Introduction to the Chesapeake Bay National Estuarine Research Reserve in Virginia

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Introduction to the Chesapeake Bay National Estuarine Research Reserve in Virginia

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ABSTRACT

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Designated in 1991, CBNERRVA established a multi-component system along the salinity gradient of the York River estuary that encompassed the diverse collection of habitats found within the southern Chesapeake Bay subregion. With its two principal tributaries, the Pamunkey and Mattaponi Rivers, the York River is the Bay's fifth largest tributary in terms of flow and watershed area. The York River estuary is classified as a microtidal, partially mixed estuary. Tidal range varies from 0.7 m and at its mouth to over 1 m in the upper freshwater tributary reaches and salinity distribution ranges from tidal freshwater to polyhaline regimes. Land use is predominantly rural in nature with forest (61%) and agricultural lands (21%) being the dominant land cover; wetlands comprise approximately 7% of the basins area. Reserve components include: (1) Goodwin Islands (148 ha), an archipelago of polyhaline salt-marsh islands surrounded by inter-tidal flats, extensive submerged aquatic vegetation beds, and shallow open estuarine waters near mouth of the York River; (2) Catlett Islands (220 ha), consisting of multiple parallel ridges of forested wetland hammocks, maritime-forest uplands, and emergent mesohaline salt marshes; (3) Taskinas Creek (433 ha), containing non-tidal feeder streams that drain oak-hickory forests, maple-gum-ash swamps and freshwater marshes which transition into tidal oligo and mesohaline salt marshes; and (4) Sweet Hall Marsh (443 ha), an extensive tidal freshwater-oligohaline marsh ecosystem located in the Pamunkey River, one of two major tributaries of the York River. CBNERRVA manages these reserves to support informed management of coastal resources by supporting research that advances the scientific understanding of watershed and estuarine systems, highlighting proper stewardship of coastal resources, and improving general public and professional literacy through education and training programs.

ADDITIONAL INDEX WORDS: *Coastal management, climate, watershed, CBP, York River*

HISTORICAL OVERVIEW

In 1988, the Chesapeake Executive Council, made up of the governors of Virginia, Maryland, and Pennsylvania, the mayor of the District of Columbia, the chair of the Chesapeake Bay Commission and the administrator for the Environmental Protection Agency (USEPA), established as one of the Bay region's research support priorities the establishment of a system of research reserves which will provide the research community with sites for long-term habitat focused research that will be protected as far as possible from immediate threats from development (Chesapeake Executive Council, 1988). It is within this context that the Commonwealth of Virginia began it's planning for the Chesapeake Bay National Estuarine Research Reserve in Virginia (CBNERRVA or Reserve). The Virginia Institute of Marine Science (VIMS)/College of William and Mary was designated by the Governor to take the lead role in establishing a suitable research reserve system for the Commonwealth.

Based on a salinity and tributary segmentation scheme, it was originally envisioned that CBNERRVA might eventually include more than 20 components. Because of the high number of potential components, designation of CBNERRVA sites was to occur in a phased manner. Phases were designated as (I) York River basin (Figure 1), (II) Rappahannock and Potomac River basins, (III) James River basin and western shore of Chesapeake Bay, and (IV) the Bay-side Eastern Shore of Chesapeake Bay. The York River basin components were designated in 1991 and CBNERRVA became the 18th reserve within the national system. Based on a number of concerns, which included staff and resource limitations, expansion of CBNERRVA outside the York River system has been suspended at this time. It is anticipated that when fully implemented, the Virginia Estuarine and Coastal Research Reserve System (VECRRS) will achieve many of the goals originally envisioned with the proposed phased expansion of the Reserve.

Mission Statement

The mission of CBNERRVA is to:

preserve a network of reserves that represent the diversity of coastal ecosystems found within the York River estuary and its principal tidal tributaries and manage these reserves to support informed management of coastal resources.

To fulfill its mission, the Reserve advances scientific understanding of watershed and estuarine systems, conducts education and training programs, conserves coastal resources and provides advisory service. The Reserve's mission complements the three-part mission of the VIMS to conduct interdisciplinary research in coastal ocean and estuarine science,

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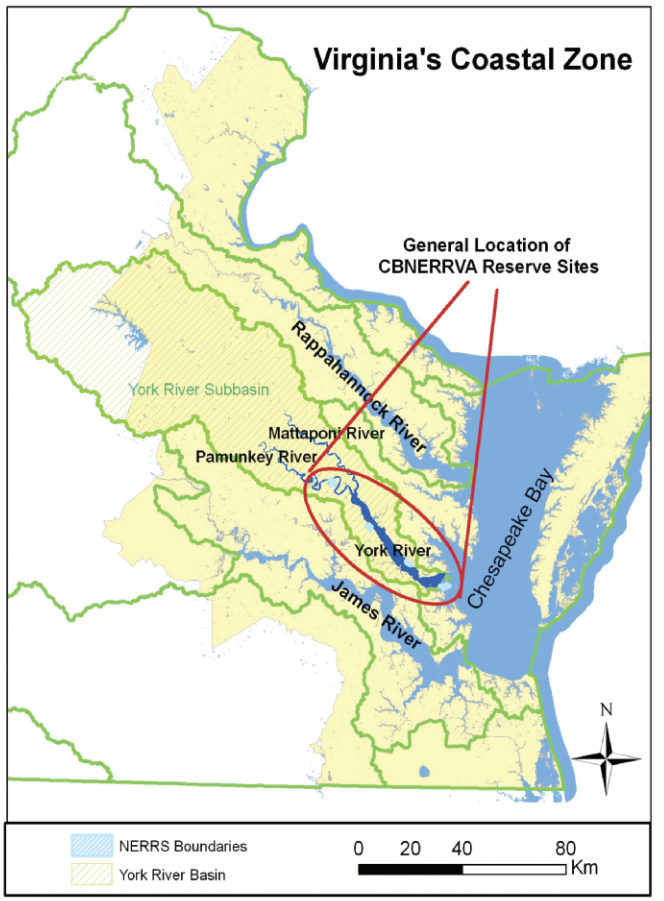

Figure 1. Coastal zone of Virginia highlighting the York River drainage basin.

educate students and citizens, and provide advisory service to policy makers, industry, and the public.

