

**Powhatan Creek Watershed
Management Plan**

November 2001

FINAL

Prepared for:

James City County, Virginia

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Table of Contents

	Page
List of Tables	ii
List of Figures	iii
Executive Summary	iv
Section I: Introduction	1
Section II: Watershed Goals	7
Section III: Watershed Recommendations	11
A. Land Use Planning	11
B. Aquatic Buffers	14
C. Better Site Design	17
D. Stormwater Management	23
E. Conservation Areas	28
F. Watershed Education	29
G. Non-Stormwater Discharges	32
Section IV: Costs and Schedule	33
Section V: Subwatershed Management Plans	36
References	80
Appendix A. The Economics of Watershed Protection	A-1
Appendix B. Watershed Education CD	A-2
Appendix C. Resource Protection Area Extension Map	A-3
Non-Tidal Mainstream Buffer Map	
Tidal Mainstream Buffer Map	
Appendix D. James City County Codes and Ordinances Worksheet	A-4

Powhatan Creek Watershed Management Report

List of Tables

No.	Title	Page
E-1.	Subwatershed Goals	vi
E-2.	Priorities and Costs for Watershed Protection and Restoration in Powhatan Creek	viii
1.1	Powhatan Creek Subwatershed Assessment Results	2
1.2	Potential Stream Restoration Areas and Associated Retrofits	3
1.3	Powhatan Creek Conservation Area Priorities	4
1.4	Priority Stormwater Retrofits.....	6
3.1	Land Use Strategies for Powhatan Creek Watershed.....	13
3.2	Buffer Strategies for Powhatan Creek Subwatersheds	16
3.3	VDOT Minimum Local Street Width Requirements	19
3.4	James City County Setback, Frontage, and Open Space Requirements	20
3.5	Better Site Design Strategies for Powhatan Creek Subwatersheds	22
3.6	Prioritization of Potential Sites for Regional Facilities to Manage Stormwater Runoff from Future Development	26
3.7	Education and Stewardship Program Recommendations	31
4.1	Implementation and Cost Schedule	33

Powhatan Creek Watershed Management Report

List of Figures

No.	Title	Page
1.	Powhatan Creek Subwatershed Classification Map.....	viii
2.	Priority Conservation Areas.....	6
3.	Stormwater Criteria Designations.....	24
4.	Regional Pond and Priority Retrofit Locations.....	27
5.	Subwatershed 201.....	37
6.	Subwatershed 202.....	41
7.	Subwatershed 203.....	44
8.	Subwatershed 204	47
9.	Subwatershed 205	51
10.	Subwatershed 206	55
11.	Subwatershed 207	58
12.	Subwatershed 208	61
13.	Subwatershed 209	65
14.	Subwatershed 210	68
15.	Non-tidal Mainstem	71
16.	Tidal-Creek Segment	76
	Resource Protection Area Extension Map	Appendix C
	Non-Tidal Mainstream Buffer Map	
	Tidal Mainstream Buffer Map	

Executive Summary

This watershed management plan provides a summary of the findings from the Powhatan Creek baseline report, the three special studies and the stakeholder process conducted by the Center for Watershed Protection, the James River Association and James City County. A specific watershed management plan and accompanying maps have been drafted for the 12 subwatersheds based on the eight tools of watershed protection. The subwatershed maps serve as a blueprint for the protection and restoration of Powhatan Creek and may be used as planning maps during the implementation of the watershed management plan and as an important tool during the development review process.

The 22 square mile Powhatan Creek watershed is truly a state and national treasure with its historic past and present biodiversity. The mouth of the creek discharges to the James River near Jamestown Island, the site of the first permanent settlement in North America and a major tourist destination. The scenic Powhatan Creek is also notable for its exceptional biodiversity and bottomland wetlands. It was recently ranked as having the greatest significance for biodiversity and natural areas in the lower Peninsula of Virginia (Clark, 1993). Rare, threatened or endangered plants such as the small whorled pogonia, Virginia least trillium, and false hopsedge are found here. Bald eagle habitat and an important heron nesting colony are located within Powhatan Creek's expansive floodplain wetlands.

Rapid development seen in the last two decades poses a threat to water quality and natural habitats in Powhatan Creek. Impervious cover is an indicator of the extent and pattern of growth in the watershed, and this growth pattern over the years is very revealing. In 1970, watershed impervious cover was estimated to be 3%, but grew to 8% in 1998, 9.8% in 2000, and is projected to reach a maximum of 15.5% in the future. Prior research has shown that stream and wetland quality begins to decline when the amount of impervious cover in a watershed exceeds 10%. Based on our latest estimates, Powhatan Creek appears to be very close to crossing this key threshold.

The principal effects of impervious cover in Powhatan Creek include:

- Changes in hydrology of streams, wetlands and floodplains
- Increased pollutant loads delivered in urban stormwater (bacteria, sediment, nutrients)
- Channel erosion in headwater streams
- Water level fluctuations that degrade wetlands and rare, threatened, or endangered plant species habitat
- Favors the establishment of invasive plant species
- Fragmentation of contiguous forests
- Increased flooding

Based on a widely used stream classification model, eight subwatersheds were classified as sensitive and only four subwatersheds were classified as impacted in 1998. Recent growth in the watershed

Powhatan Creek Watershed Management Report

has been rapid, and as of 2000, six subwatersheds are classified as sensitive, and six are now classified as impacted. Based on future growth in the watershed, it is likely that all subwatersheds will shift to the impacted category under the current zoning in the coming decades.

Watershed residents and other stakeholders play a vital role in the creation of a watershed management plan. It is important to involve the citizens, businesses, and other interested parties in the development of a watershed plan, since they will have to live with the decisions which are made. Stakeholders also bring to the table the issues which are important to them. Their participation gives them a stake in the outcome and helps to ensure plan implementation. Two public meetings were held with watershed stakeholders; the first covered the baseline assessment and fieldwork which 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. The eight overall watershed protection and restoration goals identified by the stakeholders are:

1. Prevent further degradation of water quality in Powhatan Creek and maintain the outstanding quality of tidal and nontidal mainstem wetlands. Extend Resource Protection Areas (RPA) to protect all perennial streams and connected wetlands.
2. Maintain biological and habitat diversity and promote habitat connectivity by protecting wildlife and riparian corridors between watersheds, subwatersheds, and the tidal and nontidal portions of Powhatan Creek.
3. Develop an “affordable and effective” watershed management plan that can be implemented by James City County.
4. Establish a transparent and stream-lined permitting process, and provide cost effective and incentive based regulations or guidelines for “green” development.
5. Improve the existing mechanisms for completing stormwater maintenance and retrofitting, and develop a mechanism for adequate long-term funding.
6. Link the unique history and culture of Jamestown and Colonial Williamsburg with Powhatan Creek watershed protection. Implement the majority of the watershed plan by the 2007 Jamestown Celebration.
7. Promote watershed awareness and active stewardship among residents, community associations, businesses, and seasonal visitors through educational programs, recreational opportunities, and participatory watershed activities.
8. Restore the physical integrity of degraded headwater streams where possible and protect the high quality streams from the negative morphological effects associated with increased urbanization.

