

## ENVIRONMENT

### **Introduction**

James City County's natural environment is one of its most valuable assets, and at the same time one of its most vulnerable. The County is located on a narrow, hilly, wooded peninsula between three major rivers that feed into the Chesapeake Bay. There are extensive wetlands, unstable soils, steep slopes, scenic vistas, wildlife, and woodland areas. The County continues to experience significant development pressures, mostly due to its location between two major metropolitan areas and its growing attraction as a retirement community and tourist destination. These circumstances can result in considerable environmental concerns: decreased water quality; increased soil erosion and stormwater runoff; loss of scenic vistas, agricultural lands, and historic sites; destruction of wildlife habitats; deforestation; and air pollution. As such, it is important to have a good sense of the County's natural resources and to identify methods for protecting and using them efficiently.

### **Location and Area**

James City County is located on a peninsula approximately 50 miles southeast of Richmond and 40 miles northwest of Norfolk. The County is bounded by three rivers: the James to the south, the York to the northeast, and the Chickahominy to the west. Total land area, including inland water, is about 144 square miles, or approximately 92,400 acres. There are 152 miles of shoreline along the three rivers, containing about 138 miles of marshlands and 14 miles of beach. Along these shores are both tidal and nontidal wetlands.

### **Geology and Soils**

Knowledge of the topography, underlying geologic formations, soils, hydrographic features, and mineral resources is necessary to promote the best land uses for James City County and contributes to an appreciation of the County's lands and resources. According to research by Gerald Johnson and colleagues, the landscape of James City County is comprised of a series of terraces that descend step-wise in elevation from the York-James Peninsula, 149 feet above sea level in the northwestern part of the County, to sea level along the York, James, Chickahominy rivers and lesser tidal creeks. Each riser, or scarp, of a stair step is an abandoned ancient shoreline and the adjacent flat is the developing floor of a shallow sea or tidal river. Streams have carved valleys into the terraces creating the rolling hills and deep valleys of the County.

Under James City County are more than a thousand feet of sediments deposited in ancient seas, bays, and estuaries. This sediment layer dips gently seaward and rests on metamorphic, igneous, and sedimentary rocks of even greater age, from over two hundred million years to possibly more than a billion years old. The porous beds of sand, shell, and gravel make up the aquifers from which James City extracts most of its water supply. The aquifers are recharged by surface water and water moving down from the west in a process that takes hundreds to hundreds of thousands of years to occur.

James City County has mineral resources for pottery manufacturing, road and construction projects, and agricultural uses. Sand, gravel, and lime, as well as beds rich in minerals and other nutrients are present in the Yorktown Formation and were used by colonists for mortar, walkways, and land applications. Over the years almost all mining efforts have stopped and many of the potential resources have been covered by developments and roads. For additional information and references, see the technical report.

### Effects of Land Use and Protection of Soils

Most County soils are highly erodible, meaning that disturbances can lead soils to wear away and be re-deposited elsewhere, which disrupt drainage patterns and can adversely impact wetland, forest, and wildlife habitat.

Education and regulation are the two primary methods of protecting soils and other natural resources. Soil surveys and other inventories help identify areas that are vulnerable to poor development and land use practices. The County Erosion and Sediment Control regulations, floodplain ordinance, Chesapeake Bay Preservation Ordinance, and other regulations attempt to address development issues regarding soils. The Land Use Map and Zoning Ordinance can also play a role in discouraging land use changes and encouraging proposed land uses to locate on more compatible, well-suited soils. Good stewardship of private property is also helpful in protecting soils. A thorough analysis by a geotechnical engineer or soil scientist is recommended before beginning any construction activity that relies heavily on the engineering properties and characteristics of soils.

### Soil Suitability for On-Site Waste Disposal Systems

On-site waste disposal systems provide sewage removal and treatment for developments that are not connected to public sewer lines. Most systems distribute effluent into the soil through subsurface tiles or perforated pipe into absorption fields. Various factors such as permeability, water table level, depth of impermeable soil layers, and frequency of flooding, impact the absorption rate of the effluent. The *James City County Soil Survey* describes the different soil types of the area and classifies them according to their suitability for septic systems. The three categories in which the survey places the soil types, based on the limitations they create with respect to the use of septic systems, are slight, moderate, and severe.

- *Slight*—Soil properties and site features are generally favorable for septic systems and limitations are minor and easily overcome.
- *Moderate*—Soil properties or site features are not favorable for septic systems and special planning, design, or maintenance is needed to overcome or minimize limitations.
- *Severe*—Soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

The majority of land in the County consists of soils in the “severe” category; however, there are many areas of the County with “severe” soil types which have well-functioning septic systems. While the soil survey may show an area to contain soil not suitable for a septic tank, an on-site inspection may reveal a feasible location within that area that can sustain a septic system. Advanced treatment systems may be an option for property owners who do not have soils suitable for a traditional septic system. For this reason it is important for owners to have an on-site inspection performed before determining whether a specific lot is suitable for an on-site waste disposal system.

### County and State Policies and Regulations for On-Site Waste Disposal Systems

The County and state have several policies and regulations regarding the installation, maintenance, and use of on-site waste disposal systems. Implementation of these regulations, along with proper use and care by property owners, can help minimize the potential harmful effects of waste disposal systems on water quality.

### *County*

The County requires septic drainfields for developments where public sewer is not available, generally anywhere outside the Primary Service Area (PSA). The County does not permit the creation of a new lot without primary and reserve drainfields and approval the Virginia Department of Health (VDH).

The Chesapeake Bay Preservation Ordinance states, "All on-site sewage disposal systems not requiring a National Pollutant Discharge Elimination System (NPDES) permit shall be pumped out at least once every five years." This is the primary means for reducing nutrient loss from septic systems.

### *State*

Any locality may require the installation, maintenance, and operation of on-site waste disposal systems when sewers or sewage disposal facilities are not available. They may also prevent, without liability to the owner, the maintenance and operation of septic tanks or such other means of disposing of sewage when they contribute or are likely to contribute to the pollution of public or private water supplies.

Any on-site waste disposal permit is valid for eighteen months following the date of issuance unless there has been a substantial, intervening change in the soil or site conditions where the septic system is to be located.

### **Farmland, Forestland, and Wildlife Habitat & Soil Infiltration**

Soils in hydrologic groups A and B have the greatest capacity to permit infiltration when thoroughly wet. Conversely, soils in hydrologic groups C and D have the least infiltration capacity. Over two-thirds of James City County soils are included in the latter category. These soils can hold water on the surface for several hours and even days after a storm event. Knowledge of the hydrologic soil group on a property can help estimate runoff from storm events, which can be helpful in the evaluation of sites for certain types of Low Impact Development (LID) features (see Water Quality section below). See *Map ENV-1* for locations of hydrologic soil groups A and B.

### **Farmland, Forestland, and Ecosystems**

Faced with increasing development pressures, James City County currently uses and is developing a variety of tools for protecting open space, contiguous forests, rare, threatened and endangered species, wetland and stream buffers, and other natural resources. In addition there are a variety of measures that landowners can use to protect their property, which are discussed in detail in the Community Character section.

### **Ecosystem**

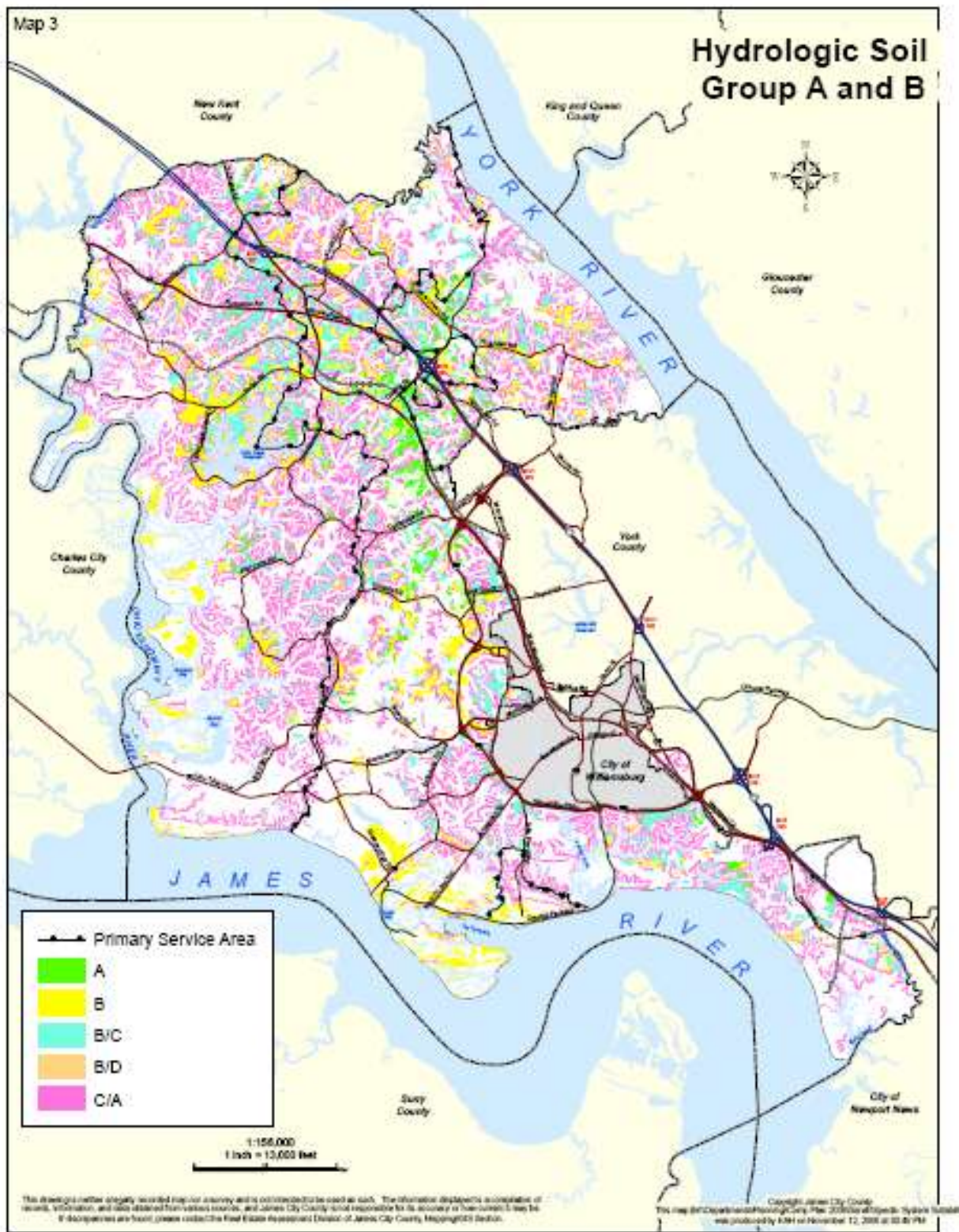
James City County contains a wide variety of ecosystems. The uplands are largely hardwood or pine forest, while the bottomlands are unforested, with the exception of several swamps containing a mixture of bald cypress, black gum, red maple, sweetgum, and bottomland oaks. The County also contains freshwater marshes where plants such as pickerel weed, duck potato, and wild rice grow.<sup>1</sup>