Chesapeake Bay Management Issues and CBNERRVA Focus Areas (2008-2012)

Degradation of marine and estuarine environments is of global concern and the Chesapeake Bay system is no exception. A growing population along with associated land use changes are primary factors causing water quality and habitat degradation in the Bay's watershed, its tributaries and the Bay proper. Key management issues and threats to the Bay system include:

- Excess sediments which result in degraded habitat, reduce water clarity, and serve to transport toxic materials, pathogens and nutrients to water resources;
- Excess nutrients, both nitrogen and phosphorus, that stimulate algal blooms and lead to oxygen deprived waters and reduced water clarity;
- Introduction of toxic chemicals (e.g., mercury, PCBs, pesticides) and associated health impacts on wildlife and humans;
- Loss and/or degradation of key habitats (e.g., submerged aquatic vegetation, wetlands, riparian forests, oyster reefs) that provide a wide variety of critical ecosystem services; and
- Declining finfish and shellfish populations due to overfishing, disease issues and habitat loss.

CBNERRVA has developed four focus areas that address national, regional and local issues. Cutting across specific program boundaries, issue focus areas allow the Reserve to address key management concerns in a more integrated and comprehensive manner. Primary focus areas directing Reserve programs that provide direct support for coastal resource management include:

- Functions and linkages of land-margin ecosystems;
- Ecosystem vulnerability to climate (Figure 2) and human-induced stressors;
- Water quality and aquatic stressors; and
- Integrated ocean observing systems.

Figure 2. Episodic large storms (Tropical Storm Ernesto, 9/1/2006) impact Bay resources and coastal communities. Photo credit: William Reay.

RESERVE SETTING

Chesapeake Bay

Chesapeake Bay was first named "Chesepiooc" or "Great Shellfish Bay" by Native Americans for its bounty of crabs, oysters and other shellfish. As the nation's largest estuary, it remains today as a national treasure and one of the most productive in the world. Formed from a drowned river valley by melting glaciers over 12,000 years ago, the Chesapeake Bay main-stem stretches approximately 305 km (190 mi) from Havre de Grace, Maryland to Norfolk, Virginia. The Bay and its tributaries have approximately 18,700 km (11,680 mi) of shoreline and a water area of 11,600 km^2 (4,480 mi^2)(Cronin, 1971). Despite its vast size, Chesapeake Bay is relatively shallow with an average depth on the order of 6.4 m (21 ft)(Cronin,

1971); 20 percent of the Bay exhibits water depths less than 2.1 m (7 ft) and 10 percent exhibits water depths less than 0.9 m (3 ft).

The Bay receives about half of its water volume from the Atlantic Ocean with the rest entering from surface waters (rivers and streams), ground water and direct precipitation. The Bay's watershed, on the order of 165,700 km^2 (64,000 mi^2), incorporates parts of six states (i.e., New York, Pennsylvania, West Virginia, Delaware, Maryland, and Virginia) and the District of Columbia. Major river systems flowing into the Bay include the Susquehanna, Patuxent, Potomac, Rappahannock, York, and James River, with the Susquehanna providing about half of the freshwater input. The large extent of the Bay, its tributaries, and watershed, and the mixing of fresh and high salinity ocean water results in a large diversity of aquatic, intertidal, riparian and upland habitats. The Bay, its tributaries, and its watershed represents a complex ecosystem that supports over 3,600 species of plants and animals including approximately 350 species of finfish, 170 species of shellfish, 200 species of birds and waterfowl, and over 2,700 plant species (USEPA/CBP; http://www.chesapeakebay.net/status.cfm).

In addition to natural resources, the Bay watershed is home to more than 15 million people and is projected to grow to 18 million by 2020 (http://www.chesapeakebay.net/pop.htm). Approximately 70 and 90 percent of Virginia's and Maryland's population live within coastal counties, respectively (Crossett *et al.*, 2004). Throughout modern history, the Chesapeake Bay and its tributaries have help sustain the regions economy through commercial and recreational fisheries and other opportunities, and served as a hub for shipping and commerce. The Bay annually produces 227 million kg (500 million lbs) of seafood and contains two (i.e., Baltimore and Hampton Roads) of the five major North Atlantic ports in the U.S. (USEPA/CBP; http://www.chesapeakebay.net/status.cfm). Agriculture and related activities continue to play a very important role with respect to land use and economics within the Bay watershed. On an aerial basis, agricultural lands represent approximately thirty percent of the Bay's watershed. A growing tourism trade, service and high-technology jobs, and a strong military presence all continue to support the regions economy.

