Section II: Watershed Goals

The public and other stakeholders play a vital role in the creation and implementation of a watershed management plan. It is important to involve the citizens, businesses, and other interested parties in the development of the watershed plan, since they will have to live with the decisions that are made. Stakeholders also bring to the table the issues that are important to them. Their participation gives them a stake in the outcome and helps to ensure the implementation of the plan. Two meetings were held with watershed stakeholders; the first introduced the baseline assessment and fieldwork that was performed by the Center, the second engaged participants in the process of setting goals for the subwatersheds as well as the watershed as a whole. After receiving input from residents and other watershed stakeholders on what goals were deemed important to the community at large, the following set of principles were drafted to guide recommendations of the Powhatan Creek Watershed Management Plan:

1. Prevent further degradation of water quality in Powhatan Creek and maintain the outstanding quality of tidal and nontidal mainstem wetlands. Extend RPA's to protect all perennial streams and connected wetlands.

Many stakeholders felt that the County should try to improve water quality rather than simply prevent it from getting worse. With the exception of fecal coliform and slightly elevated nutrient loading, water quality is fairly good throughout the watershed. Focusing water quality improvement efforts on reducing bacteria and nutrient loading would help reach this goal as well as keeping shellfish beds open. Currently, very little data on stormwater pollutant loads is available within the Powhatan Creek Watershed. Monitoring efforts should be expanded from baseflow studies to include the impacts on headwater streams from storm events. Greg Hancock, professor at William and Mary, and his students are currently monitoring stormflow and water quality in two headwater streams. These monitoring efforts could be expanded to include assessment of the effectiveness of the restoration and protection efforts in Powhatan Creek. The Friends of Powhatan Creek already have a good baseflow monitoring program which could benefit from increased quality control such as sending monthly samples to Virginia Institute of Marine Science (VIMS) to check the accuracy of the data they are collecting. Monitoring information is necessary to assess the overall effectiveness of the management strategies in maintaining high water quality standards in Powhatan Creek. Overall, the watershed protection strategies discussed in this report, such as reforestation and expansion of RPAs and buffers along the mainstem and tributaries, should contribute to protecting wetlands, mainstem shorelines and water quality. Additionally, adoption of better site design techniques to limit impervious cover in new developments, increased homeowner stewardship practices, and stormwater retrofits for existing development will help reduce the negative impacts of stormwater runoff.

2. Maintain biological and habitat diversity and promote habitat connectivity by protecting wildlife and riparian corridors between watersheds, subwatersheds, and the tidal and non-tidal portions of Powhatan Creek.

As described in the Baseline Assessment and Conservation Areas reports, Powhatan Creek is one of the most outstanding natural areas in Virginia and hosts a variety of floodplain and wetland areas that are home to six RTE plant species. In addition, eagles, ospreys, waterfowl, and two heron rookeries are found within the diverse mosaic of wetlands, forests, and beaver dam complexes throughout the watershed. Watershed residents recognize the importance of protecting the habitats of these species in order to maintain viable populations. Stakeholders agree that protecting remaining large tracts of contiguous forest and riparian corridors from development and encroachment is fundamental to maintaining a healthy watershed. To accomplish this goal, the County should focus on preserving natural areas and maintaining connectivity between these areas (especially those linking Yarmouth with Powhatan). The County should continue its efforts to provide a riparian corridor along the mainstem through the RPA regulations; however, we recommend extending the RPA buffers to include all perennial streams and connected wetlands. Widening the natural buffer along the mainstem of Powhatan Creek to a minimum of 300 ft is also recommended for new development. Educational efforts and financial incentives that enhance stewardship roles of homeowners may also help in reducing buffer encroachment problems.

3. Develop an affordable and effective watershed management plan that can be implemented by James City County.

Everyone involved in the development of the watershed plan agreed that timely and effective implementation of recommended strategies is constrained by financial and political factors. By devising strategies that build upon existing regulations, programs, and policies, we can eliminate lengthy bureaucratic inertia, take advantage of established monetary resources, and better target the management budget for more expensive land acquisitions and structural stormwater practices. Examples include linking the management plan with the County's Comprehensive Plan and enhancing provisions within the Chesapeake Bay Preservation Ordinance. Utilizing existing land trusts, watershed organizations and universities to supplement land conservation, monitoring and outreach activities is another way to capitalize on existing infrastructure. Increased coordination between agencies with jurisdiction in the watershed, such as VA Department of Transportation (VDOT), City of Williamsburg, VA Department of Forestry, the Army Corp, public utilities, and the County is also integral to effective implementation of the watershed plan.

4. Establish a transparent and stream-lined permitting process, and provide cost effective and incentive-based regulations or guidelines for "green" development.

Urbanization dominates the current and future land use in many of the subwatersheds within Powhatan Creek. Recommendations for future development of residential and commercial areas focus on zoning changes and instituting flexibility in development standards which reduce impervious cover (better site design (BSD) principles). Stakeholders felt strongly that encouraging

open space design, other techniques to reduce imperviousness, and preserving forest and buffers should not result in a complex and burdensome review and permitting process, nor should the measures be economically unsustainable. Additionally, any financial or regulatory incentives that could be provided to promote BSD, such as tax, stormwater, or density credits; or buffer averaging programs should be utilized. Innovation and creativity in creating greener development such as open space trading and increased clustering should also be encouraged.

5. Improve the existing mechanisms for completing stormwater maintenance and retrofitting, and develop a mechanism for adequate long-term funding.

While flooding remains a great concern among watershed residents, comprehensive management of stormwater practices was a high priority as well. As detailed in the Stormwater Management Plan, recommendations for retrofit opportunities, and improved maintenance of stormwater management practices are paramount to maintaining water quality in Powhatan Creek. Effectiveness of structural practices can be improved through increased inspections and maintenance enforcement. Successful retrofit project will be limited by environmental factors, monetary concerns, and public support. Strategies to help meet this goal include HOA education, and creation of a stormwater utility to fund maintenance and retrofitting projects.

6. Link the unique history and culture of Jamestown and Colonial Williamsburg with Powhatan Creek Watershed Protection.

Tourism is a significant part of the area's economy, and sustainable development of the watershed's natural resources are linked to preserving the historic character of the watershed. Powhatan Creek is where the first settlers located--an event being marked by the celebration in 2007. Many stakeholders feel that protecting the natural resources of those early settlers is as important as preserving the urban habitats of Williamsburg and Jamestown. Establishing a goal of full implementation of the watershed management plan in line with the 2007 event would provide significant public and political incentive to actively pursue management recommendations. The educational systems in place both in Williamsburg and Jamestown Settlement would also provide a unique forum for promoting watershed awareness to tourists and residents alike.

7. Promote watershed awareness and active stewardship among residents, community associations, businesses, and seasonal visitors through education programs, recreational opportunities, and participatory watershed activities.

Much of the watershed is privately owned and effective private stewardship of those watershed areas is an integral part of watershed protection. Stakeholders wanted every watershed resident to be educated on nutrient and pollution control and felt HOAs should be targeted for education on the proper techniques for home and lawn care, stormwater practice maintenance, and buffer management. The County should promote active participation in watershed activities such as monitoring, buffer planting, and policing efforts (unmaintained stormwater ponds). Passive and active recreational activities such as hiking and boating can be used to raise watershed awareness

through trails, nature centers, fishing tournaments, and stream clean ups. Powhatan Creek already has a watershed organization–Friends of Powhatan Creek–that can distribute educational information, conduct watershed education efforts, and sponsor watershed events. A CD with powerpoint slides was created to assist with this process (Appendix B).

8. Restore the physical integrity of degraded headwater streams where possible and protect high quality streams from negative morphological impacts associated with increased urbanization.