These ecosystems provide important habitat for a wide range of species in the County. Bald eagles are one of the most notable and threatened animals, but many birds rely on the marshes and extensive waterways for food and nesting grounds. Common mammals include the white-tailed deer, foxes,

---

<sup>1</sup> CA Clampitt, Virginia Department of Conservation & Recreation, *Natural Areas Inventory of the Lower Peninsula of Virginia, Natural Heritage Technical Report*, 1992.

Map ENV-1: Hydrologic Soils Groups A and B



beavers, and raccoons. In addition to those larger animals, the forests, marshes, and streambanks are also home to reptiles, amphibians, and insects.<sup>2</sup> Prime examples of lesser known threatened organisms include Mabee's Salamander and the Rare Skipper.<sup>4</sup>

The Virginia Department of Conservation and Recreation's Natural Heritage Division (NHD) collects information on biodiversity and community types. Through this process, the NHD has created an inventory of locations where sensitive ecosystems exist. Priorities for conservation are also set to guide protection of the most important natural areas using a variety of conservation tools including the County's Natural Areas Policy. Refer to the Environment Technical Report for the location of Natural Heritage Sites.

### Farmland

Prime farmland soils, as defined by the U.S. Department of Agriculture, are those best suited to providing food, feed, forage, fiber, and oilseed crops. These soils produce the highest yields with minimal inputs of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland is also very attractive for development projects because the soils are generally the most stable, the topography is relatively flat, the land is suitably cleared, and the ownership is generally consolidated in large parcels. Many of the County's prime farmland soils are developed or intended for development. The loss of agricultural lands to other uses puts pressure on marginal lands, which are generally wet, erodible, or difficult to cultivate. By law, the federal government avoids funding projects that will result in decreases of prime farmland. Careful consideration of prime farmland soils must be given to future land use cases involving conversion. *Map ENV-2* illustrates the location of prime farmland.

### Forestland

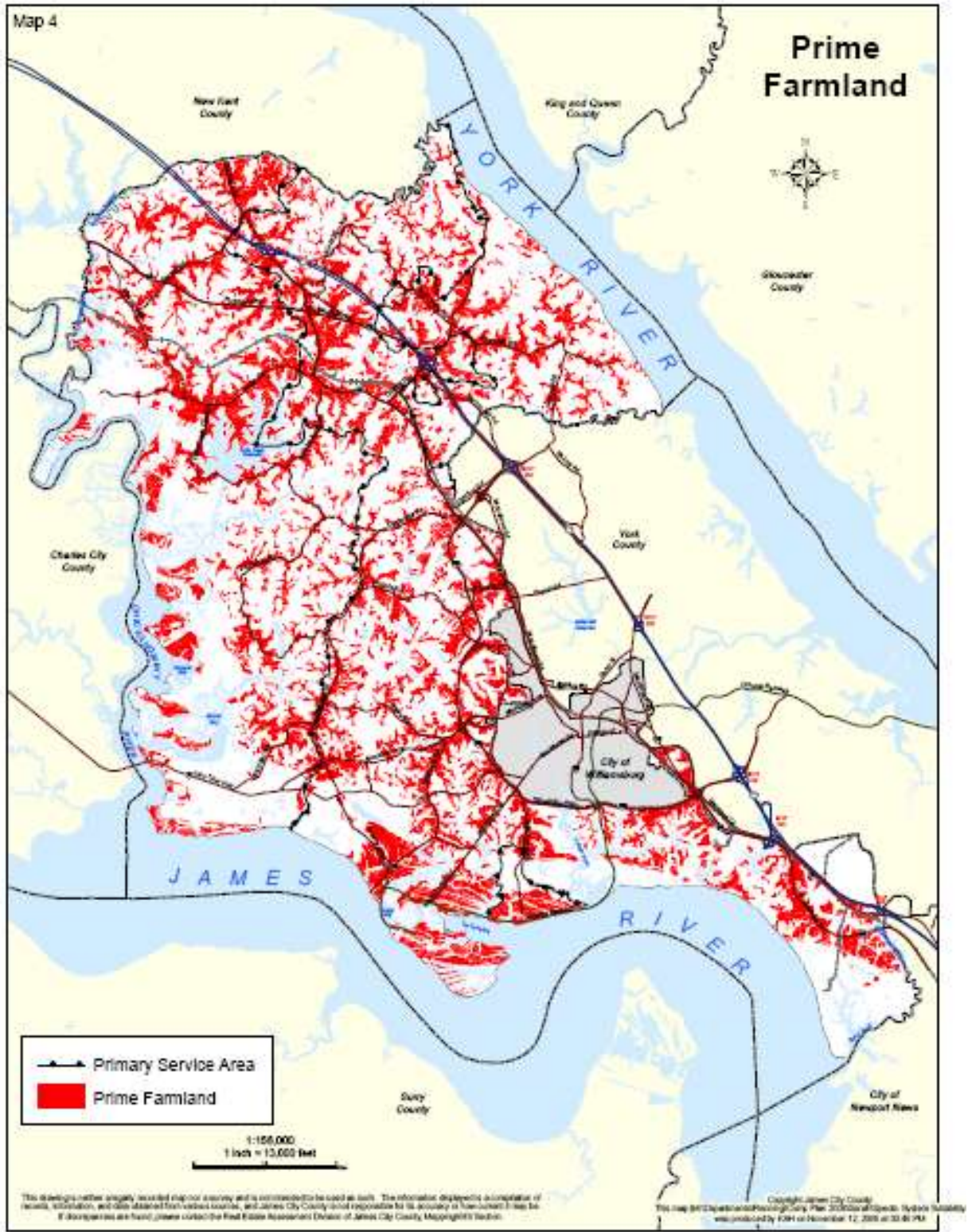
The 2002 Forest Inventory of James City County reveals that 54,150 acres of land in the County (approximately 59% of total land area) are forested. Since 1992, this represents a loss of 17% or 10,816 acres. At present growth rates, further loss of forestland is a major concern. Virtually the entire County has been cleared or farmed several times since 1607. In some cases, high value stands of trees have become established. Low quality and low value stands are typical in other areas. Hardwood stands continue to decrease in quality due to the misapplication of selective cutting practices, which take only the highest quality trees and leave the lowest quality trees.

Forests contribute more than wildlife habitat and timber. Tree roots have been proven to be the best natural device to hold streamside soil in place. Forested riparian buffers (those adjacent to water bodies) are particularly valuable for improving water quality and preserving biological diversity. These forested areas filter runoff before it enters the waterway, stabilize eroding soils, and provide wildlife habitats for many sensitive species. Deforestation that is not part of an overall forestry management plan, such as that typically associated with development, is a significant environmental and aesthetic concern and impacts the County's wooded character.

---

<sup>2</sup> Virginia Department of Game and Inland Fisheries, Fish and Wildlife Information Service, <http://vafwis.org/fwis/?Menu=Home>.

Map ENV-2: Prime Farmland



## Shorelines

### General Description of James City County Shorelines

In 1998, James City County commissioned the Hampton Roads Planning District Commission (HRPDC) to write the *James City County Comprehensive Plan Shoreline and Groundwater Element* to meet comprehensive plan requirements of the Chesapeake Bay Preservation Act and for use in development of the 2003 County Comprehensive Plan.<sup>3</sup>

As stated in the report, James City County is divided into two major drainage basins or watersheds, the James River watershed and the York River watershed. Of the 100 miles of total shoreline in the County, about 17 are in the York River watershed. The James River and its associated tributaries, including the Chickahominy River, make up the largest portion of the County's shorelines.