York River Geographical Description

As the nation's largest estuary, Chesapeake Bay contains a diverse collection of habitats and salinity regimes. In order to incorporate the diversity of habitats in the southern Chesapeake Bay subregion, CBNERRVA established a multi-component system along the salinity gradient of the York River estuary. The York River estuary is the Bay's fifth largest tributary in terms of flow and watershed area on the order of 6900 km^2 (2662 mi^2). The York River basin is located within Virginia's Coastal Plain and Piedmont physiographic provinces and includes all of the land draining into the Mattaponi, Pamunkey and York Rivers. Land use is predominantly rural in nature with forest cover accounting for 61 percent of the basin's cover, agricultural lands accounting for 21 percent, developed lands 2 percent, wetlands 7 percent, barren lands 1 percent and water accounting for the remaining 8 percent (Chesapeake Bay Program watershed profiles: http://www.chesapeakebay.net)(Figure 3). Percentage of impervious surfaces, a component of developed lands, is on the order of 1 percent. Starting from the headwater regions, the York River basin includes all or portions of the following counties: Albemarle, Orange, Louisa, Fluvanna, Spotsylvania, Goochland, Hanover, Caroline, Essex, King William, King and Queen, New Kent, James City, Gloucester and York. Year 2000 population estimates for the York River watershed was 372,500 (EPA/CBP Watershed Profiles; www.chesapeakebay.net) and is projected to reach 452,000 in the next twenty years. Population centers within the watershed include Poquoson, Gloucester Point, Ashland, West Point and Spotsylvania Courthouse. While there are currently no major metropolitan areas contained within the watershed, growth from Fredericksburg, Richmond and Hampton Roads is impacting the region.

The York River receives freshwater from its two major tributaries whose confluence is at West Point located approximately 52 km (32 mi) from the rivers mouth near the Goodwin Islands component of the Reserve. Long-term daily mean streamflow is 1.41×10^6 m^3 (4.98×10^7 ft^3) for the Mattaponi (USGS Station: 01674500; 1942-2007) and 2.66×10^6 m^3 (9.39×10^7 ft^3) for the Pamunkey (USGS Station: 01673000;

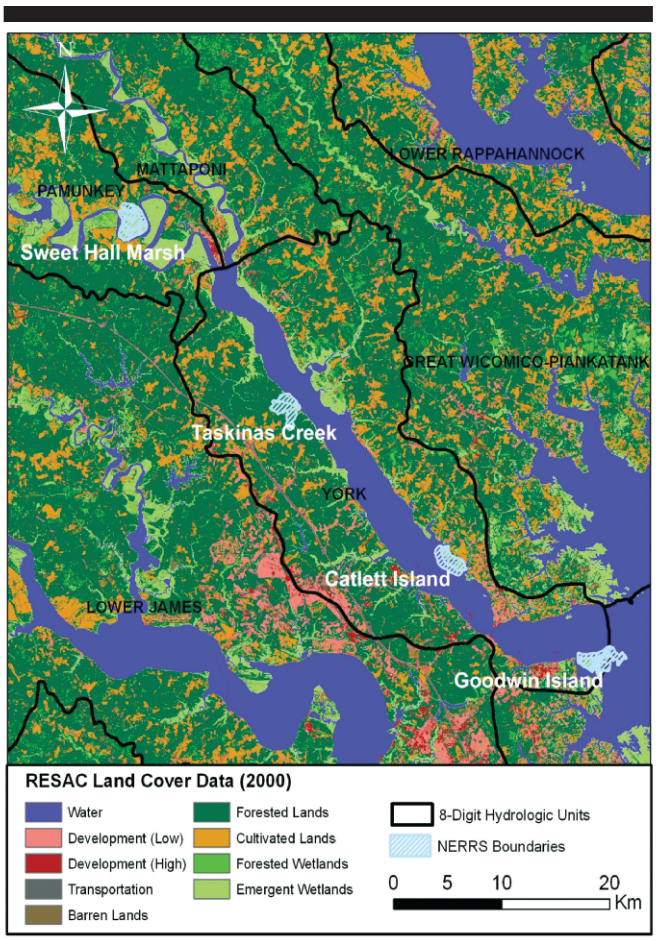

Figure 3. Reserve component locations and land-use within the York River basin and surrounding lands.

1972-2007) Rivers. The York River estuary also receives freshwater input from a large number of smaller ungaged subbasins and direct groundwater discharge to tidal waters. The York River system is classified as a microtidal, partially mixed estuary. Mean tidal range ranges from 0.7 m (2.3 ft) at its mouth to over 1 m (3.3 ft) in the upper tidal freshwater regions of the Mattaponi and Pamunkey Rivers (Sisson *et al.*, 1997). Principal bathymetric features of the York River consist of an axial channel flanked by broad, shallow shoals of less than 2 m (4.6 ft) in depth (Nichols *et al.*, 1991); main channel depths are on the order of 14 m (46 ft) near Gloucester Point to 6 m (20 ft) near West Point. Because the Mattaponi and Pamunkey Rivers do not exhibit a prominent fall-line as delineated by other major western shore Bay tributaries, the uppermost extent of tidal propagation is somewhat variable and on the order of 120 km (75 mi) upriver on the Mattaponi and as far as 150 km (93 mi) upriver on the Pamunkey (Lin and Kuo, 2001). Salinity distribution along the York River estuary ranges from tidal freshwater to polyhaline regimes.

Climate

Due to Virginia's varied landscape and close association with large water masses, the state's climate is diverse and can be classified into five different regions: the Tidewater, Piedmont, Northern Virginia, Western Mountain and Southwestern Mountain regions (www. Climate.Virginia.edu/description.htm). The York River watershed is located within the Tidewater and Piedmont climate regions. Climate within the York River basin is moderate with an average annual temperature of 14°C (57°F). Average winter season temperatures range from 2-5°C (36-41°F), with average daily minimum values of -5 to -1°C (23-30°F). Colder winter temperatures are associated with the more northwestern portions of the watershed. Average summer daily maximum temperatures vary from 23-24°C (73-75°F) with average daily maximum values ranging from 29-31°C (84-88°F). Warmer summer temperatures are associated with the lower, southern portions of the watershed.