The Stream Assessment Report provides information on the relative quality of the tributary stream network of Powhatan Creek. Some of these streams are highly impacted by development, some of which are optimal candidates for stream restoration. Stakeholders thought that restoration efforts that could effectively restore bank stability, enhance in-stream habitat, and replace stream-side vegetation should be done where possible. Greater emphasis was placed on protecting the streams currently classified as high quality from further deterioration.

Section III: Watershed Recommendations

This section presents subwatershed-based recommendations for Powhatan Creek in the context of six tools of watershed protection: land use planning, aquatic buffers, better site design, stormwater management, conservation areas, and watershed education. Each tool is introduced in detail below and is linked with overall watershed goals, James City County's current framework, and specific recommendations for Powhatan's subwatersheds.

A. Land Use Planning

Targeted Watershed Goals

Maintain biological and habitat diversity and promote habitat connectivity by protecting wildlife and riparian corridors between watersheds, subwatersheds, and the tidal and non-tidal portions of Powhatan Creek.

Extend RPAs to protect all perennial streams and connected wetlands

Prevent further degradation of water quality in Powhatan Creek and maintain the outstanding quality of tidal and nontidal mainstem wetlands.

Develop an "affordable and effective" watershed management plan that can be implemented by James City County.

Land use planning tools are needed to assist in the conservation of lands that are important to safeguarding the long-term protection of water quality, pristine streams, wildlife corridors, contiguous forest and the unique biodiversity of the Powhatan Creek watershed. The preservation of conservation areas and the mainstem corridor will allow for the protection of habitat and the movement of wildlife from Powhatan Creek to other watersheds such as Yarmouth Creek. These areas also serve as recharge sites for clean groundwater, and the buffers help to protect water quality and prevent invasive species from negatively affecting Powhatan Creek. Specific techniques which could be developed include the ability to cluster down, restrict re-zoning in sensitive subwatersheds, and trading required open space from impacted subwatersheds to sensitive subwatersheds and the mainstem of Powhatan Creek. Land use planning tools are very cost effective. They cost virtually nothing to implement versus traditional acquisition programs which can be very expensive. Effective implementation of land use techniques requires flexibility and incentives within the zoning and development standards to motivate developers to do what is best for the watershed; so that development and safeguarding Powhatan Creek are compatible goals.

While the County has a significant framework available for utilizing land use techniques for watershed protection, we recommend some of the following strategies for enhancing land use planning as a tool. Four of these techniques are described below, and use of these techniques in specific watersheds is summarized in Table 3.1.

1. Open Space Trading: Open space trading would allow the reduction of the open space requirement in impacted subwatersheds (203, 204, 206, 207, and 210) in exchange for the protection of conservation areas in other subwatersheds or the mainstem buffer. When

development is proposed in subwatersheds targeted for growth, developers would be allowed to account for some of their open space requirement by protecting or paying a fee-in-lieu to protect a designated conservation area or the mainstem buffer. This technique also is sensible economically because land values are often appreciably greater in areas zoned for higher density. Implementation of this technique may also assist in reducing the cost of preserving and protecting the 1800 acre goal from the *Conservation Area Report*.

Specific language for this type of ordinance should include:

- Reduced open space requirement down to 10-15% in targeted growth areas in exchange for the purchase of conservation areas or the payment of a fee-in-lieu to be used to purchase targeted conservation area lands. These areas could be managed by a third party such as the Williamsburg Land Trust or Virginia Outdoors.

- Re-zoning in growth subwatersheds should maintain the higher open space requirement of the two zoning requirements and allow for open space transfer to conservation areas.

2. Cluster Down: This zoning change would allow the developer to build the same number of units provided in its current zoning, but would reduce individual lot sizes and therefore reduce the overall development footprint while increasing additional contiguous forest, conservation area or stream buffer beyond its set open space requirement (ie. 10% or 40%). This would primarily affect developable lands which are adjacent to or part of conservation areas (especially contiguous forest), and areas adjacent to the mainstem of Powhatan Creek. This technique is particularly applicable in subwatersheds 201, 202, 205, 208, 209 and along the tidal and nontidal mainstem. Incentives for developers to cluster down include reduced infrastructure costs, and potential added value to the homeowners who know that the adjacent land will be preserved.

3. Limit Re-Zoning in Sensitive Watersheds: Changes in zoning that would increase impervious cover and allow for more intense urbanization than current zoning permits should be prohibited. The ability of the county to restrict the re-zoning of lands in sensitive subwatersheds and conservation areas is crucial to the protection of the integrity of the Powhatan Creek watershed. In contrast, granting re-zoning requests in these areas would act to increase the development value of these lands making it more difficult for land conservation programs to be successful.

4 RPA Extensions: Extension of the Resource Protection Areas (RPAs) to include all perennial streams and connected wetlands beyond the USGS blueline designation is another recommendation for the increased protection of Powhatan Creek's resources. This recommendation is also being proposed by CBLAD in their revisions to the RPA regulations. The Center has made recommendations based on our reconnaissance during our fieldwork (See Appendix C). One stakeholder group also recommended that steep slopes be included

within the RPA boundary, this has been instituted by several other Virginia jurisdictions and may assist in increasing the width of the mainstem buffer. In the Yarmouth Creek watershed plan, the Center will make an even more formal recommendation on the extension of RPAs beyond the blue lines based on our fieldwork.

Table 3.1 Land Use Strategies for Powhatan Creek Watershed

Land Use Tool	Target Areas	Subwatershed	Description
Open Space Trading	Impacted subwatersheds; Targeted growth areas	203, 204, 206, 207, 210	This technique allows for the reduction of open space requirement in areas targeted for growth in exchange for increased open space protection of conservation areas or in association with the protection of mainstem buffers.
Cluster Down	Development adjacent to buffers or conservation areas	201, 202, 205, 208, 209, Tidal and non-tidal mainstem	This technique maintains overall site density, but reduces lot sizes and imperviousness and adds resulting open space to adjacent buffer or conservation area.
Restrictive Re-Zoning	Sensitive areas	201, 202, 205, 208, 209, Tidal non-tidal mainstem	This tool prohibits changes in zoning that would result in increased imperviousness.
RPA Extension	All perennial streams and connected wetlands	all subwatersheds	This would extend protective RPA boundaries to all perennial streams and connected wetlands.

B. Aquatic Buffers

Aquatic buffers are an important element in a comprehensive watershed protection strategy. While generally limited in their ability to remove pollutants in an urban setting, a well-established and unbroken buffer network provides many benefits to overall watershed health. In addition to separating development from the stream system, buffers help maintain aquatic and terrestrial transition zone habitats, provide a wildlife corridor, protect sensitive wetland and floodplain areas, and reduce the impact of invasive species. Buffers serve as a "stream right-of-way" allowing for lateral movement, protecting private property from flooding, and helping reduce watershed imperviousness. A good buffer program generally meets the following criteria:

Targeted Watershed Goals

Prevent further degradation of water quality in Powhatan Creek and maintain the outstanding quality of tidal and nontidal mainstem wetlands

Maintain biological and habitat diversity and promote habitat connectivity by protecting wildlife and riparian corridors between watersheds, subwatersheds, and the tidal and non-tidal portions of Powhatan Creek.

Restore the physical integrity of degraded headwater streams where possible and protect high quality streams from negative morphological impacts associated with increased urbanization.