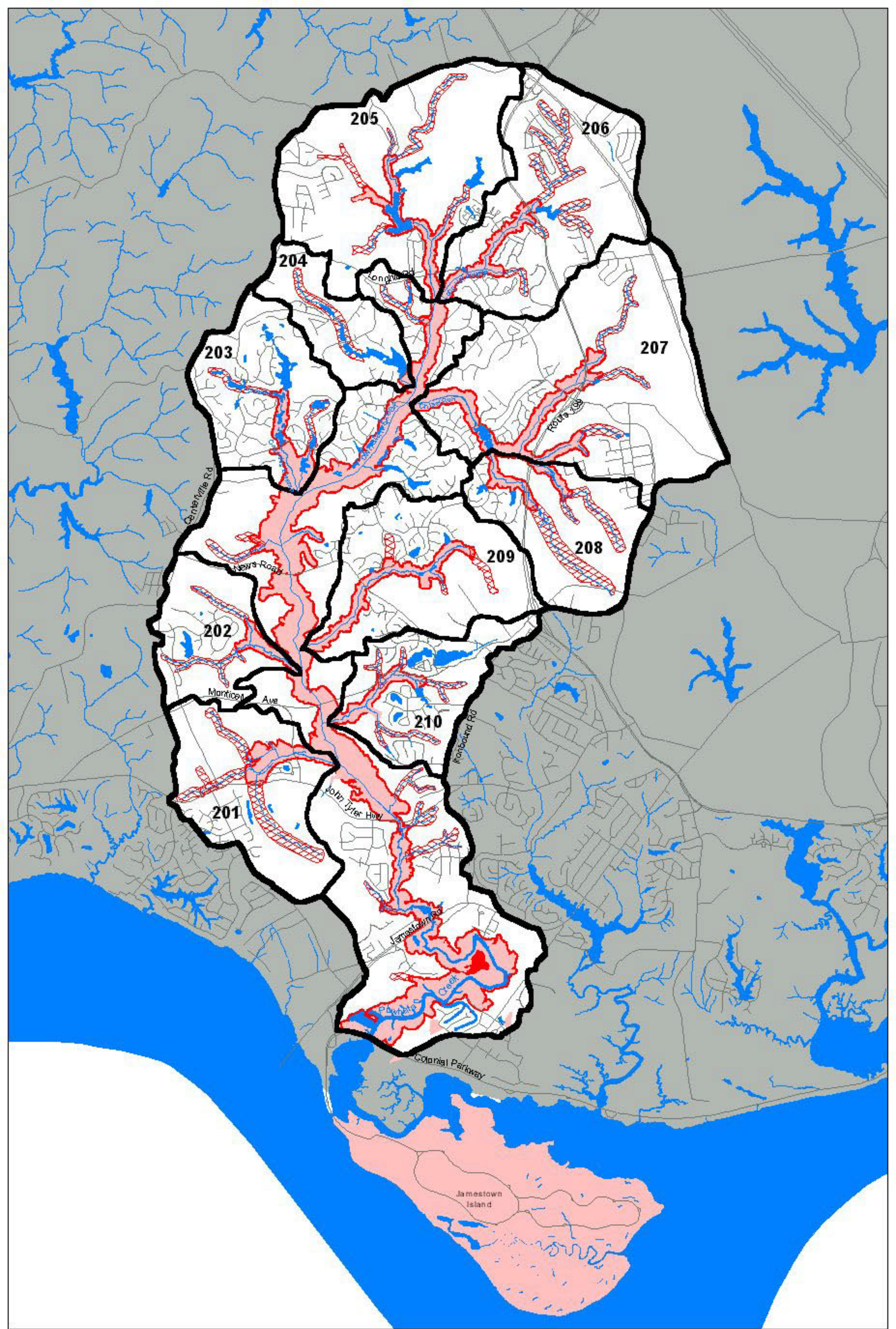
Powhatan Creek Watershed Management Report

Process

The 22 square mile Powhatan Creek watershed was divided into 12 subwatersheds from one to four square miles in area to create individual planning units (Figure 1). Land use and impervious cover were analyzed for each subwatershed in order to set expectations for current and future water quality and habitat conditions. Field conditions and conservation areas were evaluated to check expectations developed in the land use and impervious cover analysis. Together with the results of our conservation area work and the stream habitat assessment, draft goals were created for subwatersheds based on science and the existing and potential future land use. It was determined that Powhatan Creek includes a mix of relatively high quality subwatersheds with considerable biodiversity, a number of subwatersheds where stream conditions and habitat diversity have already been impacted by large regional stormwater ponds, and a high quality wetland complex along the mainstem.

A sensible philosophy was devised by the Center along with stakeholders to protect the high quality streams and conservation areas using land use and conservation tools. At the same, provide for additional development in degraded subwatersheds, with a goal of preventing further degradation by using stormwater retrofits, effective stormwater management, stream restoration, on-lot stormwater management and watershed education programs. In cases where development is going to occur in sensitive watersheds, special stormwater criteria, where impervious cover and stormwater runoff are reduced, have been created in order to reduce the impacts. In addition, the mainstem tidal section was designated as a Sensitive Resource Area, which reflects the need for special tools to help protect the significant natural resources of this area. The stakeholder process helped develop a broad consensus for these goals and added even more specific goals for both the entire watershed and individual subwatershed planning units. A summary of the individual subwatershed goals is as follows:


Table E-1. Subwatershed Goals			
Subwatersheds	Current Status / Future goal	Watershed Goals	Tools
201, 202, 205, 208, 209, Mainstem nontidal	Sensitive / Sensitive <i>less than 10% impervious cover</i>	Preserve important conservation areas, sensitive streams and contiguous forest	Conservation easements, land acquisition, limit re-zoning, open space transfer; when development does occur -- cluster and use Special Stormwater Criteria (SSC)
203, 204, 206, 207, 210	Impacted / Impacted <i>10 -25% impervious cover</i>	Reduce pollutant sources, improve pond aesthetics and uptake, restore degraded streams and protect streams from further degradation	Direct development here, implement watershed education and stewardship programs, stormwater retrofits, on-lot stormwater practices, and stream restoration, consider up-zoning



LEGEND

- Watershed Boundary
- Subwatershed Boundary
- Current RPA and RPA Buffer
- Recommended RPA Extension
- Hydrology

Powhatan Creek Watershed


 4000 0 4000 Feet

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Mainstem Tidal	<p>Impacted / Impacted</p> <p><i>13.6% impervious cover</i></p>	<p>Sensitive Resource Area</p> <p>Minimize increases in impervious cover, maintain high quality of wetland habitat, maintain buffers for the preservation of marsh wildlife communities and water quality</p>	<p>Increase buffer, cluster to preserve buffer, open space design, limit up-zoning, open space trading</p>
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Recommendations

Prioritized implementation recommendations for the Powhatan Creek watershed are summarized in Table E-2. Preliminary cost estimates and potential responsible parties have been identified so that financial resources can be allocated and staff roles can be defined. Real watershed protection requires a multi-faceted approach which combines land use decisions with on-the-ground implementation, education and protection of watershed functions. This approach strives for permanent protection, and attempts to minimize long-term costs by implementing proactive, preventative solutions. This method is not inexpensive, our estimate is \$300,000 a year over 5 - 6 years, this number would increase with a larger open space acquisition or conservation easement program. Long-term protection of water quality, fisheries, quality of life and biodiversity have quantifiable community benefits including increased property values and enhanced quality of life, which compound over time. More details on the economic benefits of watershed protection can be found in Appendix A.