Average annual precipitation rates within the watershed varies from 111 cm (44 in) in the upper reaches of tidal waters (Walkerton; 1932-2007) to 121 cm (48 in) in lower reaches (Williamsburg; 1948-2007). Precipitation is generally well distributed throughout the year. Much of this rainfall is associated with storms resulting from warm and cold frontal systems that generally track from west to east. In the vicinity of the Virginia coast, storm movement is typically northeastward paralleling the coast and Gulf Stream (www. Climate.Virginia.edu/description.htm). Excessive rainfall can result from hurricanes and tropical storms that cross Virginia. These large-scale events generally occur in early August and September. During September, anywhere from 10-40 percent of Virginia's rainfall comes from tropical cyclones. Average annual seasonal snowfall varies from approximately 51 cm (20 in) in the Piedmont region to less 18 than 25 cm (10 in) in the lower southern Coastal Plain regions (USDA County Soil Surveys). Average relative humidity in the mid-afternoon is on the order of 50 percent throughout the watershed.

Reserve Components

CBNERRVA consists of four components, Goodwin Islands, Catlett Islands, Taskinas Creek and Sweet Hall Marsh, which represent a diversity of coastal ecosystems found within the York River estuary and its principle tidal tributaries (Figure 3). The Goodwin Islands, located near the mouth of the York River, are a 148 ha (366 acres) archipelago of polyhaline salt-marsh islands surrounded by inter-tidal flats, extensive submerged aquatic vegetation (SAV) beds, and shallow open estuarine waters (Figure 4). The Catlett Islands, 220 ha (542 acres) in area, consist of multiple parallel ridges of forested wetland hammocks, forested upland hammocks, emergent mesohaline salt marshes and tidal creeks surrounded by shallow subtidal areas that once supported beds of submerged aquatic vegetation (Figure 5). Taskinas Creek encompasses 433 ha (1070 ac) within the boundaries of York River State Park (YRSP) (Figure 6). The non-tidal portion of Taskinas Creek contains feeder streams that drain oak-hickory forests, maple-gum-ash swamps and freshwater marshes which transition into tidal oligo and mesohaline salt marshes. Sweet Hall Marsh, 443 ha (1094 ac) in area, represents an extensive tidal fresh water-oligohaline marsh ecosystem located in the Pamunkey River, one of two major tributaries of the York River (Figure 7). Details regarding general location, ownership, management, physical conditions, representative habitats, rare and endangered flora and fauna, cultural/historical resources, and identified management issues are provided below for each Reserve component.

GOODWIN ISLANDS

Location

The Goodwin Islands (37° 13' N; 76° 23' W; Figure 4) component of the CBNERRVA is located on the southern side of the mouth of the York River. The islands are at the northeast-

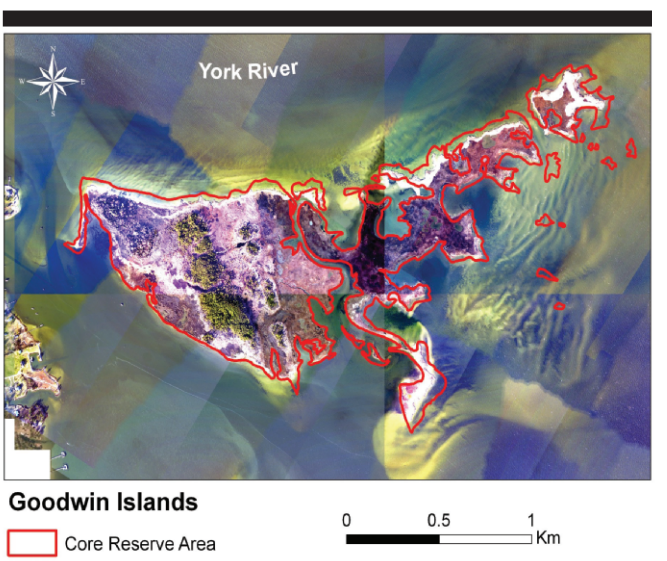

Figure 4. Aerial photo of Goodwin Islands Reserve component delineating core boundary.

ern tip of York County approximately 10 km (6 mi) down the York River from VIMS.

Ownership and Management

Goodwin Islands are owned by the College of William and Mary. VIMS serves as the on-site manager of the islands and assures consistency with the MOU between VIMS/College of William and Mary and NOAA dated February 6, 1991.

Physical Conditions

Water circulation patterns around the islands are influenced by York River discharge and wind patterns of the Chesapeake Bay. Tides at the Goodwin Islands are semi-diurnal and display an average range of 0.7 m (2.3 ft). Mean seasonal water temperature values range from 13.7-15.6°C (56.7-60.1°F) for spring (March-May), 25.7-27.2°C (78.3-81.0°F) for summer (June-August), 18.0-19.2°C (64.4-66.6°F) for fall (September-November), and 4.7-8.2°C (40.5-46.8°F) for winter (January-February, and December). Located within the polyhaline region of the York River estuary, mean seasonal salinity values range from 13.9-23.0 psu for spring, 17.2-23.0 psu for summer, 16.5-24.0 for fall, and 15.9-23.3 psu for winter. Summary water quality statistics were derived from SWMP 15-minute interval data for the years 1998-2004.