- Minimum width of 100 ft (JCC meets this criteria)
- Three-zone buffer system with specific goals and restrictions for the outer, middle, and streamside zones (may be appropriate with a larger mainstem buffer)
- A vegetative target based on pre-development plant community
- Clear and measurable criteria for delineation of buffer origin and boundaries
- Limited numbers and specific criteria for stream and buffer crossing
- Carefully prescribed use of buffer for stormwater treatment practices
- Highly visible buffer demarcation before, during, and after construction
- Commitment to buffer education and enforcement

Protection and management of aquatic buffers in the Powhatan Creek Watershed relates mainly to the County's Chesapeake Bay Preservation Ordinance and silviculture practices. Under the Chesapeake Bay Preservation Ordinance, the entire watershed is a designated Chesapeake Bay Preservation Area that establishes a 100 ft Resource Protection Area (RPA) buffer adjacent to and landward of connected tidal and non-tidal wetlands, tidal shores, and tributary streams. Tributary streams are defined as any perennial stream depicted on the most recent USGS 7.5 minute quadrangle map. Under this RPA system, James City County has maintained a significant riparian corridor along mainstem Powhatan Creek. However, many perennial streams, and their connected wetlands are not protected under this ordinance and less stringent buffer requirements are allowed. Silviculture practices are exempt from the Virginia Chesapeake Bay Act, provided that operations adhere to water quality protection procedures prescribed by the VA Department of Forestry in its Best Management Practices (BMP) Handbook for Forestry Operations. No evidence of forestry BMPs were seen associated with several timber harvesting operations observed during our fieldwork.

While James City County has an established buffer program, we have identified areas of concern that may limit the overall effectiveness of the watershed's existing buffer network. The RPA boundary does not include all hydrologic and ecologically critical headwater reaches (including perennial streams) or sensitive floodplain areas within the watershed. Demarcation of the RPA buffer areas is an important tool in ensuring on-the-ground visibility of buffers and helping to prevent encroachment by property owners unaware of the boundaries and proper management of their buffer. In Powhatan, some signage for the RPA was noted during the fieldwork in the tidal portion of Powhatan Creek, these program should be extended to the other areas within the watershed.

Recommendations for enhancing the buffer system in the Powhatan Creek watershed range from RPA and existing buffer expansion, strategic utilization of land use planning and site design techniques, clearly defining buffer management criteria, and increasing buffer awareness. We have grouped buffer improvements into the following six categories described below.

1. RPA Extensions: It is our opinion that current RPA boundaries clearly do not extend to all perennial streams within the watershed. We recommend using the layer created by the Center through our fieldwork, with perhaps further refinement during an extended dry period using county staff or William and Mary. USGS 7.5 minute quad sheets are often not a good measure of perennial streams. For example, the stream pictured on the cover (after an extended drought) is labeled as a intermittent stream on the USGS quad sheets.

2. Inclusion of intermittent streams and unconnected wetlands within a buffer system: Limiting RPA protection to connected perennial streams and wetlands does not protect sensitive intermittent headwaters and "pocket" wetlands. These areas may provide critical habitat for RTE species, contain contiguous forests, or impact the water quality of receiving streams. Current standards do not define any buffer for these areas unless they are protected by wetlands regulations. The County should consider a 100 ft buffer for significant pocket wetlands and a 50ft buffer for intermittent streams.

3. Buffer reclamation, widening, and revegetation: Identification and reclamation of encroachment areas, in addition to the restoration of native pre-development vegetation throughout the buffer complex is critical to maintaining the integrity of the watershed's buffer network. Programs and encouragement to aid buffer revegetation in areas cleared and developed prior to RPA regulations can be very beneficial. Buffer widths should be increased as necessary to include special habitats or provide additional separation between development and the waterway. The non-tidal portion and tidal mainstem Powhatan Creek, for example, should increase existing minimum buffer widths from 100 to 300 ft. to help maintain the outstanding tidal marshes, marsh transition zone, and the immediate shoreline.

4. Buffer Management Criteria: Clear vegetative targets and criteria for crossings (road, utility, and golf courses), maintenance, and enforcement should be standardized. Visible signage should be a part of the development process from pre-construction to the occupancy stages.

5. Directing of required open space or natural areas derived from clustered development to riparian buffer areas: The county should look for opportunities to expand the buffer area in developing areas by utilizing open space and cluster design developments. In these cases, the open space areas can be directed towards and added to the existing riparian buffer area. Buffers can serve as a sink for required open space and may even provide an off-site mitigation location for diversion of open space requirements.

6. Watershed education on buffer management: Homeowners, lawn care companies, and community management entities should be educated on the benefits of a buffer network and proper vegetative management of buffer areas within their care.

While opportunities exist to enhance the buffer network in all subwatersheds, specific measures are tailored to each of the subwatersheds depending on variations in existing RPA boundaries, stream quality, levels of buffer encroachment, development history, and future land use. Specific recommendations are summarized in Table 3.2.

Table 3.2 Buffer Strategies for Powhatan Creek Subwatersheds

Subwatershed	Comments and Recommendations
Mainstem Tidal	Several RPA buffers are not maintained in a forested condition, most of which were developed prior to the Chesapeake Bay Preservation Act Buffer education Establish program to assist landowners in creation of buffer zones Preservation of a larger natural buffer (minimum 300 ft) on new development to protect marsh transition zone Cluster development to protect marsh buffers
Mainstem Non-Tidal	High quality stream habitat Contains a priority Stream Protection Area Increase width of mainstem buffer to 300ft to preserve contiguous forest and limit invasive species
201	Open space clustering of low density residential on east side of Paleochannel to preserve buffer Increase forested buffer on Paleochannel wetlands Expand RPA to include Paleochannel
202	Good stream quality Concentrate required open space along streams and wetlands
203	Golf courses and backyards -- Look for opportunities to increase buffer widths and reduce number of crossings
204	Possible RPA extension Homeowner education on buffer management
205	Best stream habitat in watershed Cluster or open space design to protect stream valleys
206	Reforestation/vegetation of buffers during stream restoration

Table 3.2 Buffer Strategies for Powhatan Creek Subwatersheds	
207	Use open space requirements to increase buffers on 1st order and intermittent streams Allow for off-site open space transfer to protect buffer areas
208	Excellent stream habitat scores RPA extensions Concentrate required open space along streams, wetlands, and conservation areas
209	Excellent stream condition RPA extensions Concentrate required open space along streams, wetlands, and conservation areas
210	RPA extensions Concentrate open space along streams and wetlands or in the mainstem corridor Homeowner education on buffer management

C. Better Site Design

Targeted Watershed Goals

Establish a transparent and stream-lined permitting process, and provide cost effective and incentive based regulations for "green" development.

Develop an affordable and effective watershed management plan that can be implemented by James City County.

Better site design (BSD) is a critical tool for watershed protection and could be more effectively implemented in the Powhatan Creek watershed. BSD techniques incorporate a combination of 22 model development principles designed to reduce impervious cover, minimize clearing and grading during construction, and maintain native vegetation on-site. BSD is a tool for allowing flexibility and creativity in designing residential and commercial areas scheduled to be developed; therefore, better site design is not an issue of zoning or future land use, rather it is a means of producing the most environmentally sensitive development possible. One of the primary benefits of BSD, the reduction in impervious cover, is particularly relevant to this watershed because it equates to less stormwater impact on the water quality of Powhatan Creek. The 22 model development principles, are organized into three groups, as listed below; residential streets and parking lots, lot development, and conservation of natural areas.

1. Residential Streets and Parking Lots: Ten techniques for reducing car habitat in new developments by reducing residential street widths and lengths, Right of Way (ROW) widths, and the quantity and size of cul-de-sacs; promoting alternative turnarounds, vegetated open channels, and porous paving; assessing parking ratios and requirements; and by providing

compact stall dimensions, incentives for structured parking, and integrated stormwater treatment with parking lot landscaping.

2. Lot Development: Six techniques for reducing imperviousness by modifying the shape, size, and layout of residential lots. This includes advocating open space design subdivisions that incorporate smaller lot sizes, reduce construction costs, conserve natural areas, and promote watershed protection. Relaxing yard setbacks and frontages, promoting flexible sidewalk and driveway standards, disconnecting rooftop runoff, and specifying open space management are principles for better lot design.