Another key component of this watershed plan is measuring and monitoring the success of the plan. In Powhatan Creek, this consists of monitoring the effects of management measures on stream channel stability, water quality, RTE species and impervious cover. This will enable county staff to learn from the successes and challenges of plan implementation and craft better strategies in the future.

Powhatan Creek Watershed Management Report

Table E-2. Priorities and Costs for Watershed Protection and Restoration in Powhatan Creek					
Priority	Goals Achieved	Protection Tool or Evaluation Measure	Where	Costs to JCC and Action	Responsible Party
1	1,2,3	Use subwatershed maps to review future development projects, negotiate proffers, and review re-zoning requests	Watershed wide	Minimal <i>Use the subwatershed maps created by the Center</i>	JCC Planning, Development Management, Environmental Division
2	1,2,3	Implement new RPA boundary based on perennial streams	Watershed wide (See Map in Appendix D)	Minimal <i>Use the new layer created by CWP (perhaps further improve with help of William & Mary)</i>	JCC Environmental Division
3	1,2,3	Prohibit re-zoning which increases impervious cover in sensitive subwatersheds	Sensitive subwatersheds (201, 202, 205, 208, 209, tidal and non-tidal mainstem).	Minimal <i>Policy change</i>	Planning Board
4	1,2,3,4	Cluster down - Ability to reduce lot sizes in low density zoning areas to create additional open space	Sensitive Subwatersheds (201, 202, 205, 208, 209, Tidal and non-tidal Mainstem)	Small 0.1 FTE (Full-Time-Employee) Watershed Planner <i>Ordinance or code change or Overlay zone</i>	JCC Planning

Powhatan Creek Watershed Management Report

Table E-2. Priorities and Costs for Watershed Protection and Restoration in Powhatan Creek					
Priority	Goals Achieved	Protection Tool or Evaluation Measure	Where	Costs to JCC and Action	Responsible Party
5	1,2,3	Open Space Trading or Fee-in-lieu-- to acquire conservation areas and mainstem buffers (reduced open space requirement in certain watersheds in exchange for protection of conservation areas and the mainstem buffer)	Subwatersheds (203, 204, 206, 207, 210)	Minimal 0.1 FTE Watershed Planner <i>Ordinance or code change or Overlay zone</i>	JCC Planning
6	1,2,3,6	Purchase conservation easements in conservation areas and along mainstem buffers (Table 1.3 and Figure 2)	Sensitive subwatersheds (201, 202, 205, 208, 209, tidal and non-tidal mainstem).	Very Expensive (1million per year) <i>Goal: Preserve 250 - 300 acres a year over 6 years</i>	JCC Planning, Development Management, Williamsburg Land Trust
7	1,2	Special stormwater criteria in sensitive stream areas and conservation areas	201, 202, 203 (small section), 205, 208, 209, tidal and non-tidal mainstem	Small <i>stormwater ordinance change</i>	JCC Environmental Division
8	3	Hire a watershed planner/restoration coordinator	County wide	Expensive 1.0 FTE Watershed Planner \$35 to \$40K a year <i>Implementation of watershed plan</i>	Environmental Division

Powhatan Creek Watershed Management Report

Table E-2. Priorities and Costs for Watershed Protection and Restoration in Powhatan Creek					
Priority	Goals Achieved	Protection Tool or Evaluation Measure	Where	Costs to JCC and Action	Responsible Party
9	1,5,8	Stormwater retrofits	201, 202, 205, 206, 207, 210	Expensive \$60k / year <i>Retrofit two facilities a year for 5 years (could be paid for with stormwater utility)</i>	JCC Environmental Division / Watershed Planner/ Restoration Coordinator
10	1,5	Long term maintenance of stormwater facilities / Stormwater utility	Watershed Wide	Expensive 0.5 FTE Stormwater engineer <i>Creation of a stormwater utility</i>	Planning board/ JCC Environmental Division
11	1,3,4	Impervious cover limit of 10%	208, 209	Small 0.05 FTE Watershed Planner <i>Ordinance</i>	JCC Planning
12	1,3,7,8	Expand BMP homeowner education program to include lawn care and conversion, pet waste, car washing and other watershed behaviors	Watershed wide	Small \$5 to \$7.5K year (FOP) <i>CD included with powerpoint slides for presentations to HOAs</i>	JCC Environmental Division/ Friends of Powhatan Creek
13	1,3,4	Better site design	County wide	Small 0.1 FTE Watershed Planner <i>Zoning changes</i>	Planning division

Powhatan Creek Watershed Management Report

Table E-2. Priorities and Costs for Watershed Protection and Restoration in Powhatan Creek					
Priority	Goals Achieved	Protection Tool or Evaluation Measure	Where	Costs to JCC and Action	Responsible Party
14	1,3,4	Encourage Better Site Design across watershed –workshop with developers and planning staff	Watershed wide	Minimal <i>(streamlined review process) and workshop for review staff and developers (Center will make part of Yarmouth Stakeholder Involvement process)</i>	Center for Watershed Protection/ JCC Environmental Division
15	1,7	Golf course management task force to discuss potential improvements in turf management/nutrients, pesticides, buffer protection, stream crossings and invasive species	202, 203, 204, 207	Minimal 0.05 FTE Watershed Planner <i>Facilitate task force</i>	Fords Colony/ JCC Environmental Division
16	1,8	Restore three stream sections over 5 years	201,206,207,210	Expensive \$100k a year for five years Prioritize restoration sites Geomorphic prioritization (\$30k or staff time) <i>Oversee restoration projects</i>	JCC Environmental Division Watershed Planner/ Restoration Coordinator
17	1,3	Monitor the effects of the Special Stormwater Criteria (SSC), JCC’s regular criteria and the stream restoration efforts on stream channels	Watershed wide	Small Estimate of \$10 - \$15k/year <i>Evaluate the effectiveness of protection and restoration efforts/criteria</i>	Environmental Division and Greg Hancock, William and Mary