Representative Coastal Habitats

Consisting of an archipelago of salt-marsh islands, the Goodwin Islands component core area is approximately 148 ha (366 ac) in area. Primary ecological community groups occurring at Goodwin Islands include tidal meso-polyhaline marshes, maritime dune grasslands, salt scrub, and maritime upland forest (Erdle and Heffernan, 2005a). Salt marsh vegetation is dominated by smooth cordgrass (*Spartina alterniflora*) and saltgrass (*Distichlis spicata*). Other marsh associates include salt meadow hay (*Spartina patens*), glasswort (*Salicornia virginica*), sea-lavender (*Limonium carolinianum*), and stands of black needlerush (*Juncus roemerianus*). Characteristic species of the narrow stands of maritime dune grasslands include saltmeadow hay (*Spartina patens*), beach panic grass (*Panicum amarum*), seaside goldenrod (*Solidago sempervirens*) seaside spurge (*Chamaesyce polygonifolia*) and searocket (*Cakile edentula*). Salt shrubland community, consisting primarily of groundsel tree (*Baccharis halimifolia*) and saltbush (*Iva frutescens*), is irregularly scattered along low dunes and the island perimeter. The higher, interior western portions of the Goodwin Islands support a large stand of loblolly pine (*Pinus taeda*) with some mixed oak. The understory is dominated by southern wax myrtle (*Myrica cerifera*) and to a lesser degree red bay (*Persea palustris*). The northwestern corner of the island contains a fringe forest of sugarberry (*Celtis laevigata*), slippery elm (*Ulmus rubra*) and cottonwood (*Populus deltoides*); understory consists of Chinese privet (*Ligustrum obtusifolium*) and other shrub species. The surrounding aquatic zone includes extensive SAV beds of eelgrass (*Zostera marina*) and widgeon grass (*Ruppia maritima*) approximately 183 ha (453 ac) in area (Orth *et al.*, 2005), large expanses of unvegetated bottoms, and shallow open estuarine waters.

Rare Plant and Animal Species

Flora and fauna surveys conducted to date do not indicate the presence of rare plant and animal species. Breeding bald eagles have been documented in recent years, although Tropical Cyclone Isabel damaged nesting habitat in the fall of 2003 (Watts, pers. comm., 2004).

Cultural and Historic Resources

An archaeological survey has not been conducted at Goodwin Islands. Based on observations and personal communications, Goodwin Islands contains prehistoric and historic resources.

Identified Management Issues

Identified resource management issues on Goodwin Islands and the immediate surrounding region include: (1) control of known problem invasive plant species which include common reed (*Phragmites australis*), japanese honeysuckle (*Lonicera japonica*), japanese stilt grass (*Microstegium vimineum*), and border privet (*Ligustrum obtusifolium*), (2) control of native animal problem species which include raccoon (*Procyon lotor*), fox species and white-tailed deer (*Odocoileus virginicus*), (3) assessment, protection and restoration of critical spawning, nesting and nursery habitat with specific emphasis on colonial nesting birds such as the great blue heron (*Ardea herodias*), horseshoe crab (*Limulus polyphemus*) spawning grounds, breeding and nesting areas for shorebirds including American oystercatchers (*Haematopus palliates*), and diamondback terrapins (*Malaclemys terrapin*), (4) assessment of sea level rise and shoreline erosion on critical habitats and geomorphic features, (5) restoration of SAV beds to past aerial coverage, (6) continued implementation of hunting management plan, (7) assessment of direct and indirect impacts of fishing activity on natural resources, (8) development of petroleum/toxic material spill contingency and response plans, (9) development of a fire contingency plan, (10) assessment of increased development and public access pressures on natural, cultural and historic resources, (11) survey of archaeological resources and development of a archaeological resource management plan, and (12) unauthorized public use of the Reserve which includes non-permitted collection of plants and animals, artifact collection, and unleashed domestic animals.

CATLETT ISLANDS

Location

The Catlett Islands (37° 18' N; 76° 33' W; Figure 5) are located approximately 18 km (11 mi) from the mouth of the York River and 8 km (5 mi) from VIMS, on the North side of the York River in Gloucester County, Virginia. Timberneck Creek flows into the York River on the eastern side of the Catlett Islands and Cedarbush Creek enters the river on the western side. Poplar Creek bisects the two large areas of the Catlett Islands.

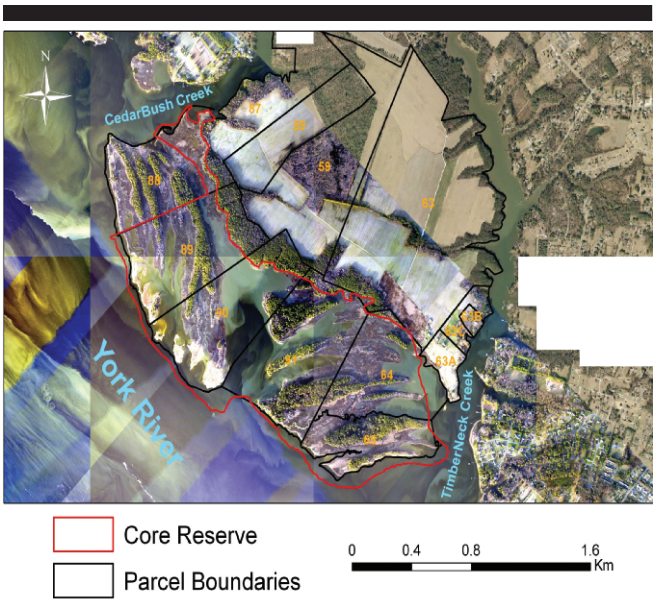

Figure 5. Aerial photo of Catlett Islands Reserve component delineating core boundary and tract parcels.

Ownership and Management

The Reserve core encompasses the entire Catlett Island ecological unit except for a small portion (32 ha or 79 ac; Parcel ID: 88) located on the most northwest portion of the islands. The majority of land comprising the Catlett Islands component is owned by Timberneck LLC (Parcels 64, 87, 89, 90 and 91). Parcel size is 47 ha (115 ac) for tract 64, 63 ha (155 ac) for tract 87/89, and 45 ha each (112 ac) for tracts 90 and 91. VIMS/W&M holds deed to a small portion (20 ha; 48 ac) of the most southeast portion (Parcel 65) of the island complex. VIMS serves as the on-site manager of the Catlett Islands and assures consistency with the Catlett Island National Estuarine Research Reserve in Virginia Conservation Easements dated September 5, 1990 and November 14, 1990, and as amended in 2008.