3. Conservation of Natural Areas: Six techniques for conserving and managing the natural areas at the development site include creation of a variable width, naturally vegetated, well-marked buffer; limited clearing and grading of forests and natural vegetation on site; conservation and incorporation of on site vegetation; restriction of stormwater outfalls; and provision of incentives to encourage conservation.

In reviewing its development codes and standards, the JCC received a relatively high score on the codes and ordinance worksheet (COW) assessment (Appendix D). The COW assesses the extent to which local codes and ordinances allow or prevent the model development principles from being implemented by developers. James City County development standards appear to allow usage of many of these principles such as open space requirements, cluster development, and buffer requirements. The County scored 75 out of 100 points–indicating that opportunities exist to improve the county's development codes. In the self assessment, JCC identified three major areas in its codes that may limit environmentally-friendly development. These included: parking requirements, setbacks and frontages, and street standards. Scoring was as follows:

		COW Points		
Principle	**Category**	**JCC**	**Maximum**	**Percent**
Principles 1-10	Residential Streets and Parking Lots	27	40	67.5 %
Principles 11-16	Lot Development	26	36	72.2 %
Principles 17-22	Conservation of Natural Areas	22	24	91.7 %
		75	**100**	**75.0%**

Although most of the better site design tools are available to developers, in the field, it appeared that in much of the new development, BSD aspects were not being utilized. Regulatory, economic, and educational barriers to BSD usage must be identified and addressed if the Powhatan Creek watershed is to benefit from this protection tool. Recommendations for improving the County's ability to utilize better site design techniques include code revision in some of the areas identified previously, increased education of developers and planning staff , the provision of incentives for developers to

use them, and the targeted use of BSD criteria in sensitive watersheds. Specific recommendations are described below:

1. Code Revision: During the COW self-assessment, the County identified some areas in the development codes that may be potential barriers to BSD. Based on those areas, we have come up with a set of recommendations.

   Recommendations relating to residential streets and parking lots:

   - Set maximum road standards to conform with the VDOT minimum levels (see Table 3.3).
   - Use VDOT minimum cul-de-sac standards as maximum criteria, or require cul-de-sacs with a radius > 45ft to incorporate a bioretention island.
   - Reduce ROW widths to distances based on safety and utility requirements.
   - Set maximum limits on parking ratios for commercial areas and require areas above minimum standards to utilize grass or porous materials.
   - Integrate stormwater treatment and landscaping requirements in parking lots by encouraging bioretention areas.

Table 3.3 VDOT Minimum Local Street Width Requirements for Open and Closed Section Roads in Both Residential and Non-Residential Areas

Average Daily Trips	Open Section Roads	Closed Section Roads			
		Residential		Non-Residential	
		less than .5 mile	.5 mile or more	Parking restricted	Parking allowed
Up to 250	18'	28'	30'	24'	30'
251 - 400	20'	28'	30'	24'	30'
401 - 1000	22' (20')*	36'	36'	N/A	38'
1001- 2000	22' (20')*	36'	36'	N/A	38'
2001- 4000	22'	38'	38'	N/A	40'
Over 4000	24'	40'	40'	N/A	40'

* Figures in ( ) refer to mountainous regions. Source: (VDOT, 1996)

Recommendations relating to Lot Development and Conservation of Natural Areas:

- Reduce some of the minimum setbacks and frontage widths to help reduce impervious cover and accommodate new types of development such as neo-traditional. Table 3.4 summarizes the current minimum yard and open space requirements for each zoning district. Based on recommendations from CWP's National Site Planning Roundtable (citation), minimum distances for residential front, rear, side yard minimums to be <20, <25, and <8 ft, respectively. Relaxing minimums is particularly important in some of the Neo-traditional designs where lots can be rear loaded and front setbacks can be greatly decreased. Currently, the county only has a cluster overlay district for R-1, R-2, and R-5 districts that relaxes yard and lot geometry regulations

    - Provide flexibility to meet conservation and buffer goals (density bonuses, open space trading, etc.)

Table 3.4 James City County Setback, Frontage, and Open Space Requirements

Zoning District	Minimum Setbacks (ft)			Minimum Frontage (ft)	Minimum Open Space (%)
	Front	Side	Rear		
Limited Residential (R1)	35 (from ROW, ROW >50) 60 (from street centerline, ROW <50)	15	35	100 (lots <43560 ft2) 150 (lots >43560 ft2)	10
General Residential(R2)	25(from ROW, ROW >50) 50 (from street centerline, ROW <50)	10	35	75 (lots <20000 ft2) 100 (lots 20,000-43560 ft2) 150 (>43560 ft2)	15
Planned Communtiy (R4)	not specified	not specified	not specified	not specified	40
Multi-family (R5)	35 (from ROW, ROW >50) 60 (from street centerline, ROW <50)	5 (single family)	20 (single family)	80 (single family)	35
Rural Residential (R8)	35 (from ROW, if ROW >50) 60 (from street centerline, ROW <50)	15	35	100 (lots <43560 ft2) 150 (lots >43560 ft2)	10
Limited Business (LB)	50 (from ROW, ROW >50) 75 (from street centerline, ROW <50)	20	20	not specified	35

Table 3.4 James City County Setback, Frontage, and Open Space Requirements					
Zoning District	**Minimum Setbacks (ft)**			**Minimum Frontage (ft)**	**Minimum Open Space (%)**
	Front	**Side**	**Rear**		
General Business (B1)	50 (from ROW, if ROW >50) 75 (from street centerline, if ROW <50)	20	20	not specified	30
Limited Business/ Industry (M1)	50 (from ROW, ROW >50) 75 (from street centerline, ROW <50)	20	20	75	30
PUD	75	no min	no min	not specified	35
Mixed Use (MU)	50 (from ROW, ROW >50) 75 (from street centerline, ROW <50)	no min	no min	not specified	10
General Agricultural (A1)	50 (from ROW, ROW >50) 75 (from street centerline, ROW <50)	15	35	250	not specified

2. BSD Education: A common barrier to BSD usage is a general lack of awareness of the environmental and economic benefits of BSD, feasibility within existing code requirements, and a misunderstanding of "buzz word" terminology such as "cluster." We recommend the County provide BSD information or workshops for planners, home builders, and developers. Developers should be educated on BSD techniques, the economics benefits of using BSD, and development code modifications that allow for incorporation of those techniques. Planning staff should be kept up-to-date on various site design principles so improvements to site designs can be recommended during the plan review process.

3. Incentives for BSD: The county should institute incentives for BSD such as expedited review for projects utilizing better site design principles, or financial incentives such as stormwater credits, tax credits, or density bonuses.

4. Target BSD to Sensitive Subwatersheds: BSD is particularly important in subwatersheds designated for new growth, subwatersheds with impervious cover caps and special stormwater criteria, and in areas where aquatic buffers or sensitive species and habitat will benefit from open space design. Better Site Design has been written into the Special Stormwater Criteria for sensitive subwatersheds. Table 3.5 summarizes the importance of BSD tools within each of the subwatersheds and mainstem segments within the Powhatan Creek watershed based on the impact of future development within those areas.