Powhatan Creek Watershed Management Report

Table E-2. Priorities and Costs for Watershed Protection and Restoration in Powhatan Creek					
Priority	Goals Achieved	Protection Tool or Evaluation Measure	Where	Costs to JCC and Action	Responsible Party
18	1,2,3	Plan for & monitor the protection of the RTE species in New Town - monitoring should continue through the development process	Subwatersheds 208/209	Small \$5k a year <i>Evaluate the effectiveness of protection efforts</i>	Donna Ware, William and Mary
19	1,2	RPA signage with new development	Watershed wide	Small \$5 to \$10k/ year	JCC Environmental Division
20	6,7	Powhatan Creek Watershed Signs which link the 2007 Celebration	Mainstem bridge crossings	Small \$5k	JCC Environmental Division
21	1,2,7	Program for assisting landowners in buffer creation.	Watershed wide	Small 0.1 FTE Watershed Planner +\$6k for equipt <i>Work with schools to establish a seedling grow out station. Restoration coordinator or existing staff to help distribute trees.</i>	JCC Environmental Division - Restoration Coordinator, Friends of Powhatan Creek
22	1,2	Acquisition of priority conservation and other sensitive areas	Sensitive subwatersheds (201, 202, 205, 208, 209, tidal and non-tidal mainstem).	Minimal - (Redirect existing resources) <i>Target a portion of the Open Space acquisition fund to conservation areas in Powhatan</i>	JCC Parks and Recreation Division

Powhatan Creek Watershed Management Report

Table E-2. Priorities and Costs for Watershed Protection and Restoration in Powhatan Creek					
Priority	Goals Achieved	Protection Tool or Evaluation Measure	Where	Costs to JCC and Action	Responsible Party
23	1,3	Re-compute impervious cover for all subwatersheds in 5 years	Watershed wide	Small \$10-20K in year 5 <i>Re- compute impervious cover</i>	JCC GIS Department or CWP
24	1,5	Future regional stormwater facilities (2-3 over 5 years)	Options include: 204, 205, 206, 207, 208	Expensive (estimate 2-3 @ \$250k per facility) <i>Plan/ construct</i> <i>Have new users pay in</i>	Environmental Division
Total				•Expensive 2 FTEs \$1.5 million over 6 years Additional funds for conservation easements/open space protection	

Section I: Introduction

The 22 square mile Powhatan Creek watershed is truly a state and national treasure with its historic past and present biodiversity. The mouth of the creek discharges to the James River near Jamestown Island, the site of the first permanent settlement in North America and a major tourist destination. The scenic Powhatan Creek is also notable for its exceptional biodiversity. It was recently ranked as having the greatest significance for biodiversity and natural areas in the lower Peninsula of Virginia (Clark, 1993). Rare, threatened or endangered plants such as the small whorled pogonia, Virginia least trillium, and false hopsedge are found here. Bald eagle habitat and an important heron nesting colony are located within Powhatan Creek's expansive floodplain wetlands.

Based on a widely used stream classification model, eight subwatersheds were classified as sensitive and only four subwatersheds were classified as impacted in 1998. Recent growth in the watershed has been rapid, and as of 2000, six subwatersheds are classified as sensitive, and six are now classified as impacted. Based on future growth in the watershed, it is likely that all subwatersheds will shift to the impacted category under the current zoning in the coming decades. Clearly, it will be important to balance future growth with protection of Powhatan Creek and its natural resources.

Three special studies were performed to gain a better scientific understanding of the stream system; these included the *Stream and Floodplain Assessment*, the *Conservation Area Study*, and the *Stormwater Management Masterplan*. The *Stream and Floodplain Assessment* consisted of an instream habitat survey for the majority of the non-tidal watershed and reported on stream channel stability and habitat conditions in each of the subwatersheds. The conservation area study identified the presence of Rare, Threatened or Endangered (RTE) species, contiguous forest and high quality wetlands and identified potential threats and impacts to their existence. The stormwater master plan developed specific stormwater criteria for subwatersheds, identified existing stormwater practices for retrofit possibilities, and located potential regional stormwater facilities. Summary findings are presented below; more detailed reports of each study are available.

Stream Habitat and Floodplain Assessment

Stream habitat surveys show early and clear signs of stress in headwater streams. The influence of watershed development on the mainstem and tidal creek has been more difficult to detect, but these changes may be masked by the very recent nature of development, the extensive influence of beaver activity and the stormwater and open space requirements adopted by James City County in the past.

Outcomes

- identification of 4 subwatersheds in excellent condition
- identification of 3 subwatersheds in good condition
- identification of 4 subwatersheds in fair condition
- identification of 6 potential locations for stream restoration (Table 1.2)

Powhatan Creek Watershed Management Report

Table 1.1 contains the subwatershed rankings for habitat conditions as well as the amount of impervious cover in each subwatershed.

Table 1.1 Powhatan Creek Subwatershed Assessment Results				
Rank	Subwatershed	Impervious Cover	Habitat Score	Rating
1	205	5.1%	168	Excellent
2	Mainstem non-tidal	3.8%	164	Excellent
3	208	5.8%	160	Excellent
4	209	5.3%	159	Exc./Good
5	202	6.4%	148	Good
6	207	16.4%	144	Good
7	210	18.6%	142	Good/Fair
8	204	10.0%	132	Fair
9	206	14.7%	128	Fair
10	203	10.5%	124	Fair
11	201	6.8%	114	Fair
N/A	Mainstem tidal	13.6%	NA	Important fishery, shellfish beds and history
**Further details can be found in the <i>Powhatan Creek Stream Habitat and Floodplain Assessment</i> (Brown, 2001).				

Powhatan Creek Watershed Management Report

Table 1.2 Potential Stream Restoration Areas and Associated Retrofits				
Subwatershed	Catchment	Stream Reach *	Associated Retrofit (Rank)	Comments
201	Stem	201	R201-1 (7 of 16)	Recommended wetland/stream restoration of the ditched and drained wetland/stream system. Note presence of RTE species.
206	201-1	102, 103, 104	--	Restoration associated with incised, degraded stream channel conditions found along active nick points in the northern tributary. Proposed regional pond to manage stormwater from new and existing development.
206		201	R206-1 (1 of 8)	
206	202-1	106	R206-3 (4 of 16)	Eroded channel and nick points downstream of dry pond serving Prime Outlets. Retrofit of dry pond proposed for construction in conjunction with the stream restoration.
207	101-1, 101-2	101	R207-2 (2 of 8)	The lower portion of this highly incised and degraded reach would benefit from proposed regional facility. Note: Adjacent land zoned for limited Industry/Business.
207	202-1	103	R207-4 (1 of 16)	Pond to control unmanaged runoff from development upstream of proposed stream rehabilitation
210	204-1	109, 204	R210-1 (9 of 16)	Highly incised channel. Retrofit of dry pond to provide channel protection in recommended in conjunction with stream rehabilitation.

* Potential stream restoration reaches are denoted by blue crosshatches on the subwatershed management maps in Section 5. The stream reach numbering system is presented in Figure 8 and Figure 9 in the Powhatan Creek Watershed Stream and Floodplain Assessment Report (Brown, 2001).