The health of the County's shorelines can be determined by examining their specific conditions, such as erosion rates and flushing characteristics. Along the majority of the shoreline, erosion ranges from zero to two feet per year. Most remains in its natural unaltered state, as opposed to having an artificial erosion control structure, such as a bulkheading, breakwaters, and riprap structures along its bank. The following brief inventory of the County's shoreline conditions should be used in conjunction with the HRPDC's study to develop policy for protecting County shorelines and for meeting Chesapeake Bay Preservation Act requirements.

### Erosion

Erosion rates provide a relatively simple and concise tool to measure and compare the cumulative impacts of natural and human effects on the shoreline. As such, this information has various applications for land use planning and decision-making. It can assist the local or regional planner in determining appropriate locations for future development and redevelopment, and the most appropriate methods for addressing erosion issues. For example, where data identifies a shoreline area to be in a state of "severe erosion" (greater than or equal to three feet per year), this information can be used to develop appropriate building setback policies and/or to direct shoreline development to areas which are experiencing less intense erosion. Likewise, this data, in conjunction with sensitive living land or aquatic resource data, can serve as a good information base that planners, resource managers, and local elected officials can use to make sound recommendations or decisions. Erosion rate information can also provide local wetlands boards with quantitative data upon which they can partially base permit approvals and denials, to suggest to the applicant the most appropriate erosion control options to address the problem, and to assess potential impacts on adjacent properties or properties down-drift or up-drift if those options are implemented.

Generally speaking, for enhancing water quality and aquatic habitat, vegetative and non-structural forms of erosion control, also known as living shorelines, are preferred over other forms of shoreline stabilization. However, non-structural forms of erosion control are not effective at shoreline stabilization as wave energy increases and erosion becomes more severe. For the more exposed shorelines of the Colonial National Historical Park along the James River, the Shoreline Management Plan developed by VIMS recommends the use of bank re-grading and beach stabilization with vegetative plantings and breakwaters. This technique has already proven successful in other areas of the County. Where shoreline stabilization is necessary, a unified area approach, rather than an

---

<sup>3</sup> Hampton Roads Planning District Commission, *James City County Comprehensive Plan Shoreline and Ground Water Element*.

individual site-by-site approach, is recommended. When such an approach is taken, individual costs can be reduced and increasing erosion problems for neighboring properties can be avoided. It is important to note that often a combination of these methods is necessary.

The James City County Shoreline Situation Report notes that severe erosion is generally limited to the James River shoreline north of Jamestown Island. Erosion along other parts of the James River and along the York River is moderate, though more prevalent along the James. Tributary creeks to the York River appear to be stable; however, tributary creeks to the James River appear to be eroding.

#### Natural (Unaltered) Shoreline Features

In general, the following types of natural shoreline features existed in the County at the time inventories were conducted by the Virginia Institute of Marine Science (VIMS 1995): fringing intertidal marshes, extensive intertidal marshes, supratidal marshes, fresh water marshes and swamps, sheltered and exposed tidal flats, coarse sand beaches, and sheltered and exposed fine sand beaches. Unaltered shorelines, in particular tidal wetland areas or marshes, absorb wave energy and buffer erosion of upland areas. Unvegetated tidal flats and beaches are considered tidal wetlands, despite the lack of vegetation present. Nontidal wetland areas are also important for flood control purposes. These features, in an unaltered state, have many critical water quality functions; therefore, knowing where they exist and their relative size, health, and role in water quality protection is important. This knowledge can be integrated into the planning process so that recommendations for future land use and development do not impact them negatively or can be minimized. In addition, many of these features have intrinsic value in terms of their aesthetic nature or the recreational and open space opportunities they present. They can also be important habitat areas. Recognizing these areas and developing effective management strategies to protect them should be an important part of the planning process.

#### Altered Shoreline Features

While the cumulative impacts of placement of shoreline erosion control structures (bulkheading, breakwaters, and riprap structures) and water access points are generally not considered by local governments or permitting agencies, they can present a very real threat to water quality. Inappropriate or unnecessary shoreline erosion control techniques can potentially exacerbate erosion at the site, and/or create an erosion problem on an adjacent property or downdrift or updrift areas. Additionally, shoreline erosion controls can create an unsuitable environment for the persistence of wetlands, submerged aquatic vegetation, and beaches. As a result, water quality can be degraded either locally or on a regional level.

The James City County Wetlands Board reviews and permits structures to ensure a shoreline project is justified based on environmental merits, and it stresses that riprap structures are more environmentally beneficial than bulkheads. Boating activities and development of associated water access and use areas can also degrade water quality, exacerbate natural shoreline erosion rates, and potentially harm sensitive land and aquatic living resources found in those areas.

Through comprehensive shoreline planning, inventories of unaltered and altered shoreline features, sensitive living resources, oceanographic characteristics, and adjacent land use designations can be created and their interrelationships examined in both a pre- and post-erosion control structure placement context. In doing so, it can be determined whether or not an erosion problem truly exists and, if so, what factors are responsible for the problem and what measures are most appropriate to

relieve the problem. In addition, any potential updrift or downdrift impacts can be analyzed. Regardless, it should be remembered that erosion control structures are a temporary fix and, if they are not the most appropriate for a given situation, they can be extremely expensive in the long-term to the property owner and even the community at large.

The goal of shoreline protection should be to direct future development or redevelopment away from shoreline areas which are identified as critically eroding, and to areas where suitable access can be developed without degradation of water quality or living resources.

### **Bathymetry**

James City County Comprehensive Plan Shoreline and Groundwater Element, the Chesapeake Bay region contains one of the fastest growing populations in the United States. Associated with this increase in population has been a rapid rate of both upland and shoreline development, which is considered to be one of the primary causes of increased overall sediment loadings into the Bay, its larger tributaries and, its smaller tidal creeks. Land clearing practices and the creation of impervious areas through development activities has led to an increase in stormwater runoff and sediment transport. In addition, valuable tidal wetland areas which trap sediment before they reach the water provide a buffer for wave-induced shoreline erosion, have been lost. Due to this increased sediment transport and deposition and natural erosion processes, a large number of tidal creeks that once contained navigable depths at mean low water (MLW) are now impassable at low tide, impeding recreational use of these waterways.

In order to maintain access to tidal creeks that historically have been used for boating activities, it is often necessary to conduct maintenance dredging, which can be very expensive. Proper disposal of dredge material can be a problem, too particularly when the material is contaminated. Dredging activities can disturb extremely productive habitats and be detrimental to sensitive living resources. Comparing historical and current bathymetric data for a given waterway can identify shoreline areas with water depths that are adequate to accommodate desired boating activities, not only for the present but also into the future. Therefore, integrating bathymetric data into the planning process in order to determine future recreational access areas will ensure that new access points are located in areas where dredging can be minimized or altogether avoided.

### **Flushing Characteristics and Current Patterns**

The circulation of water in a water body is perhaps the most important factor governing the response of coastal ecosystems to environmental disturbance. This characteristic should be a predominant consideration and controlling factor in the type and intensity of land uses permitted along the adjacent shoreline and their related water uses. In a tidal river or estuary, pollutants released into the water are transported upstream as well as downstream from the discharge point. Tides serve to flush out contaminants in many estuaries and a rapidly flushing estuary can potentially take in more point and nonpoint source pollutants than a slow-flushing estuary.

When excessive amounts of nitrogen and phosphorus are introduced to coastal and estuarine waters from the surrounding watershed, eutrophication is accelerated. Excessive nutrient loading can cause algae blooms, decreased water clarity, and declines in submerged aquatic vegetation (SAV) beds, which are important shellfish and finfish habitats. As phosphorus binds to sediment and accumulates, it may be transported away from the point of entry through tidal circulation. This is significant for future development because even low intensity development along shoreline areas can result in the

disruption of flushing characteristics and interfere with proper assimilation of nonpoint source pollutants.

Significant change in the natural water flow patterns should be avoided by controlling structures and excavations in the water basin. The ecological disturbance potential increases as the water body becomes smaller or as the flushing rate drops. This is important in planning general land uses, but is specifically critical in assessing waterways for appropriateness for the development of water access facilities, such as marinas.

### Resources

Rivers and wetlands are important resources in James City County. These areas and the associated living organisms <sup>4</sup> provide an abundance of benefits to the region and should be protected.

#### Tidal Wetlands

Tidal marshes are ecologically important and valuable for flood and erosion control qualities. The *James City County Tidal Marsh Inventory* reported 7,028 acres of tidal marsh in the County in 1980. According to U.S. Fish and Wildlife Service, there are seven “priority wetland areas” in the County and the *Chesapeake Bay Local Assistance Manual* identifies two additional areas. VIMS documented 129 tidal and nontidal wetland sites in 1995, for an estimated acreage of 33,649 acres. Protection of wetlands is an important strategy for deterring erosion of shorelines. See the Technical Report for an illustration of all wetland locations in James City County.

#### Submerged Aquatic Vegetation (SAV)

SAV beds are critical living resources and can be degraded by land use activities that contribute excessive pollutants into adjacent waterways. Boating activities can also significantly impact SAV. Adjacent land use intensity and private pier and dock development allowed through zoning and subdivision laws can permit or restrict boating activity along certain waterways where SAV beds exist or have the potential to grow. Additionally, shoreline structures themselves can negatively impact submerged aquatic vegetation by reflecting wave energy and blocking available sunlight.

#### Shoreline Access

Demand for shoreline access is expected to increase by 25% from 2000 levels by the year 2010, creating a deficit for such access. James City County recently purchased Chickahominy Riverfront Park and Jamestown Campground, but shoreline access will need to continue to increase while mitigating the impacts that such activity has on water quality.