Table 3.5 Better Site Design Strategies for Powhatan Creek Subwatersheds			
Subwatershed	**Developable Area**	**BSD Value**	**Comments**
Mainstem Tidal	31%	high	Cluster type development to preserve marsh buffers and reduce number of docks Added focus on fecal coliform removal, so want to use BSD to reduce stormwater runoff and reduce impact of septic systems
Mainstem Non-Tidal	31%	high	Limit impervious cover Allow for clustering—maintaining the same density to increase preservation of the mainstem contiguous forest without reducing the number of units built by the developer
201	42 %	high	Allowances in zoning to cluster down—maintain the same density. Specifically, cluster development on the east side of C-4 and near the Paleochannel to preserve as much of the contiguous forest and buffer as possible
202	29 %	moderate	Special stormwater criteria Concentrate open space along streams and wetlands
203	29%	low	Fords Colony PUD; incorporate on-site practices and continued natural and swale drainage
204	26%	moderate	Due to low quality streams and habitat, may want to shift development here
205	54%	high	impervious cover cap, and possible downzoning of industrial/commercial Special stormwater Criteria
206	39%	low	Consider allowing the 30%/40% open space requirement to be acquired elsewhere in watershed
207	19%	low	Mostly developed Direct required open space to off-site buffer areas or identified conservation areas
208	49%	high	Most threatened subwatershed Use BSD to reduce imperviousness and related stormwater impacts Special stormwater criteria Minimize clearing and grading of forest cover
209	48%	high	Under significant development pressure Impervious cap Use BSD to reduce imperviousness and related stormwater impacts Allowances in zoning to cluster down—maintaining same density to protect natural land Special stormwater criteria
210	19%	moderate	Concentrate open space along stream buffers, wetlands, and mainstem corridor

D. Stormwater Treatment Practices

Targeted Watershed Goals

Prevent further degradation of water quality in Powhatan Creek and maintain the outstanding quality of tidal and nontidal mainstem wetlands

Maintain biological and habitat diversity.

Improve the existing mechanisms for completing stormwater maintenance and retrofitting, and develop a mechanism for long-term funding.

Restore the physical integrity of degraded headwater streams where possible and protect the high quality streams from the negative morphological impacts associated with urbanization.

The recommendations from the *Stormwater Master Plan for Powhatan Creek* have been summarized here in the Final Watershed Management Plan. The Stormwater Master Plan essentially builds on the County's current guidelines and increases protection in sensitive areas, relieves the need for stormwater management in areas already served, and maintains the current criteria in impacted subwatersheds. The report also prioritizes opportunities for stormwater retrofits and regional facilities.

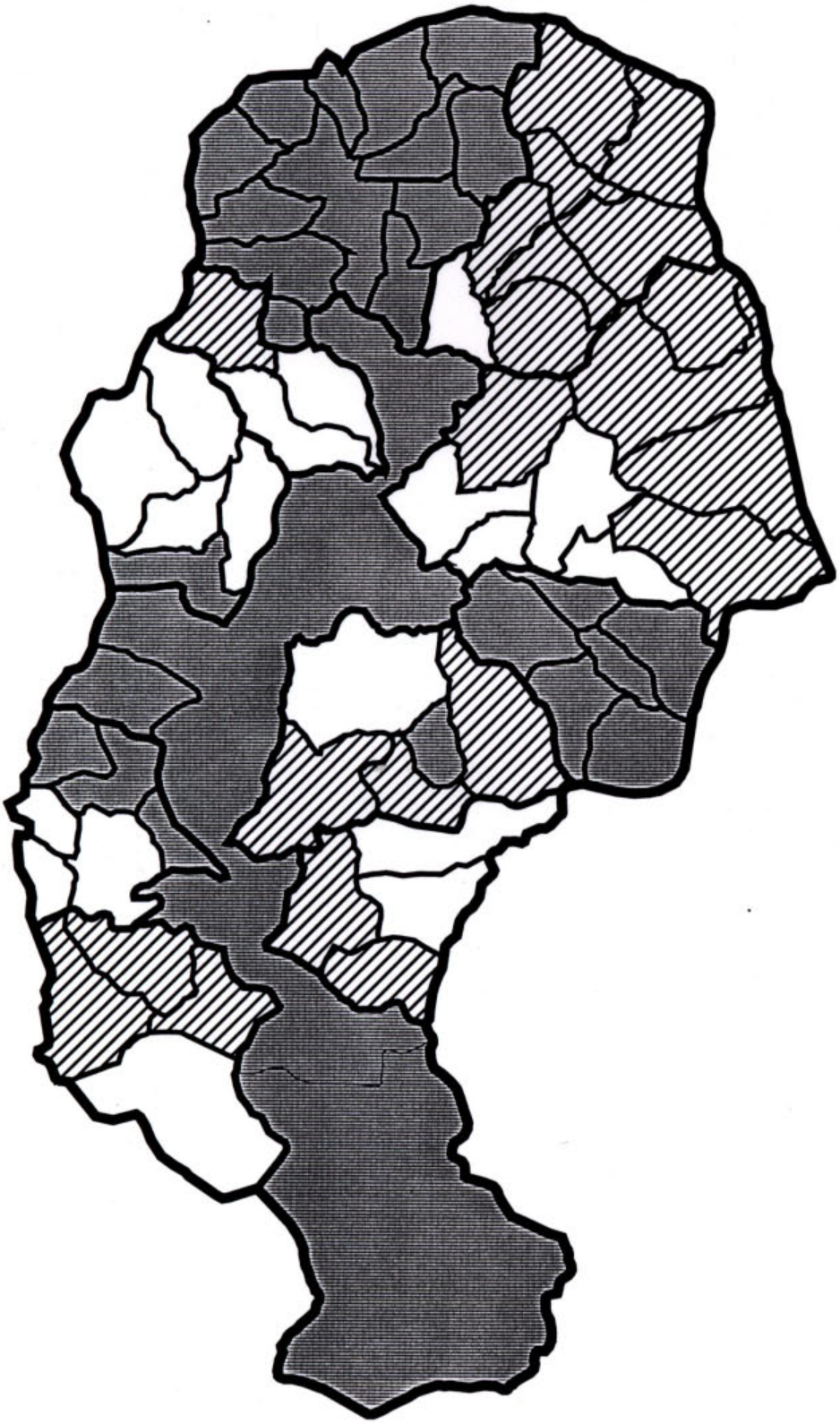
Key stormwater-related threats to the natural environment of the Powhatan Creek watershed include changes in hydrology in streams, wetlands, and floodplains; increased pollutant loads delivered in urban storms (bacteria, sediments, nutrients); and water level fluctuations that degrade wetlands and the habitat of rare, endangered, or threatened plant species. Headwater streams have shown the greatest degradation, with accelerated channel erosion reported in upper tributaries which creates sediment deposition within floodplains and associated wetlands. Finally, high levels of bacteria during wet weather have caused localized closures of shellfish beds in the tidal creek.

The goal of the Stormwater Master Plan was to develop a simple yet comprehensive framework to guide where and how stormwater is managed in the watershed. To do this, the Powhatan Creek watershed has been divided into 64 catchments. For each catchment, specific recommendations are given in the areas of:

- Stormwater criteria for new development;
- Stormwater retrofits; and
- Regional ponds for future development.

The recommended stormwater management criteria for new development falls under three categories:

1. No Action: In these catchments, additional stormwater management is not necessary because the catchment is either fully developed, or the existing stormwater practices are able to meet water quality objectives for current or future development. In 18 of the catchments, no additional stormwater action is necessary for new development within the catchment



LEGEND

- Watershed Boundary
- Subwatershed Boundary
- Catchment Boundary
- Current JCC Stormwater Criteria
- No Additional Stormwater Action
- Special Stormwater Criteria

Figure 3. Powhatan Creek Watershed Stormwater Criteria Designations

5500 0 5500 Feet

2. Current James City County Stormwater Management Criteria:
Future development in these catchments should provide on-site stormwater management, per the current James City County stormwater management criteria. These criteria are deemed effective enough to prevent impacts to water resources. Typically, regional facilities are not feasible in these catchments because they may adversely impact conservation areas, or developable area is too small to warrant the construction of a regional stormwater pond. In 21 of the catchments, new development should apply the current James City County stormwater criteria:

- Water Quality: a stormwater management plan for a development site must achieve 10 points through a combination of structural BMPs and preservation of natural open space
-
- Stream Channel Protection: 24-hour detention of the 1-year, 24-hour duration storm event must be provided
-
- Peak Discharge Control: the pre-development peak runoff rate from a 2-year design frequency storm should not increase when runoff discharges into a natural receiving channel; the pre-development peak runoff rate from a 10-year design frequency should not increase when runoff discharges into a manmade receiving channel

3. Special Stormwater Criteria (SSC) for new development: In 24 catchments within the Powhatan Creek watershed, the high quality of the streams and the presence of hydrologically sensitive conservation areas warrant stormwater management above and beyond the current County standards.