Conservation Area Study

Based on field surveys, current Resource Protection Area (RPA) boundaries (state regulated areas) do not protect all vulnerable streams or conservation areas. The boundaries may need to be expanded or another mechanism must be developed to protect these areas. Of critical concern are populations of rare, threatened and endangered species, such as Small whorled pogonia, Virginia least trillium, New Jersey rush, false hopsedge, and Torrey’s peat moss, which are widely dispersed across the watershed, and often located outside RPA boundaries. These species are highly vulnerable to watershed development. In addition, while extensive floodplain forest areas are protected within the RPA, upland forest areas are becoming smaller and more fragmented, and may deserve greater emphasis in land conservation. In previously developed areas with only a small buffer on the

Powhatan Creek Watershed Management Report

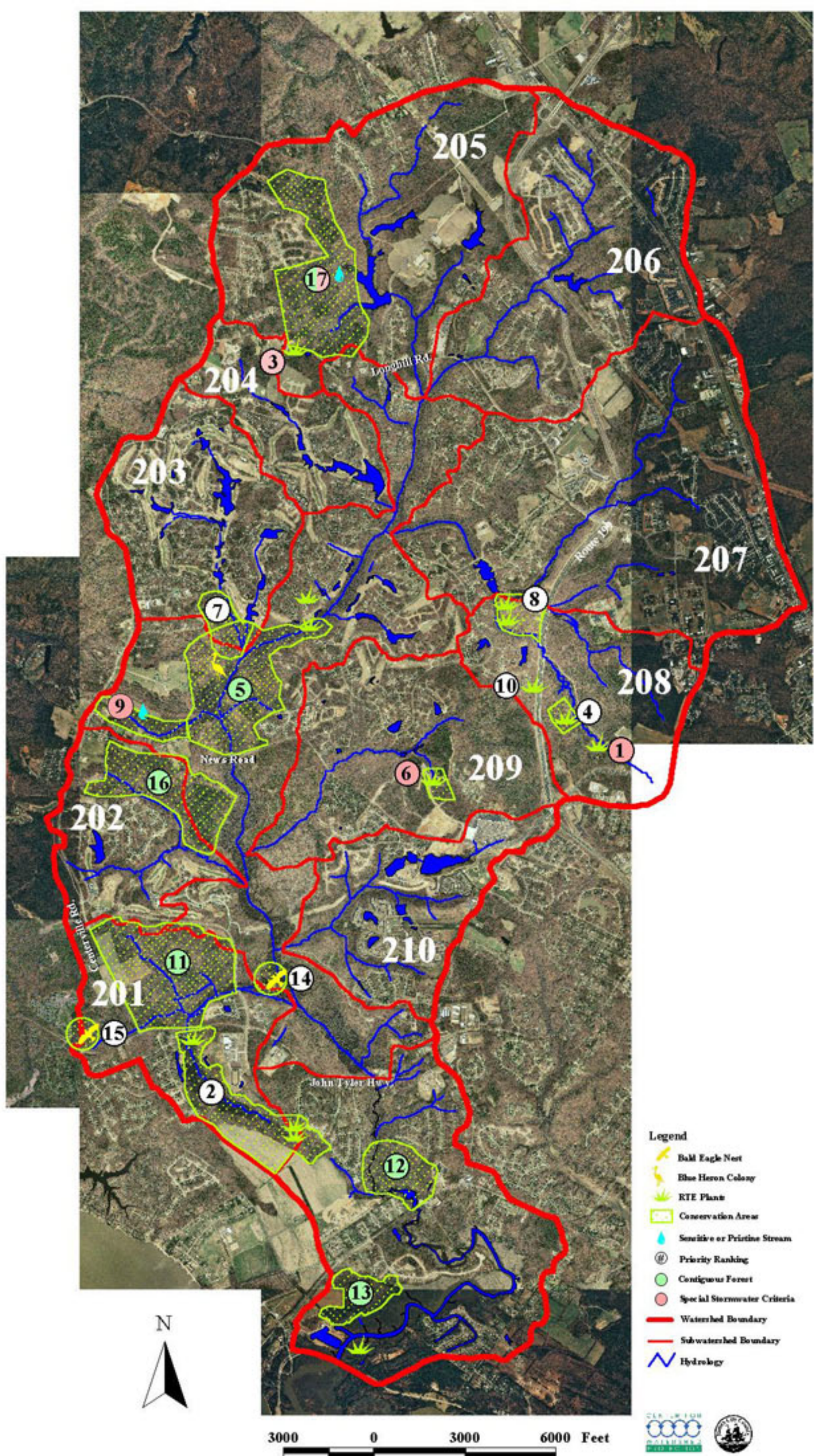
mainstem floodplain wetlands, invasive species have intruded into the wetland complex; these include Japanese knotweed, microstegium and phragmites.

Outcomes

- 17 priority conservation areas and management recommendations;
- 17 areas for land acquisition or easement (1800 total acres);
- Locations where the RPA protection should be extended;
- Recognition of the need for additional buffer to protect the high quality wetland complex of the tidal and non-tidal mainstem of Powhatan Creek (300 ft. minimum)

A description of the 17 priority conservation areas are listed in Table 1-3, as well as appropriate management recommendations. Figure 2 illustrates the locations of the conservation areas. One of the goals of the watershed management plan is to ensure the protection of these areas.

Table 1.3 Powhatan Creek Conservation Area Priorities				
Rank	Conservation Area #	Description	Total Score	Management Recommendation
1	C-25	VA least trillium New Town (NT)	64	Special Stormwater Criteria (SSC)
2	C-1/C-2/C-5	Paleochannel	59	Invasive Species Management
3	C-12/C-14	RTE wetland subwatershed 205	59	Special Stormwater Criteria
4	C-24	Small whorled pogonia (NT)	58	Greater Conservation
5	C-35	Contiguous forest/ heron rookery	57	Conservation/Acquisition
6	C-29	VA least trillium Jesters Ln	57	Conservation/Acquisition or SSC
7	C-9	Subwatershed 203 near rookery	55	Conservation/Acquisition
8	C-21	Small whorled pogonia 208 Ford's Colony (FC)	55	Conservation/Acquisition
9	C-34	High quality stream near News Rd.	54	Conservation/Acquisition or SSC
10	C-26	Small whorled pogonia (FC)	54	Conservation/ Management
11	C-4	Contiguous forest in 201	53	Conservation/Acquisition
12	C-41	Contiguous forest upper tidal	52	Conservation/Acquisition



**Figure 2: Powhatan
Priority Conservation Areas**

Powhatan Creek Watershed Management Report

Table 1.3 Powhatan Creek Conservation Area Priorities				
Rank	Conservation Area #	Description	Total Score	Management Recommendation
13	C-42/C-43	Contiguous forest lower tidal	52	Conservation/Acquisition
14	C-39	Eagles Nest above Rt. 5	52	Conservation/Acquisition
15	C-6	Eagles Nest on watershed border in 201	51	Conservation/Acquisition
16	C-7	Medium sized contiguous forest in 202	49	Conservation/Acquisition
17	C-13	Contiguous forest/ high quality streams in 205	49	Conservation/Acquisition or SSC

**Further details and scoring methods can be found in the *Powhatan Creek Conservation Area Report* (Sturm, 2001).

Stormwater Management

While JCC has strong stormwater management criteria, the existing management practices are not enough to protect highly sensitive and pristine subwatersheds from degradation. If development is to occur in these areas, special precautions and techniques should be used to protect the integrity of these areas. In areas with existing regional stormwater management, additional stormwater practices may not be needed, though on-site techniques such as rain gutter disconnection should be encouraged. The remaining areas can be developed within the current JCC stormwater management criteria. The watershed was divided into 64 catchments and stormwater management criteria which have been set for different types of catchments. Table 1.4 summarizes the eight top priority stormwater retrofit sites. More information on the stormwater management recommendations can be found in Section III.