#### Marinas

Any form of shoreline access may potentially impact water quality in some way. The magnitude of the impact will depend on the type of access, with marinas presenting the greatest impacts. Marinas can potentially impact water quality in the following ways:

- Resuspension of bottom sediments;
- Discharge of sanitary wastes from shoreside facilities and boats;
- Transportation of nonpoint source pollutants in stormwater runoff from impervious surfaces;
- Discharge of oil, fuel, and pollutants associated with boat engines and maintenance;

---

<sup>4</sup> Biota are all living organisms

- Decrease in water circulation and aquatic habitat due to built structures;
- Increase in risk potential for spills due to proximity to water resources.

Marina owners can learn about designing or retrofitting their facilities to incorporate environmentally sound practices that address runoff, maintenance activities, sanitary facilities, and spill prevention plans through the Virginia Clean Marina Program.

The construction and operation of boat ramps will have many of the same impacts on water quality as marinas, but usually to a lesser degree. Compared to marinas and boat ramps, non-motorized boating access, such as canoe or kayak access, presents few adverse impacts to water quality. Potential impacts from pier and bank fishing and pedestrian access are minimal, with the exception of the construction of docks and piers and fish cleaning activities.

#### Piers and Docks

As of 1993, overall pier and dock density along the County's shoreline was 0.19 piers and docks per 1,000 linear feet, with higher pier densities found in Powhatan Creek, Powhatan Shores, and the Chickahominy Haven area. While the individual impact of private piers and docks may be minimal, the cumulative impacts to the surrounding aquatic ecosystem may be significant, particularly in high densities. Virginia's Clean Marina Program can educate private owners on pier and dock dimensions, building materials, and other ways to preserve Virginia's waterways.

Clustering development away from shorelines can retain the waterfront area as community open space and provide a community pier. Larger minimum lot sizes for waterfront property can reduce the concentration of piers and docks and thereby disperse their impact.

#### **Water Quality**

##### Surface Water Quality and Monitoring

Waterways are a vital part of James City County's environment. The rivers and creeks provide habitat, natural beauty, and a place to recreate. It is important to ensure that these water bodies are vibrant and healthy.

##### 303d Impaired Waters and Total Maximum Daily Load (TMDL) Program

In response to requirements under the Federal Clean Water Act, the Virginia Department of Environmental Quality (DEQ) tests Virginia's rivers, lakes, and tidal waters for pollutants. Over 130 different pollutants are monitored annually to determine whether the waters can be used for swimming, fishing, and drinking. Waters not meeting water quality standards are included in the 303(d) Impaired Waters Report.

Similar to other communities in Virginia, most of James City County's waterways are included in the Virginia Water Quality Assessment 305(b)/303(d) Integrated Report. Each impaired waterway requires that DEQ establish a total maximum daily load (TMDL), which represents the amount of a pollutant that the waterbody can contain and still meet water quality standards. The TMDL also identifies the probable sources of the pollutants in question. To restore water quality, pollutant levels in an impaired waterway need to be reduced to the TMDL amount. Following development of a TMDL, a cleanup plan describing the ways to reduce pollution levels in the waterway, must be outlined. This plan is developed by the state with input from the local government and other

interested stakeholders. The final step in the cleanup process is to implement the best management practices established in the plan.

The County's waterways included in the Virginia Water Quality Assessment 305(b)/303d Integrated Report along with the type of impairment and the schedule for development of a TMDL are listed in the following table.

*Table ENV-1: Impaired Waterways*

<b>Name of Waterbody</b>	<b>Type of Impairment</b>	<b>TMDL Deadline</b>
Chickahominy River	Enterococcus (bacteria)	2020
College Creek	Enterococcus (bacteria)	2018
Diascund Creek	Escherichia coli (bacteria)	2020
Diascund Creek	Dissolved Oxygen	2020
Gordon Creek	Estuarine Bioassessments	2018
James River Mainstem	Estuarine Bioassessments	2016
James River Mainstem	Chloride	2020
Little Creek Reservoir	Dissolved Oxygen	2020
Mill Creek (Diascund Cr)	Fecal Coliform	2016
Mill Creek (Diascund Cr)	Dissolved Oxygen	2016
Powhatan and Mill Creek (James River)	Enterococcus (bacteria)	2010 - in development
Powhatan Creek	Benthic - Macroinvertebrates	2014
Skiffes Creek	Fecal Coliform	2010 - complete
Skimino Creek	Fecal Coliform	2010
Taskinas and Ware Creek	Fecal Coliform	2010
Skimino Creek	Fecal Coliform	2010
York River	Fecal Coliform	2010

*Source: 2008, 303(d) Impaired Waterways Report*

#### Citizen Water Quality Monitoring

In order to engage the public more fully in water quality issues and gather baseline water quality information, the County established a volunteer-based, citizen water quality monitoring program in 2008. Volunteers participating in this program gather data on the benthic macro-invertebrates living in the non-tidal portions of the County's eleven watersheds. The Virginia Citizen Water Quality Monitoring Program Methods Manual considers benthic macro-invertebrates good indicators of water quality since they have the following characteristics:

- are affected by the physical, chemical, and biological conditions of the stream;
- show the effects of short and long-term pollution events;
- may show the cumulative impacts of pollution;
- may show impacts from habitat loss not detected by traditional water quality assessments;

- are important in the food web of the stream;
- have a range of tolerances to pollution; and
- are relatively easy to monitor.

### Impacts of Land Development on Water Quality

Urbanization has a profound influence on stream quality. These impacts are readily seen when a stream in an older urban area is compared to one located in a more natural setting.

### Changes in Watershed Hydrology

The hydrology of a stream changes in response to initial site clearing and grading. Trees that had intercepted rainfall are cleared and natural depressions which had temporarily held water are flattened. The thick humus forest layer that once absorbed rainfall is scraped off and erodes away. Having lost much of its natural storage capacity, the cleared and graded site can no longer prevent rainfall from being rapidly converted to runoff.

Once construction is completed, rooftops, roads, parking lots, sidewalks, and driveways make much of the site impervious to rainfall. Unable to percolate into the soil, rainfall is almost completely converted into runoff. The excess runoff becomes too great for the existing waterways to handle. As a result, the natural drainage network must be managed to direct and convey the runoff away from the site by installing culverts, curbs, gutters, storm sewers, or lined channels.

### Impervious Cover Model

Recent research by the Center for Watershed Protection has revealed a strong relationship between impervious cover (roofs, streets, parking lots, etc.) and various indicators of stream quality. Studies have established that a link between impervious cover and stream condition typically shows that impacts to a stream fall into four general categories: hydrologic impacts, geomorphic impacts, water quality impacts, and biological impacts. More specifically, when natural land is converted into impervious cover, a greater fraction of annual rainfall is converted into surface runoff and a smaller volume recharges the groundwater. This increased surface runoff volume causes higher peak flows that can erode stream channels and lower baseflow, resulting in habitat degradation. In addition, surface runoff carries pollutants that degrade water quality. Research also suggests a link between impervious cover and the diversity, richness, and abundance of aquatic life.

Based on the relationship between impervious thresholds and stream quality, the Center for Watershed Protection constructed a simple urban stream classification scheme known as the Impervious Cover Model. The model serves as a planning tool to screen the condition of a watershed based on existing impervious cover. The model also provides a classification system with management options to address the protection and mitigation needs of a watershed and predicts the existing and future quality of streams based on the measurable change in impervious cover. The Impervious Cover Model was used in the creation of the Yarmouth Creek and Powhatan Creek watershed management plans and will be useful in the creation of future watershed management plans. In order to protect the local waterways, the James City County Environmental Division requires that new developments have no more than 60% impervious cover.

### Degradation of Aquatic Ecosystems

The aquatic ecosystems in urban headwater streams are particularly susceptible to the impacts of urbanization. The massive shift from the natural flows and channel conditions reduces the habitat value of the stream. The cumulative impacts of many individual factors such as sedimentation, scouring, increased flooding, lower summer flows, higher water temperatures, and pollution are responsible for the progressive degradation of urban stream ecosystems.

### Impacts of Urban Pollutants on Receiving Waters

The net effect of land development is to increase pollutant export (more pollution and more movement) over pre-development levels. The impact of the higher export is felt not only on adjacent streams, but also on downstream receiving waters such as lakes, rivers, and estuaries. Urban impacts include sediment and nutrient loading, increased bacteria, increased oxygen demand, oil and grease pollution, high levels of chlorides, and damaging thermal fluctuations.

### Impact on Tidal Areas

The potential impacts of impervious cover on tidal streams are numerous. Researchers from various parts of the country have studied the impact of urbanization on coastal areas and estuaries. Increased volumes of stormwater runoff may also have a physical effect on important wetland resources. According to the Impervious Cover Model, coastal/estuarine systems, such as shellfish beds and wetlands, have found increased degradation thresholds when impervious cover exceeds 10%. Decreases in water quality due to pollutant loading may have an adverse impact on valuable spawning habitat and on the ability of some fish to travel from sea to freshwater spawning grounds.