The designation of "Stream Protection Area" (SPA) has been given to sensitive catchments throughout the watershed. The SSC was developed to achieve two primary goals:

- Attempt to preserve pre-development hydrology: to reduce impacts to high quality streams. The volume of recharge that occurs on a site depends on slope, soil type, vegetative cover, precipitation, and evapotranspiration. Sites with natural ground cover, such as forest and meadow, have higher recharge rates, less runoff, and greater transpiration losses under most conditions. This helps to preserve existing water table elevations thereby maintaining the hydrology of streams and wetlands during dry weather. Because development increases impervious surfaces, a net decrease in recharge rates is inevitable.

- Enhanced water quality treatment of stormwater runoff: Current stormwater management for water quality in the watershed is characterized by the use of a single practice, namely wet or dry ponds, to manage stormwater from a drainage area. However, many of the practices have been poorly maintained, reducing their pollutant removal capability. In addition, although the County's codes and ordinances allow for reduced impervious cover and open space preservation in site design, developers do not always exercise these options. More sensitive site design can play a significant role in reducing water quality and hydrologic impacts resulting from development.

The SSC recommendations fall under two general categories:

- SSC for Parcel Development in SPAs (Stream Protection Areas) - Applies to development projects 2 acres or more that are subdivided into two or more lots for residential development, or is developed as commercial or industrial.
- SSC for On-Lot / Infill Development in SPAs - applies to SPA catchments that have a significant remaining number of unbuilt, platted lots.

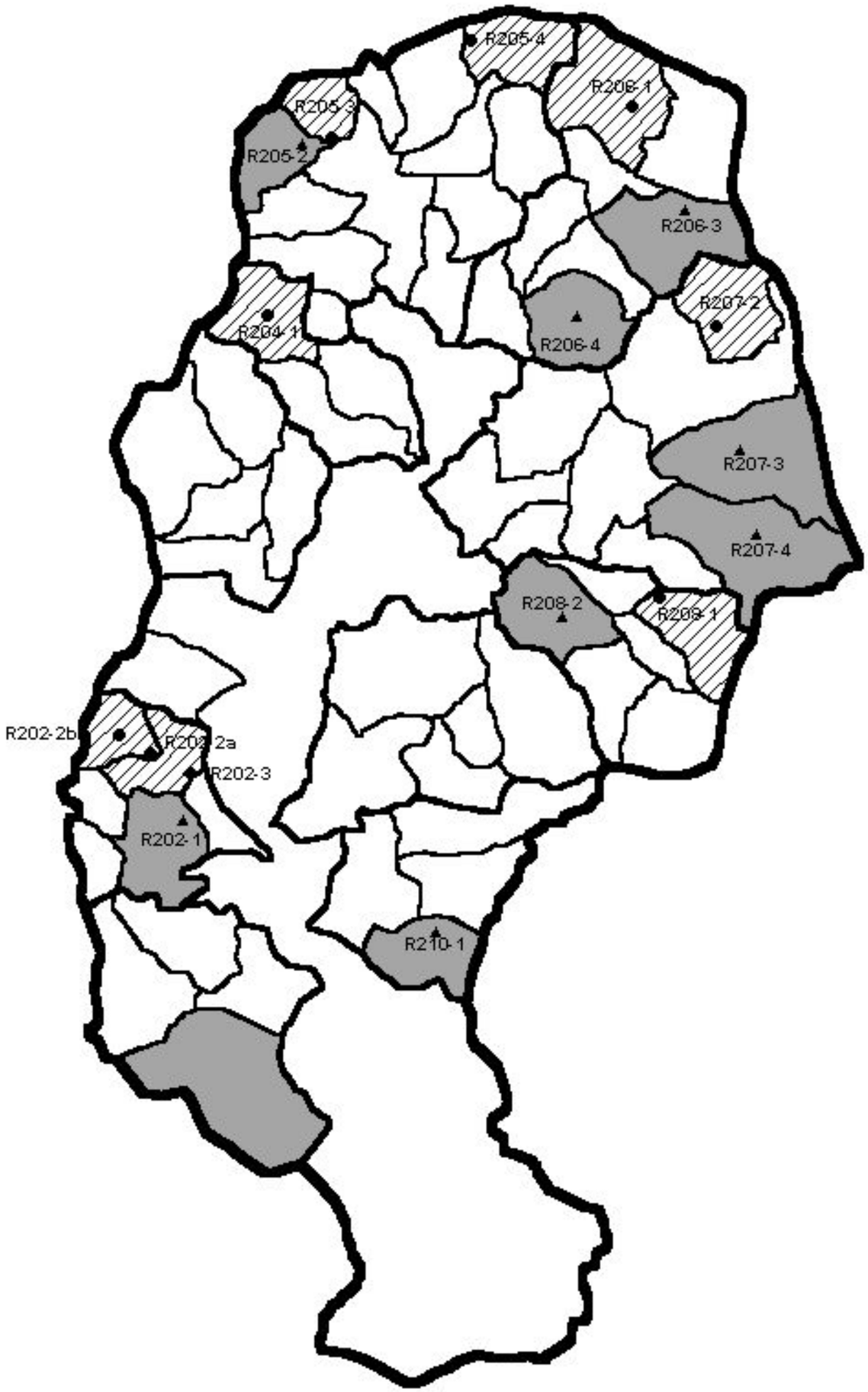
Locations for stormwater retrofits and regional facilities were also identified and prioritized for the watershed.

1. Retrofitting of existing facilities and uncontrolled, old development: The majority of development in the watershed includes stormwater practices designed under the County's prior stormwater criteria. Many of these facilities were not designed to provide adequate water quality or channel protection. In addition, small portions of the watershed, particularly in Subwatersheds 206 and 207, were developed prior to the County's adoption of requirements for on-site stormwater management. Many of the Powhatan tributaries are still adjusting to the altered hydrology. The stormwater retrofit inventory portion of this study examined potential locations for stormwater retrofits. The priorities are located in Table 1.4 and Figure 4.

2. Potential sites for regional facilities. In general two basic strategies were used to determine the citing of regional stormwater management facilities; regional facilities to control future development and regional facilities to treat stormwater runoff from areas historically developed without stormwater management practices. Table 3.6 displays the top five priorities for regional facilities. Figure 4 displays the locations of the potential regional facilities.

Table 3.6 Prioritization of Potential Sites for Regional Facilities to Manage Stormwater Runoff from Future Development

Rank	Retrofit ID#	Drainage Area (acres)	Total Points
1	R206-1	111	53
2	R208-1	157	47
3	R207-2	122	46
4	R205-4	157	45
5	R204-1	104	43



LEGEND

- Watershed Boundary
- Subwatershed Boundary
- Catchment Boundary
- Regional Pond Catchment
- Priority Retrofit Catchment
- ▲ Priority Retrofit Location
- ● Regional Pond Location

Figure 4. Powhatan Creek Watershed Regional Pond and Priority Retrofit Locations

5500 0 5500 Feet

E. Conservation Areas

Targeted Watershed Goals

The stakeholders feel it is vital to conserve not only the biodiversity and habitat corridors in the watershed, but to also protect the watershed because of its unique history, culture and tourism which serves as an economic engine for the area.