Outcomes

- Special Stormwater Criteria (SSC) for stream protection and conservation areas
- 8 priority stormwater retrofits (described in Table 1.4)
- 5 locations for potential regional facilities
- Stormwater criteria specifically for the tidal mainstem of Powhatan Creek to address water quality issues
- Locations for areas where the current stormwater criteria should be used
- Locations for areas where no additional stormwater management is needed

Powhatan Creek Watershed Management Report

Table 1.4 Priority Stormwater Retrofits				
Rank	Retrofit	Drainage (acres)	Total Points	Description
1	R207-4	80	49	Proposed Extended Detention (ED) pond upstream of Longhill Rd, proposed stream rehabilitation downstream
2	R202-1	250	45	Modification of outlet structure of dry pond to provide channel protection
3	R205-2	120	45	Retrofit of an existing dry pond to provide channel protection
4	R207-3	70	39	Proposed expansion of existing pond to provide ED
5	R206-3	60	37	Outlet modification to provide channel protection at the Prime Outlets dry pond, also site of potential stream rehabilitation
6	R206-4	110	35	Outlet modification, possible micropool addition to dry pond
7	R208-2	30	27	Potential modification to outlet structure of wet pond to provide channel protection
8	R210-1	6	26	Potential modification of dry pond to provide channel protection, potential for conjunction with stream rehabilitation
**Further details can be found in the <i>Powhatan Creek Stormwater Master Plan</i> (Zielinski, 2001).				

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.

Powhatan Creek Watershed Management Report

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

Powhatan Creek Watershed Management Report

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

Powhatan Creek Watershed Management Report

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

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

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.

Powhatan Creek Watershed Management Report

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 blue line 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

Powhatan Creek Watershed Management Report

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:

- 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.

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.

Powhatan Creek Watershed Management Report

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.

Powhatan Creek Watershed Management Report

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

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.

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.

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

Powhatan Creek Watershed Management Report

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:

Principle	Category	COW Points		
		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

Powhatan Creek Watershed Management Report

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.

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)

Powhatan Creek Watershed Management Report

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 Community (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.

Powhatan Creek Watershed Management Report

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

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

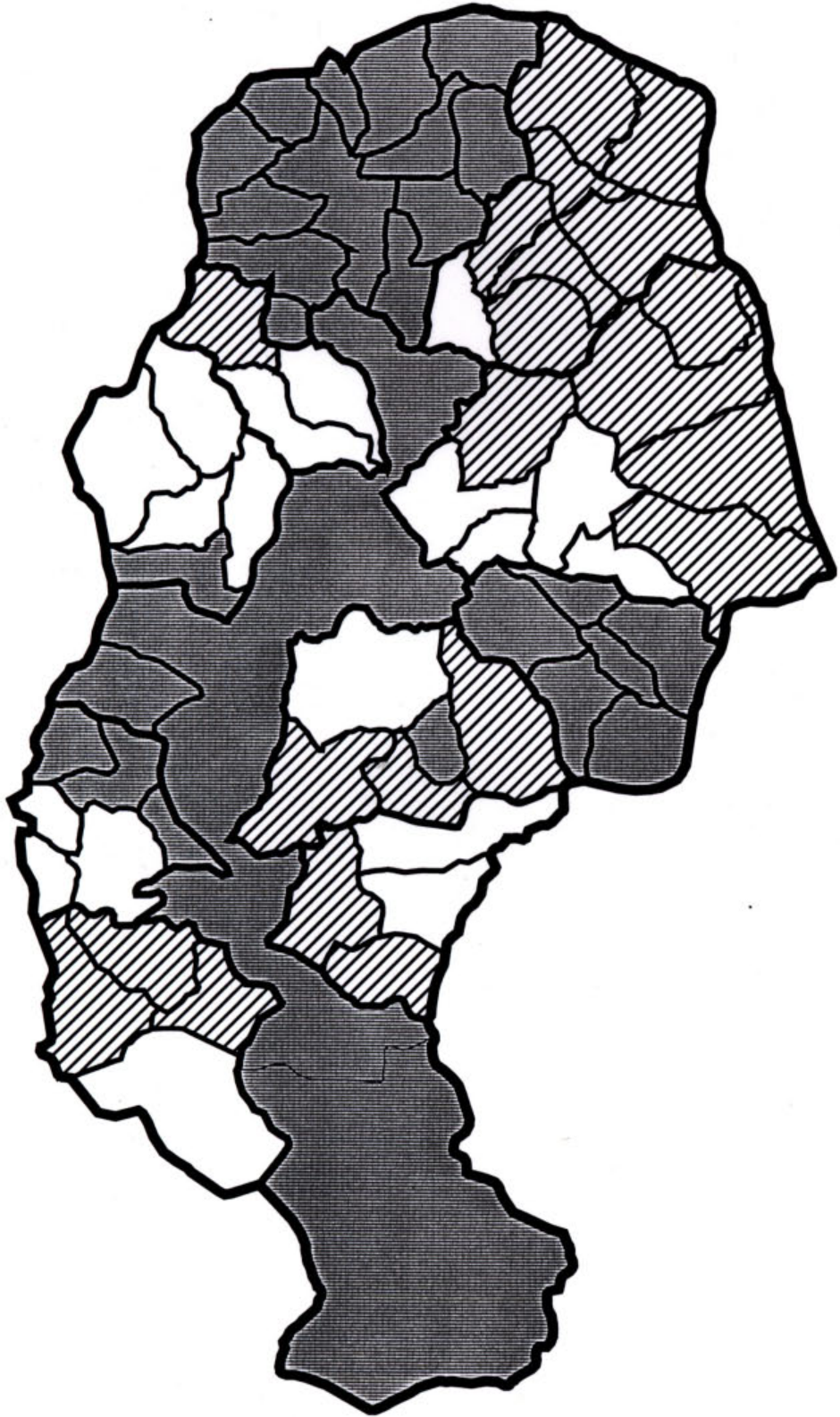
Targeted Watershed Goals

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.



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



Powhatan Creek Watershed Management Report

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.