### State and County Quality Improvement Strategies

#### Chesapeake Bay Preservation Ordinance

On August 6, 1990, James City County became the first locality to implement the requirements of the Chesapeake Bay Preservation Act (Bay Act). Due to the region's geography and environmental sensitivity, the Bay Act and regulations are of particular local importance, and James City County responded by designating all County land as a Chesapeake Bay Preservation Area. The Chesapeake Bay Preservation Area has two components, resource protection areas (RPAs) and resource management areas (RMAs). The RPA consists of lands at or near a shoreline that have water quality value due to the ecological and biological processes they perform, or are sensitive to impacts which may result in significant degradation to the quality of state waters. RPAs include tidal wetlands, tidal shores, nontidal wetlands (connected by surface flow and contiguous to tidal wetlands or to perennial streams), and a 100-foot-wide buffer adjacent to and landward of other RPA components. In James City County, the RMA is any land not classified as an RPA (i.e., the remainder of the County). Lands of particular sensitivity include, but are not limited to, floodplains, steep slopes, highly erodible soils, highly permeable soils, and hydric soils. See *Map ENV-3* for the location of RPAs.

In addition, the James City County Chesapeake Bay Preservation Ordinance prohibits land disturbing activities on slopes 25% or greater, limits impervious cover to 60% of a site, and requires the preservation of existing trees (except in impervious areas) over 12 inches in diameter at breast height. Development in the RPA is only allowed if it is water dependent or constitutes redevelopment. All existing vegetation within the RPA is to remain in its natural undisturbed state, except vegetation weakened by age, storm, fire, or other natural causes. For all development, a clearing plan and an

Map ENV-3: Resource Protection Areas



environmental inventory is required which shows the locations of existing trees, RPA components, and lands of particular sensitivity as outlined earlier. RPA areas are also verified during plan review.

#### Low Impact Development

The Low Impact Development (LID) approach consists of combining hydrologically functional site design with pollution prevention measures to reduce site and development impacts and compensate for the degradation of water quality. The ultimate goal of LID is to maintain a developed site's stormwater runoff, peak runoff rates, and frequency to imitate pre-development runoff conditions at the source, rather than just at the end of pipe (wet and dry pond) treatment. LID, in theory, should maintain predevelopment hydrology.

#### Open Space Design Principles

Otherwise known as Better Site Design, open space design principles are development principles for new residential subdivisions or commercial developments that focus on reducing impervious cover, conserving natural areas, and using natural hydrology. This tool can be used to concentrate development on one part of a site to protect conservation or environmentally sensitive areas. The County's Local Site Planning Roundtable was a consensus building process initiated in 2003 by the Builders for the Bay (Center for Watershed Protection, the Alliance for the Chesapeake Bay, and the Peninsula Housing and Builders Association) and James City County. Recommended Model Development Principles for James City County, Virginia were developed, which include suggestions for general and specific policy and ordinance revisions to increase the flexibility for site design standards while promoting the use of open space and flexible design development.

#### Powhatan Creek Watershed Management Plan

The 22-square-mile Powhatan Creek watershed, which discharges into the James River near Jamestown Island, is a state and national treasure with an historic past and significant biodiversity. Rare, threatened, and endangered organisms such as the small whorled pogonia, Virginia least trillium, bald eagle, and heron colonies are found here. Continued development pressures, however, threaten the vitality of the watershed. In November 2001, the James City County Department of Development Management completed a watershed study for Powhatan Creek to help prevent further degradation of water quality and maintain stream integrity using land use, conservation tools, and stormwater management. The Board of Supervisors adopted the eight goals and 21 priorities associated with the Powhatan Creek Watershed Management Plan by resolution dated October 10, 2006.

#### Yarmouth Creek Watershed Management Plan

Yarmouth Creek is a predominantly forested watershed of about 12 square miles located in the lower James River Basin. The Creek drains into the Chickahominy River, which discharges into the James River. A recent natural areas inventory classified almost half of the watershed as moderate to high in terms of biodiversity present. The watershed contains extensive complexes of wooded swamp, freshwater wetland, and rare tidal freshwater marsh which support at least one heron rookery and seven globally rare or state rare species among other flora and fauna. The Board of Supervisors adopted the six goals and 14 priorities associated with the Yarmouth Creek Watershed Management Plan by resolution dated October 10, 2006.

#### Gordon Creek Watershed Management Plan

Gordon Creek is a 13.8-square-mile watershed situated in the west central portion of the County. The Creek drains to a large tidal freshwater marsh which enters the Chickahominy River near its

confluence with the James River. The watershed is primarily forested with low impervious cover and large parcels, but is facing moderate development pressure. Development of a watershed management plan is currently underway. Citizen participation will play a key role in this process in order to balance environmental goals with property rights.

#### Watershed Plan Implementation

The watershed management plans have various priorities associated with them. Some of the priorities are global in scope while others are site specific. Priorities are implemented on a site-by-site basis when parcels are developed. See *Map Env-4* for an illustration of watershed locations.

#### MS4

James City County is required to have a Virginia Stormwater Management Program (VSMP) permit to discharge stormwater into local waterways. The specific permit is referred to as the Municipal Separate Storm Sewer System (MS4) General Permit and is issued by the Virginia Department of Conservation and Recreation (DCR).

The permit requires the County to develop a stormwater management program that addresses six specified minimum control measures. The six used in the County's program include the following:

1. Public education and outreach on stormwater impacts
2. Public involvement/participation
3. Illicit Discharge Detection and Elimination (IDDE)
4. Construction site stormwater runoff control
5. Post-construction stormwater management in new development and redevelopment
6. Pollution prevention/good housekeeping for municipal operations

New permit language effective in 2008, also requires the County to implement the management practices identified in any TMDLs or TMDL Implementation Plans for impaired waterways within the County. As noted in *Table ENV-1*, a TMDL has been developed for Skiffe's Creek and is under development for Powhatan and Mill Creeks. Development of an implementation plan for Powhatan and Mill Creeks is scheduled to begin in 2009.

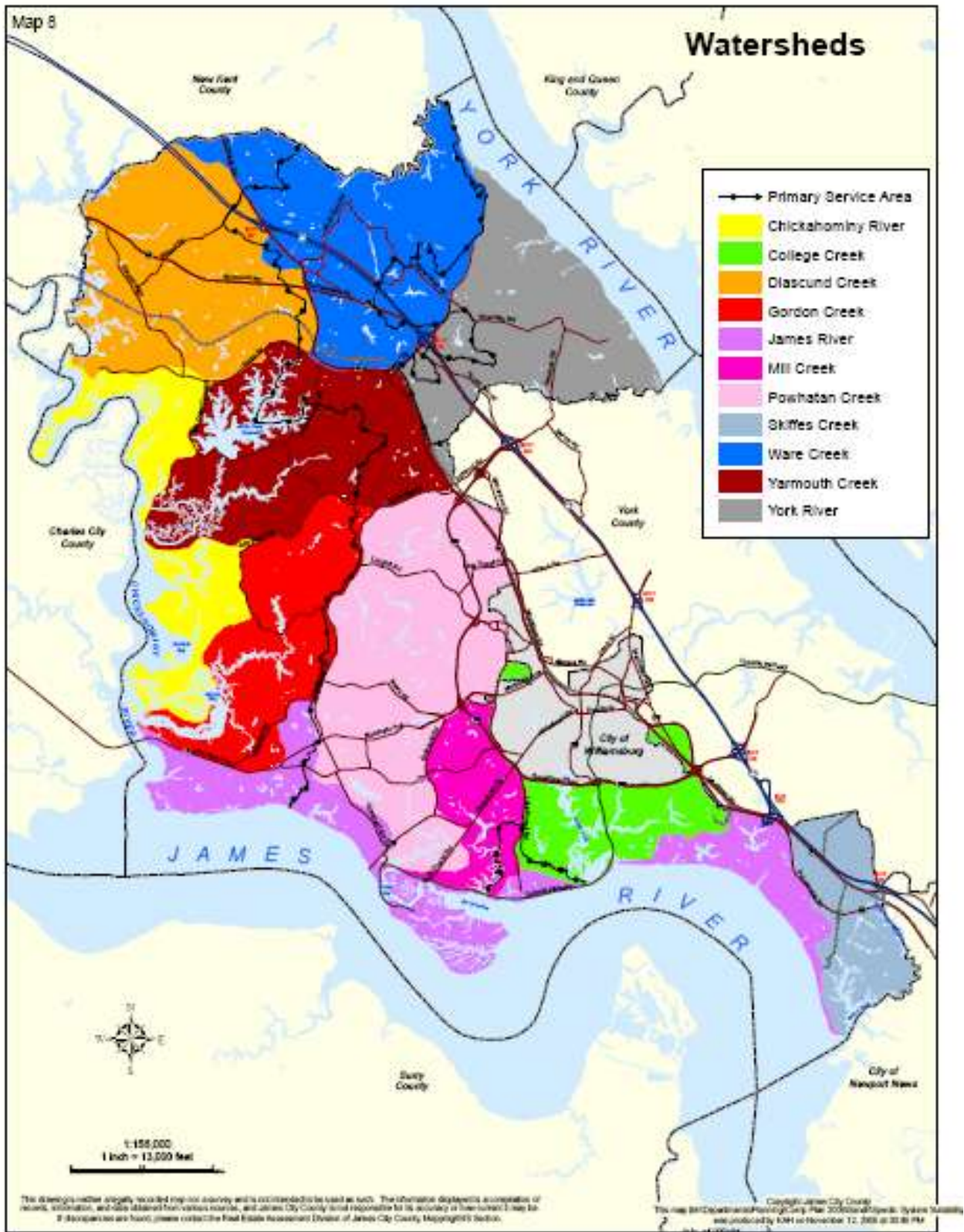
#### PRIDE

PRIDE, or Protecting Resources in Delicate Environments, is the educational component of the County's water quality program. The goal of PRIDE is to improve water quality in by explaining the importance of watershed protection and providing residents, businesses, and neighborhoods with specific watershed restoration and protection tools.