Physical Conditions

Tides at the Catlett Islands are semi-diurnal and display an average range of 0.8 m (2.6 ft). Mean seasonal water temperature values range from 15.2-18.7°C (59.4-65.7°F) for spring, 25.2-28.5°C (77.4-83.3°F) for summer, 14.9-20.9°C (58.8-69.6°F) for fall, and 4.5-12.1°C (40.1-53.8°F) for winter. Mean seasonal salinity values range from 10.7-22.6 psu for spring, 15.1-23.1 psu for summer, 13.2-25.2 psu for fall, and 10.3-23.1 psu for winter. Summary water quality statistics were derived from weekly interval data from the Alliance for the Chesapeake Bay for the years 1995-2004.

Representative Coastal Habitats

The Catlett Islands component, approximately 220 ha (542 ac) of core area, consists of multiple parallel ridges of forested hammocks and emergent wetlands. Primary ecological community groups occurring at Catlett Islands include tidal meso and polyhaline marshes, forested wetlands and maritime upland forests (Erdle and Heffernan, 2005b). Smooth cordgrass (*Spartina alterniflora*) prevails over much of the marsh area along with saltgrass (*Distichlis spicata*), saltmeadow hay (*Spartina patens*), black needlerush (*Juncus roemerianus*) and various halophytic forbs. Estuarine scrub/shrub vegetation including saltbush or high-watershrub (*Iva frutescens*), groundsel tree (*Baccharis halimifolia*), southern bayberry (*Myrica cerifera*) and northern bayberry (*Myrica pennsylvanica*) occurs in transitional areas from salt marsh to forested wetlands and hammock regions. Maritime upland forests, dominated by oak species (*Quercus phellos, Q. falcata, Q. pagoda*), loblolly pine (*Pinus taeda*) and to a lesser degree black cherry (*Prunus serotina*), red maple (*Acer rubrum*), black gum (*Nyssa sylvatica*) and other tree species dominate the higher terrain.

Rare Plant and Animal Species

Flora surveys conducted to date do not indicate the presence of rare plant species. Bald eagles have been documented on Catlett Island in years past and currently continue to utilize the Island. While there has been no successful breeding activity in recent years (2004-2005), a nest was rebuilt in 2005 and breeding activity is currently being evaluated (Watts, pers. comm.).

Cultural and Historic Resources

A cultural resource overview has been conducted for the Timberneck Farm and adjacent Catlett Islands (Blanton *et al.*, 1993). The overview documented relatively few Archaic (10,000-2,500 yrs B.P.) sites, and on the order of ten each of Middle Woodland (2,500-1,000 yrs B.P.) and Late Woodland (1,000-400 yrs. B.P.) sites. With respect to historic sites, numerous site occupations from the seventeenth through twentieth centuries have been identified.

Identified Management Issues

Identified resource management issues on Catlett Islands and immediate surrounding region include: (1) control of known problem invasive plant species which include common reed (*Phragmites australis*), japanese honeysuckle (*Lonicera japonica*), and blunt-leaved privet (*Ligustrum obtusifolium*), (2) impact assessment and potential control of the southern pine bark beetle, (3) control of native animal problem species which include raccoon (*Procyon lotor*), fox species and whitetailed deer, (4) assessment, protection and restoration of critical colonial bird nesting habitat with specific emphasis on the great blue heron (*Ardea herodias*), (5) assessment, protection and restoration of critical breeding and nesting areas for shorebirds including American oystercatchers (*Haematopus palliates),* (6) assessment of sea level rise and shoreline erosion on critical habitats and geomorphic features, (7) development and implementation of a hunting management plan, (8) development of a petroleum/toxic material spill contingency and response plans, (9) development of a fire contingency plan, (10) assessment of increased development and public

access pressures on natural resources, (11) source tracking of tidal creek fecal coliform contamination and development of remediation strategies, (12) determination of water quality status for surrounding waters and assess the potential for SAV and oyster restoration, (13) enhanced survey of archaeological resources and development of a archaeological resource management plan, and (14) unauthorized public use of the Reserve which includes non-permitted collection of plants and animals, artifact collection, hunting and camping.

TASKINAS CREEK

Location

The Taskinas Creek component (37° 24' N; 76° 42' W; Figure 6) is located within the boundaries of YRSP near the town of Croaker, in James City County, Virginia. The small subestuary of the York River is located on the southern side of the river, approximately 28 km (17 mi) upriver from VIMS and 38 km (24 mi) from the mouth of the York River.

Ownership and Management

YRSP contains 1034 ha (2554 ac). All lands within the boundaries of YRSP are owned by the Commonwealth of Virginia. Lands within the Taskinas Creek Reserve component of YRSP, identified as the Taskinas Creek Management Unit in the YRSP Resource Management Plan (VaDCR 2000), are co-managed by the Virginia Department of Conservation and Recreation (VaDCR) and VIMS in a manner consistent with the MOU between VIMS/W&M and the VaDCR dated August 19, 2008.