Powhatan Creek Watershed Management Report

The SSC recommendations fall under two general categories:

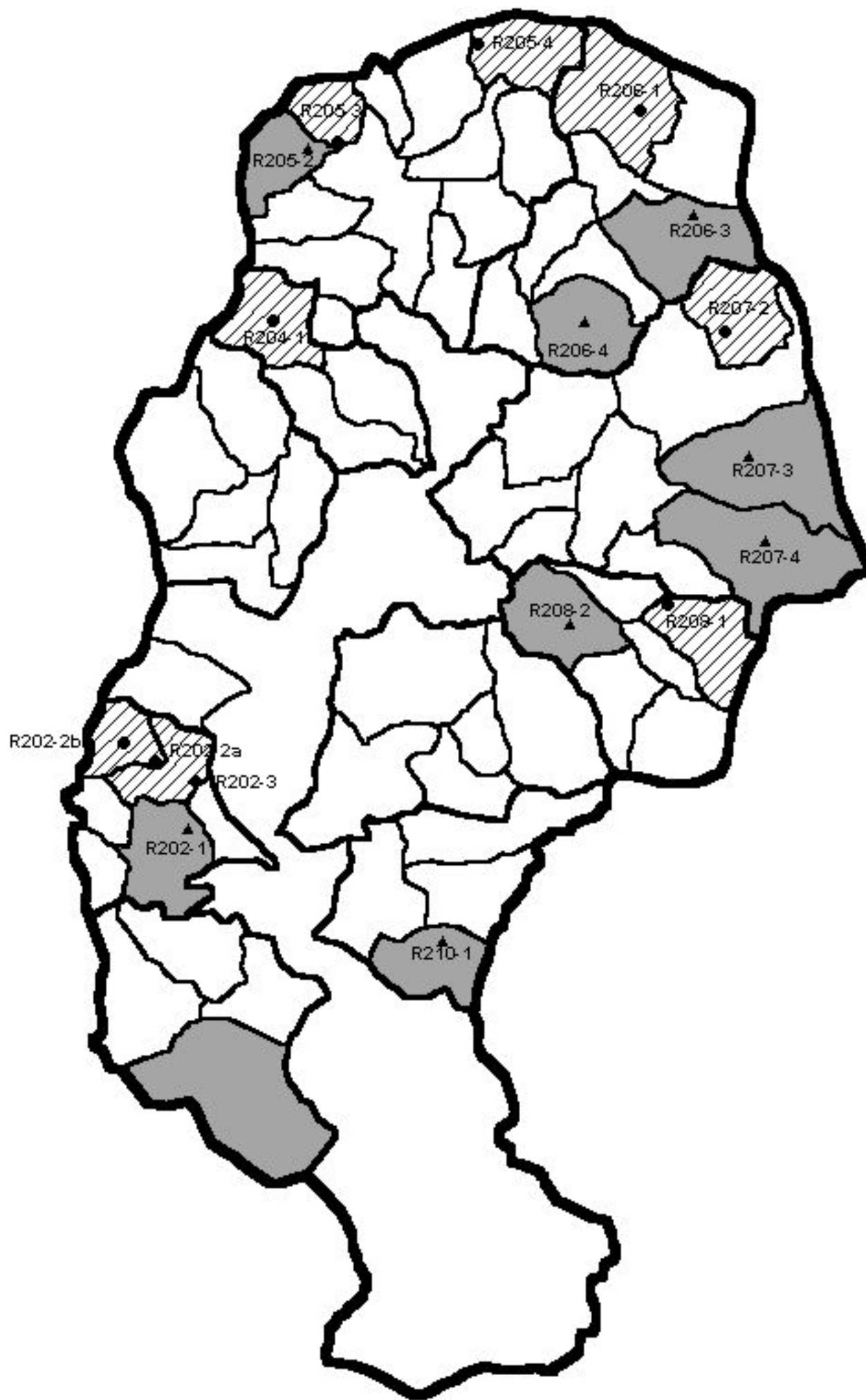
- SSC for Parcel Development in SPAs (Stream Protection Areas) - Applies to development projects 2 acres or more that are subdivided into two or more lots for residential development, or is developed as commercial or industrial.
- SSC for On-Lot / Infill Development in SPAs - applies to SPA catchments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



Powhatan Creek Watershed Management Report

E. Conservation Areas

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

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.

Powhatan Creek Watershed Management Report

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

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.

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

Powhatan Creek Watershed Management Report

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.

Powhatan Creek Watershed Management Report

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

Powhatan Creek Watershed Management Report

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
<i>Year 1</i>	
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

Powhatan Creek Watershed Management Report

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

Powhatan Creek Watershed Management Report

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
<i>Years 2-6</i>	
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

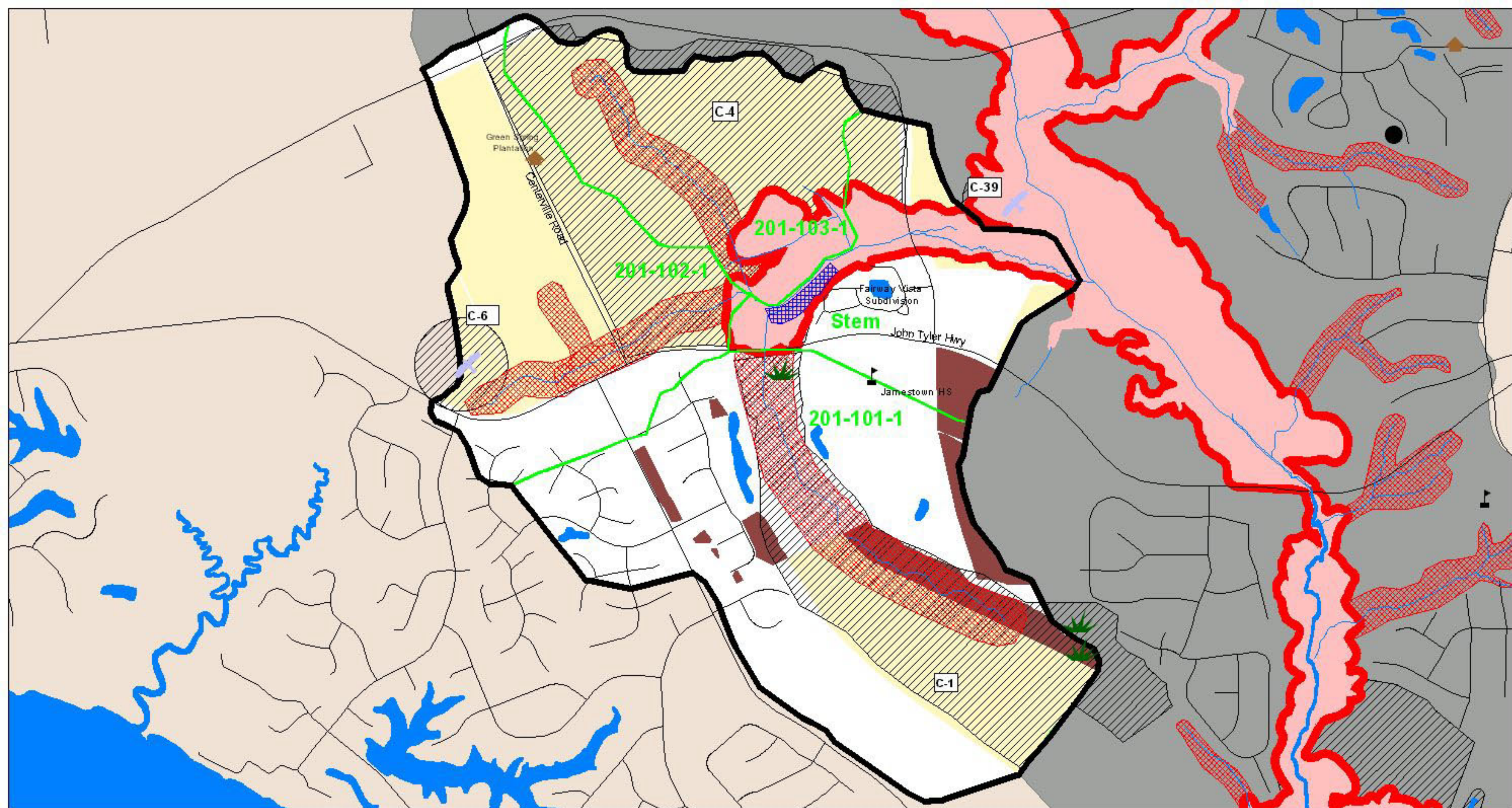
Powhatan Creek Watershed Management Report