#### Impacts of Agriculture on Surface Water Quality

Pollution which cannot be traced to a direct source such as a particular factory is referred to as nonpoint source (NPS) pollution. Agriculture-related pollution falls into this category, although James City County has less agricultural activity than other parts of Virginia. Three types of contaminants generally occur as a result of agricultural activities: nutrients, sediments, and toxicants. To learn more about these contaminants, refer to the Glossary.

Map ENV-4: Watersheds



### State Policy

Virginia has a responsibility under its constitution to protect its waters from pollution. Agriculture is one possible land use which may contribute pollution to the state's water systems. In accordance with the Chesapeake Bay Preservation Act and other regulations, the DCR Chesapeake Bay Local Assistance Division helps local governments, Soil and Water Conservation Districts, and individuals protect waterways from pollution through technical and financial assistance made available through grants provided by the Chesapeake Bay Preservation Fund.

The state also provides further financial incentives in the form of tax relief for those conscientious about reducing pollutants in their farming efforts. Any individual engaged in agricultural production for market that has an approved soil conservation plan in place may receive tax credits.

### County Policy

The primary means by which the County directly seeks to make improvements in water quality is through the Chesapeake Bay Preservation and Erosion and Sediment Control ordinances.

The County's Chesapeake Bay Preservation Ordinance requires that agricultural buffers be managed to prevent concentrated flows of surface water from breaching and noxious weeds from invading the buffer area. The ordinance also sets a goal of 40% reduction in nonpoint source pollution from agricultural uses. To help achieve this goal, the ordinance states that land used for agricultural activities shall have a soil and water quality conservation plan based upon the *Field Office Technical Guide* of the U.S. Department of Agriculture Soil Conservation Service.

### Strategies for Reducing Negative Impacts of Agriculture on Water Quality

Many strategies exist which would be helpful for alleviating the impact of agriculture on water quality in the County. Agricultural best management practices, erosion control measures, and other nutrient reduction strategies all work together to improve water quality. James City County is a partner with the Colonial Soil and Water Conservation District to support the use of tools for decreasing the impact of agricultural practices. More information about these tools is available in the Technical Report.

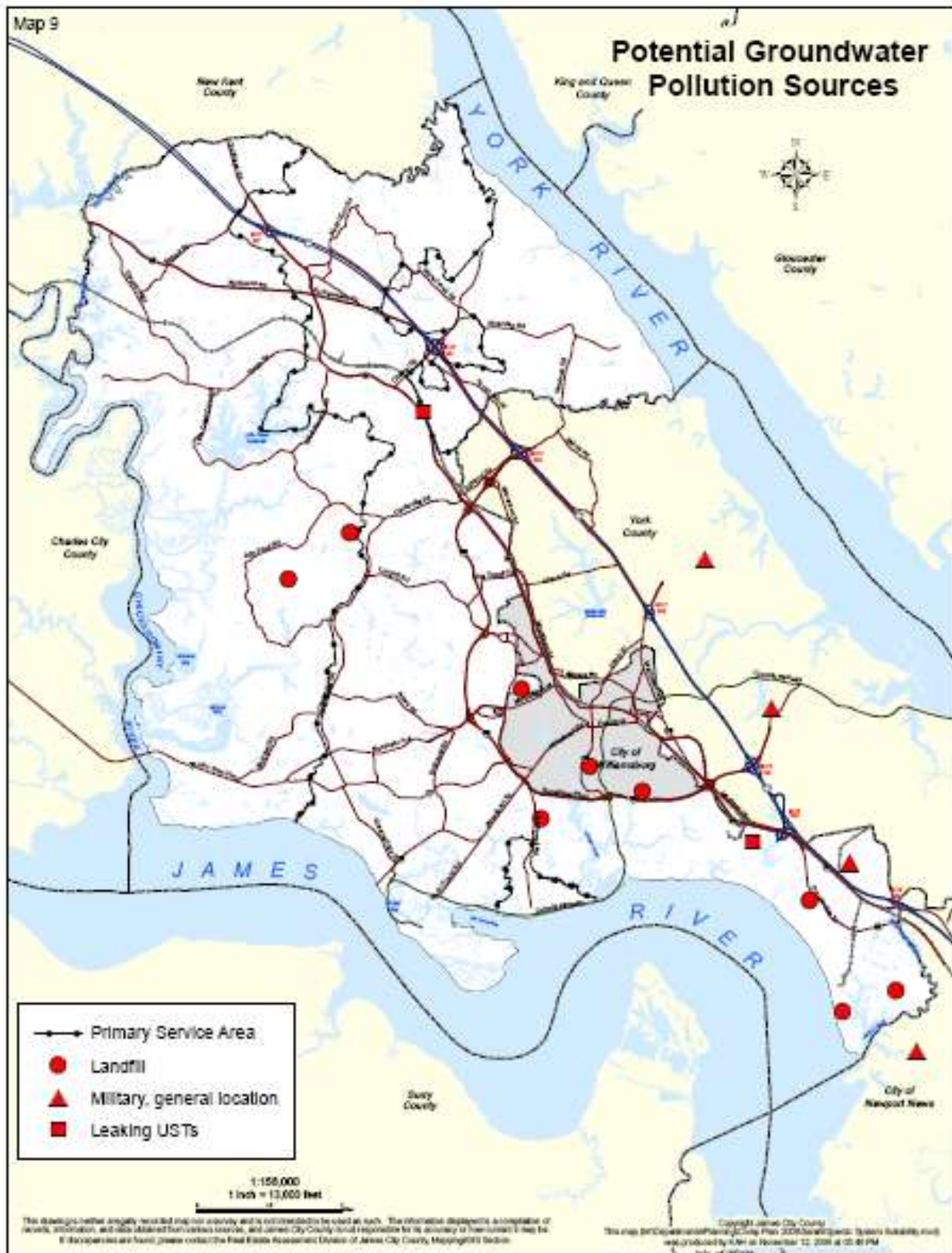
### Ground Water

James City County has access to relatively large quantities of water, but not all of it is potable. In addition, some of the surface water is difficult and expensive to treat, while ground water withdrawals have led to lower aquifer levels. The County is particularly vulnerable to water pollution because of its reliance on ground water sources and increasing population. Erosion, failing septic tanks, underground storage tanks, and pesticide and fertilizer runoff are just some of the hazards to surface and ground water quality.

### Potential Ground Water Pollution Sources

The VDH notes that there are few known problems with the quality of the ground water monitored in James City County. Two known problem categories include wells that produce water with naturally occurring substances in concentrations that are above established limits for human consumption, and private wells with unknown construction histories or locations adjacent to potentially harmful land uses. In addition, there are several potential ground water pollution sources that need to be monitored, including landfills, military facilities, and leaking underground storage tanks. See *Map ENV-5* for the location of potential groundwater pollution sources.

Map ENV-5: Potential Groundwater Pollution Sources



### Ground Water Management

Regulatory programs relating to ground water protection can be found at federal, state, and local levels. The state has created the Virginia Ground Water Protection Steering Committee (GWPC) to assess current problems, identify program needs, and set priorities for new ground water protection programs. The state administers programs addressing at least three of the major concerns for ground water identified by the GWPC, including landfills, pesticides, and underground storage tanks. James City County has also implemented a range of water quality protection ordinances in an effort to minimize the impact of current and future land development on water quality.

The County has actively participated in the HRPDC's Regional Groundwater Mitigation Program since 1990. This program provides ground water hydrology and computer modeling expertise and technical support to participating local governments.

### Potential Ground Water Management Alternatives

Appropriate ground water management options in James City County vary significantly based on the aquifer in question. County residents draw water from several different aquifers, each of which is susceptible to different sources of contamination. The James City County Ground Water Element Technical Guide should be consulted for more detailed information concerning these different aquifers. Several programs are employed by the County to help manage ground water:

*Enhanced Data Collection-* The normal monitoring of public wells, which are distributed throughout the County, provides comprehensive water quality data for public wells and the great majority of private wells. A substantial amount of water provided by the James City Service Authority (JCSA) and most private wells draw from the Piney Point Aquifer. The following are some data collection options to establish a formalized ground water data collection process for the County.

- **Private Well Inventory** – An assessment of withdrawal amounts, data on the location of private wells, and help pinpointing which residents are most susceptible to known sources of contamination.
- **Inventory of Abandoned Wells** – A database of the locations of wells that are no longer used, based on existing records, is being established. This would enable the County to provide useful information for future development near these locations.
- **Ground Water Data Clearinghouse** – The JCSA is responsible for tracking pertinent ground water data for the County. A database would allow the County to more quickly assess cumulative land use impacts on ground water and track ongoing contamination problems or threats.

*Wellhead Protection Program-* The term “wellhead protection” refers to a process for assessing land uses and activities that could pose potential threats to ground water, managing land uses and activities in close proximity to wells, and taking steps to avoid future potential conflicts between land use and ground water quality. The JCSA has already undertaken components of a wellhead protection program that include compiling a list of public and private wells, mapping the location of each public well, and prioritizing wells for protection activities.

The County should continue to enforce construction standards for public and private wells. Of particular concern are abandoned wells that predate construction standards. A mitigation plan is in

place that provides property owners with financial compensation for abandoning old wells that are no longer functional. The JCSA has a well abandonment program to provide financial incentives for private well owners to locate and properly abandon wells no longer in use.