Maintain biological and habitat diversity and promote habitat connectivity by protecting wildlife and riparian corridors between watersheds, subwatersheds, and the tidal and non-tidal portions of Powhatan Creek.

Link the unique history and culture of Jamestown and Colonial Williamsburg with Powhatan Creek Watershed Protection and Restoration.

The pristine and unique nature of the Powhatan Creek watershed resulted in it being ranked first in biodiversity for the lower peninsula of Virginia. In the past ten years, some of the rare plants and high quality wetlands and many of the contiguous forest tracts in the watershed have been impacted by development or other land altering activities. The Conservation Area Report for Powhatan Creek was created in response to these impacts and is meant to be a blueprint for the conservation of important natural areas in Powhatan Creek. The report identified 17 priority conservation areas and 17 priority land acquisition/ easement areas and recommended the extension of RPA protection to all perennial streams and connected wetlands. In all, a goal was set to protect 1800 acres of conservation areas in the Powhatan Creek watershed. In this section of the final watershed plan, we will highlight some of the findings in the report, attempt to identify useful watershed protection tools, and generate cost estimates for their implementation. The tools to protect conservation areas include:

- Acquisition/easements -- most costly, examples include open space purchase and conservation easements
- Watershed planning tools -- open space trading, limiting re-zoning, directing development to targeted subwatersheds, clustering down, down zoning, increased RPAs (see Section III A. Land Use Tools)
- Enhanced criteria for stormwater management — which focus on techniques to reduce impacts to floodplain wetlands and rare species (see Section III-D)

This section of the watershed plan will focus on acquisition/easements and RPA extensions as the enhanced stormwater criteria and watershed planning tools have been covered in other sections.

1. Conservation Easements / Land Purchase: High priority conservation areas should be considered as targets for this program. Land values should be based on an independent appraisal assuming current zoning to ensure accurate compensation and a premium should only be paid for the highest quality areas. One million dollars a year would be recommended if the goal is to have significant protection of the Powhatan Creek conservation areas by the 2007 celebration. Specific locations, estimated costs, and parcel information are located in Appendix E.

2. Acquisition: Land acquisition is the most expensive of the tools to protect conservation areas and should be applied only when other conservation methods have been exhausted or when conservation areas coincide with other county goals. The County has a program for the purchase of open space which is also funded at one million dollars a year. An example would be if the County decided to

create a nature reserve adjacent to the County park and acquired the large conservation area near the park for a nature preserve and educational programs.

3. Increased RPA protection of perennial streams and connected wetlands: USGS topographic maps and stream blue lines were often created by cartographers in the office and frequently do not reflect actual conditions in the field. Similarly, different cartographers often performed the delineations for adjacent quadrangle maps and either used different criteria or different personal judgement which resulted in their being a lack of uniformity in the designation of perennial streams between maps. As a result, many of the streams that Center staff encountered in the field which were labeled as intermittent on the USGS Quad maps were flowing even after an extended drought period in the fall of 2000.

By utilizing land conservation tools, the County could reasonably protect an average of 300 acres a year of conservation areas. This goal could be accomplished through a combination of land planning, conservation easements and acquisition, and the protection of perennial streams beyond the USGS bluelines including all perennial streams and connected wetlands.

F. Watershed Education and Stewardship Programs

Targeted Watershed Goals

Link the unique history and culture of Jamestown and Colonial Williamsburg with Powhatan Creek Watershed Protection.

Promote watershed awareness and active stewardship among residents, community associations, businesses, and seasonal visitors through education programs, recreational opportunities, and participatory watershed activities

In addition to the land use and stormwater recommendations for protecting the Powhatan Creek Watershed, we encourage increasing watershed education and stewardship programs. An education and stewardship program is appropriate in Powhatan for many reasons:

- Stakeholders have expressed the need for watershed residents and Homeowners Associations to be educated on proper nutrient and pollution control practices for home and yard.
- Implementation is relatively inexpensive when compared to structural practices such as stormwater retrofitting.
- Successful implementation of a retrofit program requires the support of a commercial and residential community educated on the benefits of structural stormwater practices.
- Preventing pollution at the source is a more effective pollutant removal strategy than engineering stormwater treatment.
- JCC already has an impressive community information network, an educational program framework to build upon, and an organized watershed association.
- JCC has incentive to maintain unique historical heritage and thriving tourism industry that could be linked with watershed awareness.
- An increased emphasis on stewardship, particularly in regards to proper riparian buffer management, reduces potential private property right infringement.

The primary goals of a Powhatan Creek awareness campaign are to alter current behaviors that contribute to pollutant loading and to garner public support for, and assistance in, achieving the overall objectives of the watershed plan. To compliment strategies identified in the Final Management Plan, we recommend targeting efforts along three major venues: pollution prevention, buffer management, and stormwater management. Pollutant load reduction is always more effective when controlled at the source rather than trying to treat the runoff after the fact. This translates into educating the public; who may be unaware of the negative impacts of personal behaviors. These practices include; the preferred practices for lawn and garden care, invasive species, pet waste disposal, car maintenance, septic system inspections, and the proper disposal of household hazardous wastes. Since many riparian buffer areas fall within private ownership and are often subject to encroachment, homeowners should be educated on the benefits of maintaining undisturbed, vegetated buffers. Additionally, the Management Plan contains significant recommendations for stormwater practices and retrofitting opportunities, and stormwater issues, particularly in regards to flooding, are important to many watershed residents. We encourage early efforts for outreach in areas targeted for potential retrofits and special stormwater criteria to enlist the support of the surrounding residential and business community.

As identified in the Baseline Assessment Report and through participation in stakeholder workshops, the County is not currently developing any new educational programs. However, Powhatan Creek has an impressive information network and structural resources in place to serve as a framework for a comprehensive education and stewardship program. We recommend development of a public outreach campaign that takes advantage of currently available educational resources to raise awareness of watershed issues and increase the role of watershed stewardship on the part of local residents, businesses, and the transient population. These resources include:

- Friends of Powhatan Creek
- Stormwater management practice education for Home Owner Associations (HOA)
- Drainage Improvement Program
- County Environmental Protection Fund
- Single-entity management of large community developments
- Significant educational resources tied to historic Jamestown and colonial Williamsburg
- Accessible media infrastructure including local papers, televised public hearings

The watershed planner/restoration coordinator could take a limited role in watershed education and the County could partner with Friends of Powhatan Creek as a vehicle for information dispersal and increasing public support. Stakeholders were adamant about educating HOAs and considered these associations, as well as the large community management entities to be the most efficient way of targeting homeowners. Additionally, the County should utilize the tremendous educational opportunity provided through academic institutions such as the College of William and Mary, and through the historic and cultural education programs associated with Jamestown and Colonial Williamsburg. Powhatan Creek was where the first settlers arrived, therefore the health of the watershed is an integral part to the areas history. Specific program recommendations are provided in Table 3.7.

