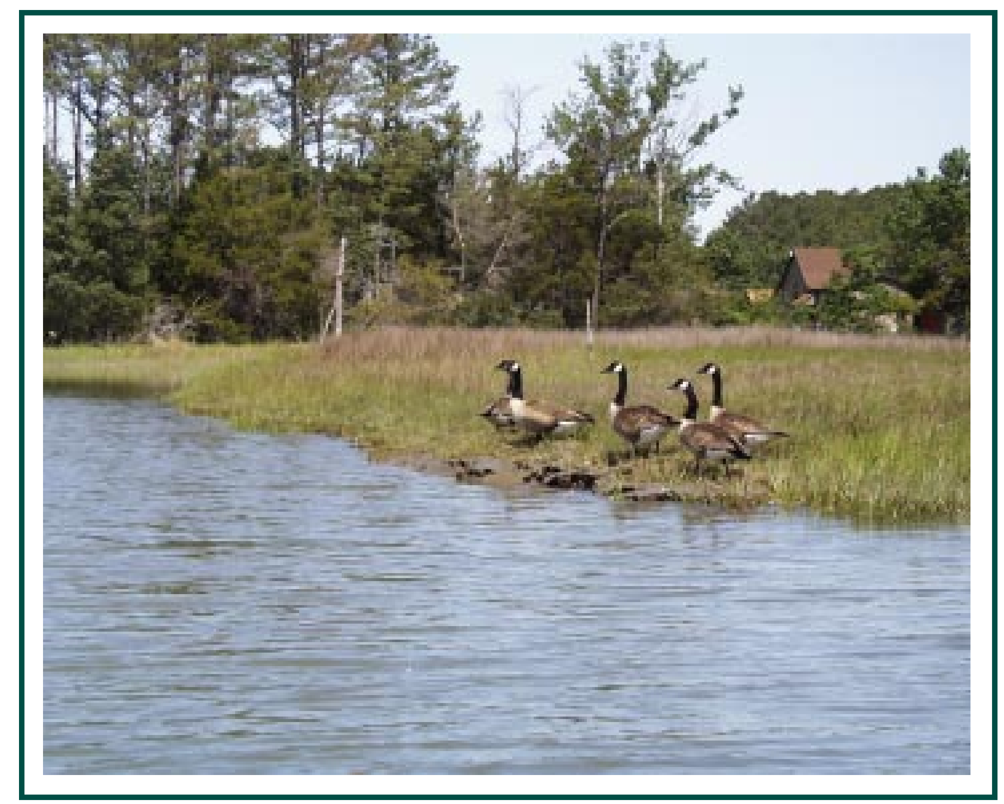
Residential - Residential zones include rural and suburban size plots, as well as multi-family dwellings.

Riprap - Generally composed of large rock to withstand wave energy, riprap revetments are constructed along shores to protect eroding fastland. Revetments today are preferred to 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 filter cloth placed between the ground and the rock. The filter cloth permits water to permeate through, but prevents sediment behind the cloth from being removed, and causing the rock to settle. Revetments can be massive structures, extending along extensive stretches of shore, and up graded banks. When a bulkhead fails, riprap is often placed at the base for protection, rather than a bulkhead replacement. Riprap is also used to protect the edge of an eroding marsh. This use is known as toe protection. This inventory does not distinguish among the various types of revetments.

Riprap revetments are popular along residential waterfront as a mechanism for stabilizing banks. Along commercial or industrial waterfront development such as marinas, bulkheads are still more common since they provide a facility along which a vessel can dock securely.

Riprap is mapped as a linear feature using kinematic GPS data collection techniques. The maps illustrate riprap as a linear feature along the shore.

Scrub-shrub - Scrub-shrub zones include trees less than 18 feet high, and is usually dominated by shrubs and bushy plants.



Geese in the upper reaches of Doe Creek

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