*Cap It Program-* Cap It is a County groundwater protection program to protect resources from contamination via unused or improperly abandoned private wells. It also reduces the threat to humans and animals that may become trapped in an open, unused well.

*Design Standards-* Design standards are used to regulate the design and construction of various land use activities. Design standards usually apply to the installation and construction of physical structures such as double-walled underground storage tanks, runoff collection systems, and stream or ditch channels. Many existing state and federal statutes already dictate design standards, and therefore many of these are already in use in the County. When used in coordination with site plan review, special use permits, or proffered rezonings, design standards can be an effective technique in preventing ground water contamination in wellhead areas.

*Operating Standards-* Operating standards are procedures to prevent pollution during the normal activities of land use, such as procedures for pesticide application or management of hazardous substances. Ground water protection operating standards could include the use of Best Management Practices (BMPs). BMPs are useful for preventing contamination from industrial or commercial activities, particularly those involving the storage and handling of hazardous materials. Some standards include restrictions on hazardous materials storage or disposal, limits on the use of road salts and de-icing chemicals, and requirements for periodic testing and system checks.

*Public Education-*In addition to its participation in the HRPDC's Ground Water Education program, the County could augment its educational effort by teaching private well owners about the threats to their personal ground water supply from septic systems, household hazardous waste, and improper lawn chemical application, as well as basic water conservation techniques. If BMPs are implemented, the County should continue its education program, specifically tailored for this audience.

## **Flooding**

James City County contains broad tidal and tributary floodplains adjacent to most streams and rivers. These important floodplain areas help reduce the impacts of flooding by slowing and temporarily storing floodwaters during large storm events. Additionally, as the majority of floodplains in the County are comprised of an intact mix of wetland and non-wetland habitats, the floodplains also serve as both important wildlife habitats and migratory corridors.

Floodplain areas are protected from activities that would degrade their usefulness as a flood conveyance system. The primary way this is accomplished is through the County's floodplain management regulations contained in the Zoning Ordinance. These regulations, administered cooperatively by the Departments of Development Management and General Services, establish the criteria by which development is either allowed or prohibited in the floodplain, with the intent of preventing or minimizing the loss of life and property. These criteria may become more important as climate change increases the threat of flooding. See the Technical Report for areas considered high risk for flooding. See *Map ENV-6* for flood zones.

Map ENV-6: Flood Zones



### Localized Flooding

In addition to flooding associated with the larger waterbodies and floodplains in the County, there are also localized areas that flood during storm events. This flooding is caused by inadequate or failed drainage conveyance systems. For 2007 the James City County Stormwater Division was established in 2007 to improve maintenance and operation of the County's drainage infrastructure. The Division conducts studies to evaluate problem areas and take corrective actions to reduce these localized flooding problems.

### **Air Quality**

Air ignores political boundaries. Automobile and industry emissions from Richmond to Virginia Beach heavily influence the air quality in James City County. Air pollution is generally divided into three sources: air pollution created by mobile sources, area sources, or point sources.

Criteria air pollutants are common throughout the United States. These pollutants can damage health, harm the environment, and cause property damage. The Environmental Protection Agency (EPA) has identified the following six criteria pollutants (a description of these pollutants can be found in the Glossary):

- Carbon Monoxide,
- Lead,
- Nitrogen Oxides,
- Ozone (formed by volatile organic compounds),
- Particulate Matter, and
- Sulfur Dioxide

The EPA established National Ambient Air Quality Standards (NAAQS) for each criteria pollutant, which defines the maximum allowed concentration. If the NAAQS for a pollutant is exceeded, it may adversely affect human health. The EPA and state agencies monitor air quality to assess compliance.

The Hampton Roads region failed to meet the eight-hour ozone standard in 2004. The DEQ created a state implementation plan for the region which was accepted by the EPA in 2007. As a result, this region has been able to meet the standard.

### **Climate Stabilization**

Climate change is a long-term, significant change in the average weather, including average temperature, precipitation and wind patterns, and is predicted to increase heat waves, heavy precipitation events, areas affected by drought, intense cyclone activity, and sea level over the 21st century. According the EPA the insulating gases that cause climate change, known as greenhouse gases, include carbon dioxide, methane, nitrous oxide, and fluorinated gases. Some of these gases occur naturally while others are produced solely by human activity. The Intergovernmental Panel on Climate Change determined in its 2007 Fourth Assessment that most global warming since the mid-20th century is likely due to human activity.

The Virginia Energy Plan is a 10-year state energy plan created by the Virginia Department of Mines, Minerals, and Energy. It estimates that carbon dioxide emissions in the state totaled approximately 130 metric tons in 2005. Carbon dioxide emissions in Virginia have been rapidly increasing, rising by 34% between 1990 and 2004. This is the ninth-highest increase of any state during this period. Energy-related carbon dioxide emissions grew at nearly twice the national rate of increase. Transportation is

the leading source of carbon dioxide in Virginia (43%), and is also the fastest growing source. The second largest source of carbon dioxide emissions in Virginia is electrical power generation (31.6%). Land use also plays an important role in global warming. Sprawling development patterns foster greater vehicle miles traveled, which increases fuel consumption. In addition, carbon dioxide is released when forests are cut and burned, and when trees are cleared, their natural capacity to remove carbon dioxide from the air and capture carbon is lost.

As a way to help mitigate the impacts of climate change, the Board of Supervisors signed the Cool Counties Declaration in September 2007. This declaration recognizes climate change and the impacts it could have on lives in James City County. By signing this document the County committed to take concrete steps toward decreasing greenhouse gas emissions by 80% by the year 2050.

The Roadmap for Achieving Climate Stabilization is the County's plan for meeting the challenge of the Cool Counties Declaration and outlines actions to meet the standards included in the declaration. This roadmap points out four key areas where greenhouse gas emissions can be reduced: energy conservation, Fleet Management, Solid Waste Management, and green building.

In addition to these efforts on the part of the public sector, other actions can be taken to address climate change. Existing ordinances and policies can be examined to determine whether modifications can encourage desirable development or remove barriers to developing in an environmentally friendly manner. Examples of desirable development are Smart Growth, Transit Oriented Design, LEED (Leadership in Energy and Environmental Design), pedestrian connections, and use of renewable energy.

In addition to the actions above, the County should be mindful of the effects of climate change and how facilities and developments are sited. Many scientific studies predict that sea level will rise and storms could become more damaging due to the effects of climate change. County facilities should not be built in locations likely to flood and should be built to withstand strong storm events. The private development of land located in flood prone or low-lying areas should be discouraged in order to avoid loss of property and danger to citizens. A Natural Hazards Mitigation Plan was developed for Peninsula jurisdictions in 2006 and, while it does not address climate change specifically, would be a good source for assessing possible vulnerabilities.

### **Community Sustainability Spotlight**

Having a viable environment is a fundamental principal of sustainability because the environment provides the basic necessities on which humans and all species depend. Clean water, clean air, functioning wetlands, and arable soil make it possible for humans to survive. Without a life supporting environment, humans will not be able to work toward the vibrant community and thriving economy which are also the foundations of sustainability. In order to create a more sustainable environment, James City County should implement plans which protect the environment and link environmental, societal, and economic goals.

### **Citizen Commentary**

Citizens have voiced both concern and approval for the environmental quality of James City County. At the community conversations the most mentioned issues were increased greenspace, tree preservation, sustainable development, stormwater mitigation, and flooding problems.

The Virginia Tech Citizen Survey noted that a substantial majority of citizens (83%) felt that there should be restrictions on land sold for development. Likewise, the majority of residents (83%) believed that development of land was happening too quickly, and 79% of those surveyed felt that it was more important to preserve farmland than to have more development. Slightly less than six in ten respondents (57%) agreed that it is better to have homes on smaller lots and set aside areas for open space in order to permanently preserve land and maintain the character of the community.

The National Citizen Survey noted that a majority of those polled (72%) felt that the cleanliness of James City County's environment was good or excellent and many (69%) believed that the overall quality of the natural environment was good or excellent. Likewise, many residents (69%) felt that air quality in the County was good or excellent. Fewer residents (49%) felt that James City County was doing a good or excellent job of preserving natural open space.