Table 3.7 Education and Stewardship Program Recommendations	
Program Target	**Recommendations**
Watershed Education Infrastructure	Provide financial support to FOP for distribution of watershed education materials Develop a watershed stewardship kit that FOP can use for workshops and/or training of HOA, civic groups, businesses, etc Link historical education efforts with watershed education Utilize HOA Stormwater Education Program as a foundation for dispersing information targeting watershed awareness and preferred behaviors to local homeowners Utilize Household Hazardous Waste Collection days and existing water conservation program to promote watershed awareness and stewardship options Work with single-entity management units to implement community wide education campaigns Post watershed management issues and stewardship options on county website and in local papers
Overall Watershed Awareness	Place signs identifying the Powhatan Creek Watershed at five or more tributary road crossings Create a watershed unit to be integrated into middle school science curriculum Promote general awareness and responsibility of citizens with respect to being good stewards of their historic watershed Encourage and promote citizen activities around watershed such as monitoring, clean-ups and policing
Pet Waste Management	Signage and waste disposal stations in high dog walking areas Fact sheets and limited media campaign
Lawn and Garden Care, Landscaping	Target homeowners, lawn care companies and managed communities with alternative products or application procedures for fertilizers and pesticides Encourage nurseries and garden clubs to utilize native trees and shrubs for landscaping and wetland plants suitable for bioretention facilities Discourage yard waste disposal into streams Recognize citizens using proper practices; “Powhatan-friendly Yard of the Month Award”
Automotive Care (Car Washing and Maintenance)	Promotion of washing on pervious surfaces and with minimum amounts of water Proper disposal and recycling of used motor fluids
Good Housekeeping	Promotion of proper disposal and/or recyling of household and commercial hazardous wastes Provide information on alternative cleaners and other household chemicals. Target septic awareness campaigns to problem areas
Rooftop Disconnection	Institute downspout disconnection and rain barrel program (FOP)
Stormwater Management	Utilize HOA Stormwater Education Programs to educate residents on retrofit opportunities.

Table 3.7 Education and Stewardship Program Recommendations	
Program Target	**Recommendations**
	Promote businesses on the value of bioretention facilities in parking lots and pervious spill over areas
Buffer Management	Educate homeowners on benefits of buffers and actively discourage buffer encroachment Promote native vegetation for buffer enhancement projects Encourage native buffers and bioengineering in the tidal portion of Powhatan Creek

G. Non-stormwater discharges

Non-stormwater discharges do not seem to be a large contributor of pollutants in Powhatan Creek. Only a few incidents of sewage leaks or breaks have been reported. There is a potential for localized areas to be affected by failing septic systems. Specifically, the greatest concern is the tidal mainstem where there is the potential for failing systems to affect the tidal areas which contain shellfish beds which are closed due to levels of fecal coliform above state standards. Marinas can also be a source of fecal pollution if individuals do not dispose of waste generated on their boats correctly. Sewage pumpout and clean marina programs can be important in reducing such a threat.

Two recommendations:

- A septic system inspection program is specifically warranted in the tidal portion of Powhatan Creek, particularly because as few as one failing septic system could result in shellfish bed closures.

- Marina pumpout stations (2 marinas) may be a consideration -- especially as boat traffic may increase with the 2007 Jamestown Celebration.

Section IV: Draft Implementation and Cost Schedule

A draft implementation and cost schedule was created to provide planning level estimates for recommendations involved in the implementation of the watershed management plan. A six year implementation time horizon was used to coincide with the 2007 Jamestown Celebration. The first year of implementation would be the most labor intensive with new programs and codes and ordinance changes. Subsequent years would focus primarily on continued stormwater retrofits, stream restoration, land conservation and watershed stewardship programs. Federal and state programs and grants are often available for the implementation of watershed restoration projects. Often there is a cost-share requirement where salaries and capital funds can be used as match. A few examples of such funds include EPA Section 319 of the Clean Water Act, Coastal Zone Management Funds, state Watershed Restoration Action Strategies funding and partnerships with the Army Corp of Engineers. The implementation of this watershed plan would also fulfill many of the requirements of both EPA's Phase II National Pollutant Discharge Elimination System (NPDES) and a proposed fecal coliform Total Maximum Daily Load (TMDL) scheduled to be written for the tidal mainstem of Powhatan Creek.

Table 4.1 Schedule for Implementation and Costs	
Tools	**Costs**
Year 1	
Land Use Planning	
1. Use subwatershed maps to review future development projects, negotiate proffers, and review re-zoning requests	Policy change
2. Limit re-zoning in sensitive subwatersheds including the mainstem tidal	Staff time Ordinance or code change
3.Ordinance to allow for open space trading to preserve sensitive areas	Staff time Policy change
4. Zoning change to allow the ability to cluster down for greater open space preservation in key areas	Staff time Ordinance or code change
5. Re-zoning even in watersheds targeted for growth would retain the higher open space requirement	Staff time Ordinance or code change
6. Hire a watershed planner/restoration coordinator to help implement changes	$35 - $45k
Buffers	
7. New RPA layer based on field determination of perennial streams and connected wetlands	Use layer provided by CWP or further field truth using W&M, or consultant

Tools	Costs
8. Incorporate buffers into watershed education and outreach efforts	See slides in CD (Appendix B)
9. Buffer enforcement or better buffer demarcations	Signage or systematic enforcement
10. Promotion of a 300ft (min) buffer on the tidal and non-tidal mainstem	Through implementing land use tools
Better Site Design	
11. Better Site Design changes to codes and ordinances (Section III-C)	Staff time Ordinance or code change
12. Changes to stormwater ordinance in sensitive watersheds (Section III-A)	Staff time Ordinance or code change
13. Better site design workshop for developers and county staff	CWP will include as part of Yarmouth Stakeholder Process
Stormwater Management	
14. Stormwater Utility	Staff time ½ FTE position (utility could pay for retrofits and regionals)
15. Stormwater retrofits	(2 a year at $30,000)
16. Regional stormwater facilities	Build 2-3 over 5 years $250,000 (have new users pay in)
17. Special criteria in sensitive stream areas and conservation areas	Staff time Ordinance change
18. Reduced criteria in areas with existing regionals	New users pay in
Land Conservation	
19. Purchase land or easements (goal of 300 acres a year)	At least 1 million a year for Powhatan
20. Continued activity by Williamsburg Land Trust, potential for them to hold easements	None or minimal
Watershed Education	
21. Continued homeowner education about stormwater practices	Already in place Staff time

Tools	Costs
22. Expand to include lawn care and conversion, pet waste, car washing and other watershed behaviors (perhaps a role for Friends of Powhatan)	Staff time / Expand waterwise program already in place $5000-$7500 year for outreach to HOAs
Stream Restoration	
23. Begin to develop projects (3 projects over 5 years)	Begin targeting and planning Staff time Consultant or W&M 30k for further prioritization
Total	200k + Land purchase

Table 4.1 Schedule for Implementation and Costs	
Tools	**Costs**
Years 2-6	
Watershed Planning	
1. Watershed manager to help implement changes	$35 - $45k / yr
Buffers	
2. Continue with buffers in watershed education program	Staff time
Better Site Design	
3. Developer education	Staff or workshop 2k
Stormwater management	
4. Stormwater retrofits	(1-2 a year at $30,000 average)
5. Regional stormwater facilities	Build 2-3 over 5years $250,000 (have new users pay in)
Land Conservation	
6.Land purchase or conservation easements (goal of 300 acres a year)	1- 2 million a year

Tools	Costs
Watershed Education	
7. Continue homeowner education program	Staff time /Friends of Powhatan Creek ($5to7k)
Stream Restoration	
8. Design and build project (2-3 in 5 years)	150k -200k / per project min
Total	**Average $300K + Land Purchase / Easements**

Section V: Subwatershed Management Plans

Conditions and watershed management concerns vary across each of the twelve subwatersheds, including the mainstem non-tidal and tidal creek segments. This section contains a detailed profile for each of these areas, with respect to current and future impervious cover; subwatershed goals; estimated developable area; stream habitat conditions, presence of wetlands, contiguous forest, and rare, threatened and endangered species; beaver activity; priority retrofit sites and potential regional facilities.

Subwatershed maps have also been created to accompany the text and serve as a blueprint for the protection and restoration of the Powhatan Creek watershed. They also can be used as a tool in which to review future development projects, negotiate proffers, or review re-zoning requests. The maps contain priority conservation areas such as contiguous forest tracts, sensitive streams and locations of rare, threatened or endangered species. The maps also contain priority retrofit sites, locations for regional facilities and information on specific stormwater criteria.