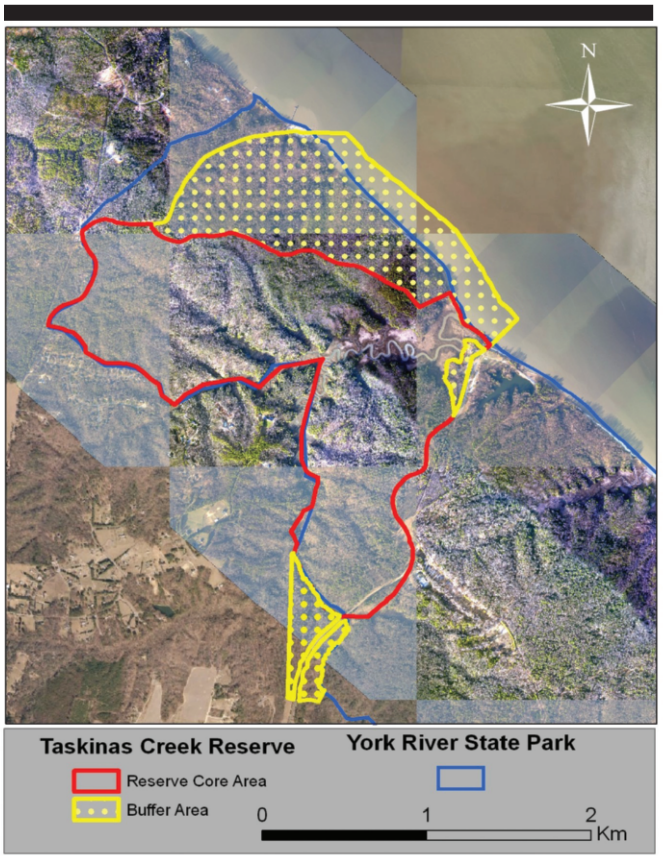

Figure 6. Aerial photo of Taskinas Creek Reserve component delineating core and buffer areas and YRSP boundary.

Physical Conditions

Taskinas Creek water quality is influenced to a large degree by watershed drainage at low tide and mainstem York River during high tide conditions. Tides are semidiurnal and display an average range of 1.0 m (3.3 ft). Mean seasonal water temperature values range from 15.2-19.0°C (59.4-66.2°F) for spring, 26.8- 28.2°C (80.2-82.8°F) for summer, 15.7-18.3°C (60.3-64.9°F) for fall, and 3.6-9.0°C (38.5-48.2°F) for winter. Located within the mesopolyhaline region of the York River estuary, mean seasonal salinity values range from 4.0-14.0 psu for spring, 7.0- 18.2 psu for summer, 6.9-17.0 for fall, and 5.8-15.3 psu for winter. Summary water quality statistics were derived from SWMP 15-minute interval data for the years 1998-2004.

Representative Coastal Habitats

The Taskinas Creek component consists of a 285 ha (704 ac) core and 148 ha (366 ac) buffer region within the boundaries of YRSP (Figure 6). The upper, most inland boundary of the core area coincides with the 30.5 m (100 ft) contour and the seaward boundary of the core and buffer is defined by the 0.3 m (1 ft) water depth contour which delineates the seaward limit of the intertidal zone. The non-tidal portion of Taskinas Creek contains feeder streams that drain oak-hickory forests, maple-gum-ash swamps and freshwater marshes. Freshwater mixed wetlands are found in the upstream reaches of Taskinas Creek. Three-square (*Scirpus americanus* and *S. olneyi*) and big cordgrass (*Spartina cynosuroides*) characterize the middle marsh reaches. Salt marsh vegetation dominated by smooth cordgrass (*Spartina alterniflora*) is found in the lower reaches of the creek, near the outlet to the York River.

Rare Plant and Animal Species

A population of mountain camellia (*Stewartia ovata)* (G4/S2), first discovered in 1990, was rediscovered at the Reserve in 2006. Thirty two plants were located in six subpopulation areas (Meyers *et al*., 2008a). One bald eagle nesting location is known just outside the boundary of YRSP and the Taskinas Creek Reserve. Eagles use both the water and upland resources within the Reserve boundary for fishing and nesting.

Cultural and Historic Resources

Archaeological studies have been conducted within YRSP. Two sites of interest have been dated to between 1000 B.C. to 1500 A.D. (Egloff, 1988). Of significance is a previously undefined type of ceramic ware (Croaker Landing) and type of projectile point (Potts Side- Notched). Additional information and archaeological/historical sites and areas of archaeological resource potential within YRSP are provided in the YRSP Resource Management Plan (VaDCR 2000).

Identified Management Issues

Identified resource management issues for the Taskinas Creek component of the Reserve and its immediate surrounding region include: (1) control of known problem invasive plant species which include the common reed (*Phragmites australis*), (2) assessment of sea level rise and shoreline erosion on critical habitats and geomorphic features, (3) source tracking of tidal creek fecal coliform contamination and development of remediation strategies, (4) assessment of increased development and public access pressures on natural resources, (5) enhanced survey of archaeological resources and development of an archaeological resource management plan, (6) determination of Reserve and YRSP carrying capacity to accommodate public use, research and education, (7) assessment of foot, bike and horse traffic on trail system, and (8) unauthorized public use of the Reserve which includes non-permitted collection of plants, animals and artifacts.

SWEET HALL MARSH

Location

Sweet Hall Marsh (37° 34' N; 76° 50' W; Figure 7) is located in the tidal freshwater-oligohaline transitional zone of the Pamunkey River, one of two major tributaries of the York River. Historically, Sweet Hall Marsh has represented the lower-most extensive tidal fresh water marsh located in this riverine system. Sweet Hall Marsh is approximately 23 km (14 mi) from West Point, where the Pamunkey and Mattaponi converge to form the York River. The site is 65 km (40 mi) upriver from VIMS and 75 km (47 mi) from the mouth of the York River.