### **Goals, Strategies, and Actions for Environment**

**Goal: Continue to maintain and improve the high level of environmental quality in James City County and protect and conserve sensitive lands and waterways for future generations.**

#### **Strategies and Actions:**

#### **1.1. Protect and improve the quality of water in County watersheds, wetlands, and waterways including water bodies that discharge into the Chesapeake Bay.**

- 1.1.1. Promote development and land use decisions that protect and improve the function of wetlands and the quality of water bodies.
- 1.1.2. Promote the use of Better Site Design, Low Impact Development, and Best Management Practices (BMPs). Promote these techniques by:
  - a. Making technical assistance more readily available and performing demonstration projects; specifically provide stormwater facility maintenance guidelines and assistance directly to BMP owners through hands-on training sessions and other tools;
  - b. Promoting public awareness on the benefits of, and necessity for, BMPs, erosion and sedimentation control, watershed management and other land disturbance regulations;
  - c. Utilizing the assistance of the Virginia Cooperative Extension Service, the U.S. Department of Agriculture Natural Resources Conservation Service, the Colonial Soil and Water Conservation District, and the Hampton Roads Planning District Commission;
  - d. Continuing to develop and enforce new and existing regulations that require soils identification and the consideration of the limitations of these soils for development and agricultural and forestal activities;
  - e. Promoting early submission of environmental inventories in order to protect trees,

County wetlands and highly erodible soils, to most efficiently use permeable soils, and to address impervious cover;

- f. Continuing to encourage the development of regional BMPs;
  - g. Continuing and expanding support for the Protecting Resources in Delicate Environments (PRIDE) program in order to provide information on BMP maintenance to the public as well as to BMP owners; and
  - h. Continuing to promote the protection of trees.
- 1.1.3. Enforce Resource Protection Areas (RPAs) protecting all tidal wetlands, tidal shores, nontidal wetlands connected by surface flow and contiguous to tidal wetlands or water bodies with perennial flow, perennial streams and a 100-foot-wide buffer adjacent to and landward of other RPA components.
  - 1.1.4. Utilize bathymetric and flushing rate data when locating and providing new public shoreline and water access opportunities.
  - 1.1.5. Utilize properly designed methods of vegetative (living shoreline) or structural stabilization, bank re-grading, beach nourishment, and/or relocation of activities to less sensitive areas.
  - 1.1.6. Locate and design water dependent activities such as marinas and docks; conduct them in an environmentally sensitive manner and include adequate marine sanitation facilities.
  - 1.1.7. Identify the specific existing and potential uses of County streams and rivers and identify standards necessary to support these uses. Protect the quality and quantity of these surface waters so they will continue to support these uses. Consideration should be given to existing and potential water resource uses when reviewing land development applications.
  - 1.1.8. Continue to work with the Virginia Department of Environmental Quality (DEQ), Department of Conservation and Recreation (DCR), and Virginia Department of Health (VDH) to identify existing or potential sources of surface and ground water pollution and take action to prevent or control the effect of the sources. Continue to enforce all existing regulations to protect all water resources and adopt additional protective measures as necessary.
  - 1.1.9. Implement identified management practices developed through the Total Maximum Daily Load (TMDL) program and seek continued funding to ensure the development of TMDL implementation plans for each County TMDL.
  - 1.1.10. Protect water resources from on-site waste disposal system failure by:

- a. Requiring Health Department approval for all subdivisions making use of on-site waste disposal systems;
  - b. Maintaining minimum lot sizes for any property containing an on-site waste disposal system;
  - c. Continuing to require primary and reserve drain fields for subdivisions with on-site waste disposal systems;
  - d. Requiring the pump out of on-site waste disposal tanks every five years;
  - e. Monitoring non-traditional on-site sewage disposal trends.
- 1.1.11. Continue to implement the Chesapeake Bay Ordinance in order to protect water quality in all drinking water reservoirs within the County.
- 1.1.12. Investigate actions needed to implement groundwater protection using suggestions from the “Potential Groundwater Management Alternatives” section.
- 1.1.13. Continue to improve the requirements, standards and specifications used to design, approve, and build BMP facilities in James City County.
- 1.1.14. Properly maintain stormwater facilities by:
- a. Utilizing available resources, including enforcement of maintenance agreements and covenants;
  - b. Developing additional mechanisms to ensure systematic identification of failing neighborhood stormwater and drainage facilities and implement repairs on a prioritized basis;
  - c. Developing means for funding BMP construction inspections and private stormwater facility assessments.
- 1.1.15. Increase education and use of sound policies such as watershed planning, agricultural BMPs, erosion control measures, stream bank buffers, and other nonpoint source controls in order to minimize negative effects of urban development and agricultural practices on water quality.
- 1.1.16. Implement the watershed protection and restoration goals and priorities adopted by the Board of Supervisors from the Powhatan Creek Watershed Management Plan, Yarmouth Creek Watershed Management Plan, and any other watershed management plans adopted by the Board of Supervisors.
- 1.1.17. Continue to develop watershed management plans for the remaining County watersheds that identify environmentally sensitive areas and specific protection, restoration and retrofit recommendations.

- 1.1.18. Continue to develop hydraulic studies for County waterways vulnerable to flooding and develop strategies to address identified problems.
- 1.1.19. Utilizing approved watershed management plans developed hydraulic studies, and assessments of riverine and coastal flooding as well as predicted sea level rise, begin to develop a County-wide stormwater master plan to establish measurable goals and comprehensively address both the water quality and flooding issues resulting from stormwater.
- 1.1.20. Develop a process utilizing watershed management plans, hydraulic studies and the resulting stormwater master plan and feasibility studies to provide the foundation for a bond or other appropriate funding mechanism to fund needed large scale water resource management projects including but not limited to flooding.
- 1.1.21. Expand James City County's partnership with VIMS to more fully identify specific issues with respect to riverine flooding, storm surge, sea level rise and other conditions affecting coastal flooding in James City County.

**1.2. Improve public knowledge of and involvement in County environmental programs and initiatives.**

- 1.2.1. Continue to educate the public about voluntary techniques to preserve and protect environmentally sensitive lands; wildlife habitats; water quality and watersheds, agricultural, forestal, and other open space lands through the PRIDE program.
- 1.2.2. Utilize the Clean County Commission to coordinate citizen efforts in participating in the County recycling program, the Adopt-A-Spot program supported by the Virginia Department of Environmental Quality, Division of Environmental Enhancement, and shoreline clean-up days sponsored by a variety of organizations.
- 1.2.3. Promote recycling by developing a post-consumer waste office paper purchasing policy for all County facilities, expanding County facility reduce/reuse/recycling programs, and by increasing private sector awareness of recycling opportunities.
- 1.2.4. Expand the citizen monitoring program to include bacterial monitoring in TMDL watersheds and other watersheds with potential sources of impairment.
- 1.2.5. Make available for decision making consistent waterway-specific water quality data for each County waterway through utilization of the citizen monitoring program.
- 1.2.6. Continue to offer training, certification and equipment to volunteer monitors.
- 1.2.7. Coordinate cross-training and joint activities that allow land use planners; stormwater managers; and transportation, utility, and capital project planners to explore how various land use/stormwater processes can be better integrated.

- 1.2.8. Promote the development of educational and passive recreational facilities which provide increased, non-disruptive access to special environmental and historical areas for citizens and visitors.
- 1.2.9. Encourage residential and commercial water conservation, including the reuse of grey water where appropriate.

**1.3. Protect and conserve environmentally sensitive areas.**

- 1.3.1. Maintain biological and habitat diversity and promote habitat connectivity by protecting wildlife and riparian corridors between watersheds, subwatersheds, catchments, tidal and nontidal wetlands and implementing a green infrastructure plan.
  - 1.3.2. Develop specific recommendations for voluntary and regulatory means to protect resources identified in studies such as the Regional Natural Areas Inventory, and watershed management plans for County watersheds.
  - 1.3.3. Operate adequately funded programs to achieve clear title to or conservation easements over environmentally sensitive lands throughout the County.
  - 1.3.4. Explore provisions for requiring and considering environmental site assessments based on the anticipated use of the property proposed for subdivision or development, as provided for in Virginia Code Section 15.2-2286.
  - 1.3.5. Continue to develop and enforce zoning regulations and other County ordinances that ensure the preservation to the maximum extent possible of rare, and threatened and endangered species, wetlands, flood plains, shorelines, wildlife habitats, natural areas, perennial streams, groundwater resources, and other environmentally sensitive areas.
  - 1.3.6. Continue to collaborate regionally to improve environmental quality, including but not limited to, working with Hampton Roads Planning District Commission (HRPDC) and County staff to develop a local level green infrastructure map which identifies critical natural and cultural networks and lands best suited for development, and develop a plan for implementation.
  - 1.3.7. Site development projects, including those initiated by the County, in such a way as to be consistent with the protection of environmentally sensitive areas and the maintenance of the County's overall environmental quality.
- 1.4. Work with the private sector, other governmental entities such as HRPDC and the Commonwealth of Virginia, and nongovernmental public sector through both regulation and non-regulatory techniques to mitigate and adapt to the effects of climate change. Implement the Cool Counties Resolution, adopted by the Board of Supervisors, by utilizing the "Roadmap to Achieving Climate Stabilization" as a guide.**

- 1.4.1. Conduct a baseline energy and greenhouse gas emissions inventory in order to establish target greenhouse gas emission levels based on Cool Counties Climate Stabilization Initiative goals and track emissions and energy savings annually.
- 1.4.2. Create an energy savings reinvestment program to encourage and reward County departments who save money from budgeted energy usage amounts.
- 1.4.3. Provide incentives and regulatory measures to improve air quality by promoting reduction of auto dependency and trip distances, the construction of energy efficient homes and businesses, and use of alternative modes of transportation.
- 1.4.4. Create a green building policy and a cost-benefit analysis policy for County building capital projects and ensure that proposed County buildings meet the guidelines of that policy in advance of Capital Improvements Program construction expenditures.
- 1.4.5. Investigate amending County ordinances to allow or encourage appropriate energy production and conservation technologies in residential areas (i.e., rain barrels, residential-sized wind turbines, solar panels, etc.).
- 1.4.6. Make County facilities a climate stabilization leader throughout the County by:
  - a. Developing an action plan for the installation of energy management control systems and renewable energy technologies, and the maintenance of heating and cooling systems at County facilities;
  - b. Developing natural landscaping policies for County properties; and
  - c. Considering a “no net tree canopy loss” policy for the development of new County facilities.
- 1.4.7. Continue to manage the County fleet to improve energy efficiency and reduce emissions by replacing fuel inefficient vehicles, assessing new technologies, and developing an anti-idling policy.
- 1.4.8. Proactively work with private, local, regional, state and federal organizations to implement air quality improvement programs that balance economic development and transportation needs.