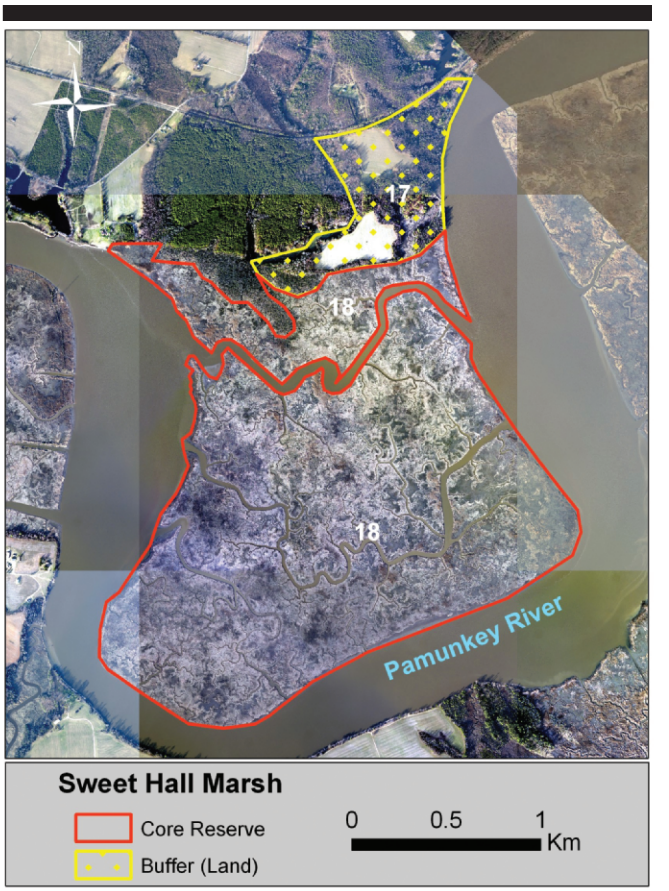

Figure 7. Aerial photo of Sweet Hall Marsh Reserve component delineating core and buffer boundaries.

Ownership and Management

Sweet Hall Marsh is privately owned by the Tacoma Hunting and Fishing Club. Parcel size is 384 ha (949 ac) for tract 18 and 59 ha (145 ac) for the buffer tract 17. VIMS serves as the onsite manager of the Sweet Hall Marsh component of the Reserve and assures consistency with the Sweet Hall National Estuarine Research Reserve in Virginia Management Agreement dated May 1, 2008.

Physical Conditions

Tides at Sweet Hall Marsh are semi-diurnal and display an average range of 1.0 m (3.3 ft). Mean seasonal water temperature values range from 14.7-16.7°C (58.5-62.1°F) for spring, 26.7-27.9°C (80.1-82.2°F) for summer, 18.6-19.1°C (65.5-66.4°F) for fall, and 4.7-6.3°C (40.5-43.3°F) for winter. Located within the oligohaline, lower freshwater reaches of the Pamunkey River, mean seasonal salinity values range from 0.1-3.4 psu for spring, 0.1-8.4 psu for summer, 0.3-8.4 psu for fall, and 0.1-3.2 psu for winter. Summary water quality statistics were derived from SWMP 15-minute interval data for the years 2002-2004.

Representative Coastal Habitats

The Sweet Hall Marsh component consists of a 384 ha (949 ac) core region that encompasses emergent, fresh and low salinity marsh, seasonally flooded forested wetlands and scrub-shrub wetlands. A 59 ha (145 ac) buffer consists primarily of uplands forests and open agricultural fields. The emergent marsh community is classified as freshwater mixed and includes arrow arum (*Peltandra virginica*), big cordgrass (*Spartina cynosuroides*), smartweeds (*Polygonum spp.*) species, rice cutgrass (*Leersia oryzoides*), wild rice (*Zizania aquatica*), sedges (Carex spp.) and rushes (*Scirpus* spp.), cattail (*Typha* spp.) and panic grass (*Panicum virgatum*). The dominant canopy species in the flooded forested wetlands include green ash (*Fraxinus pennsylvanica*), black gum (*Nyssa sylvatica*), red maple (*Acer rubrum*) and ironwood (*Carpinus caroliniana*). Scrub-shrub species include wax myrtle (*Myrica cerifera L.*), mountain laurel (*Kalmia latifolia*) and arrow wood viburnum (*Viburnum dentatum*). The uplands in the buffer zone consist of agricultural fields and mixed hardwoods and pine.

Rare Plant and Animal Species

The sensitive joint vetch (*Aeschenomene virginica*), a candidate for federal listing as an endangered species, has historically been found at Sweet Hall Marsh but has not been found in recent surveys. Fauna surveys conducted to date have found the butterfly species *Problema bulenta*, a "Rare Skipper" spe-

cies that has both a global and state rare ranking (Myers *et al.*, 2008b). Several bald eagles nesting locations are located near, but not within the boundaries of Sweet Hall Marsh. Eagles use both the water and upland resources within the Reserve boundary for fishing and resting.

Cultural and Historic Resources

Sweet Hall Marsh has not been surveyed for archaeological resources. Due to its long history of human use, it is expected that Sweet Hall Marsh and adjacent uplands would yield significant prehistoric and historic resources.

Identified Management Issues

Identified resource management issues at Sweet Hall Marsh and immediate surrounding region include: (1) assessment and control of problem invasive plant species which may include the non-native common reed (*Phragmites australis*), (2) assessment of relative sea level rise impacts (includes subsidence due to ground water withdrawal and other factors) on plant communities, (3) assessment of long-term reductions in stream flow on salinity patterns and the impacts on plant communities and fish spawning grounds, (4) source identification of mercury inputs and impacts upon upriver ecosystems, (5) assessment of introduced Blue catfish populations and impact on local fish populations (6) assessment of increased development and public access pressures on natural resources, and (7) survey of archaeological resources and development of archaeological resource management plan.

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