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.



LEGEND

- | | | | |
|--------------------------|---|-------------------------------|----------------------------|
| Powhatan Creek Watershed | Proposed RPA Extension | Proposed Conservation Areas | Undeveloped Land |
| Subwatershed Boundary | Priority Regional Stormwater Management Sites | Conservation Area ID | Medium Density Residential |
| Rpa | Priority Retrofit Sites | Bald Eagle Nest | High Density Residential |
| Rpa buffer | Catchment Boundaries | Blue Heron Colony | Mixed Use |
| Hydrology | Catchment Boundaries ID | RTE Plants | Limited Industry/Business |
| Roads | Potential Streams Rehabilitation Area | Historical Points of Interest | Rural |

**Powhatan Creek Watershed
Subwatershed 201**



Subwatershed No. 201

OVERALL PROGNOSIS:

Currently classified as **SENSITIVE**, this subwatershed could possibly shift to **IMPACTED** if the remaining 42% of developable area in the watershed is built out. The subwatershed contains a large contiguous forest tract, a large paleo-channel wetland complex, and is home to two RTE species. The consensus recommendation is to maintain the subwatershed within the **SENSITIVE** category using land conservation tools including acquisition/easement and enabling zoning to cluster down to maximize the preservation of open space / contiguous forest. Almost a fourth of the subwatershed could be protected within the RPA. Ditching, channel alteration, and beaver activity result in only Fair stream habitat scores. Portions of the wetland have been ditched, but are candidates for restoration.

See Figure

Drainage Area: 1.31 sq. miles (835.7 acres)

Land Use in Subwatershed 201

	<i>Percentage</i>	<i>Subwatershed Category</i>
2000 Impervious Cover	6.8 %	Sensitive
Future impervious cover (with buildout)	12.3 %	Impacted
Future impervious cover (with conservation area protection)	8.0 %	Sensitive
Target subwatershed classification		Sensitive

Developable area in subwatershed: 354.6 acres or 42.4% of subwatershed area

Priority Conservation Areas in 201

<i>Table 201-1. Priority Conservation Areas in Subwatershed 201</i>			
<i>Conservation Area</i>	<i>Description</i>	<i>Conservation Area Ranking</i>	<i>Acquisition Ranking</i>
<i>C-1</i>	<i>Paleochannel wetlands and rare plants adjacent to Mainland farm</i>	<i>2 of 21</i>	<i>1 of 17</i>
<i>C-4</i>	<i>Large tract of mature contiguous forest (.5 square mile of forest) Loblolly pine, red maple and green ash</i>	<i>11 of 21</i>	<i>9 of 17</i>
<i>C-6</i>	<i>Recent nesting site for bald eagle</i>	<i>14 of 21</i>	<i>12 of 17</i>

Wetland areas: The largest wetland (C-1) outside of the mainstem of Powhatan Creek located on an old paleo-channel of the creek. The wetland is nearly a square mile in size, and contains a mix of deep water, shallow water, and seasonally inundated zones. Other, smaller wetland areas in C-4 are present in the upper

Powhatan Creek Watershed Management Report

portion of the subwatershed, although they were ditched and drained several decades ago. These areas may be excellent candidates for wetland restoration.

Beaver dam complexes: Strong influence. Almost a half mile length of the paleo-channel wetland has been inundated by beaver activity.

Historic Sites:

Green Spring Plantation--Located on 196 acres of National Historic Park property, Green Spring was the plantation home of Royal Governor Berkeley in the 17th century. It was America's first great experimental farm. It served briefly as the Capital of Virginia after Bacon's Rebellion. The jail where rebels were held still stands today. During the Revolutionary War, The Battle of Green Spring was fought nearby just four months before the Battle of Yorktown. The 18th century manor house rebuilt by William Ludwell-Lee was destroyed by Union troops during the Civil War. Plans to revitalize and preserve the numerous archaeological remains of this historic site are underway by the Friends of Green Spring.

Mainland Farm--Not long after 1607, the colonists realized that better farming opportunities awaited them on the mainland, or "Main." Mainland Farm is the oldest (1618) continuously running farm in America. Reflecting this fact, James City County has raised \$2 million needed to preserve this 217-acre historic treasure.

Stream Conditions in 201

<i>Table 201-2. General Stream Condition in Subwatershed 201</i>		
<i>Stream Quality</i>	<i>Description</i>	<i>Rank</i>
<i>Fair</i>	<i>Streams within C-4 have been historically ditched and channelized Candidates for restoration.</i>	<i>11 of 11</i>

Habitat assessment: Despite the relatively low impervious cover in the subwatershed, the initial stream assessment scores for the streams in the subwatershed are only rated as fair. The scores are among the lowest in the entire subwatershed. The relatively low subwatershed habitat score may reflect some unique physical and historical conditions that have occurred in the subwatershed. These include relatively flat terrain and stream gradients, historical ditching and channelization and the strong influence of beaver dam inundation on the free-flowing stream network in this subwatershed.

Stormwater Management in 201

Subwatershed 201 was divided into four catchments. The lower portion of the subwatershed is largely developed with stormwater management, whereas the upper portion is a preferred conservation area. The major stormwater management strategy involves using on-site stormwater management for future development, in conjunction with cluster or open space design, to limit disturbance to recommended conservation areas.

Powhatan Creek Watershed Management Report

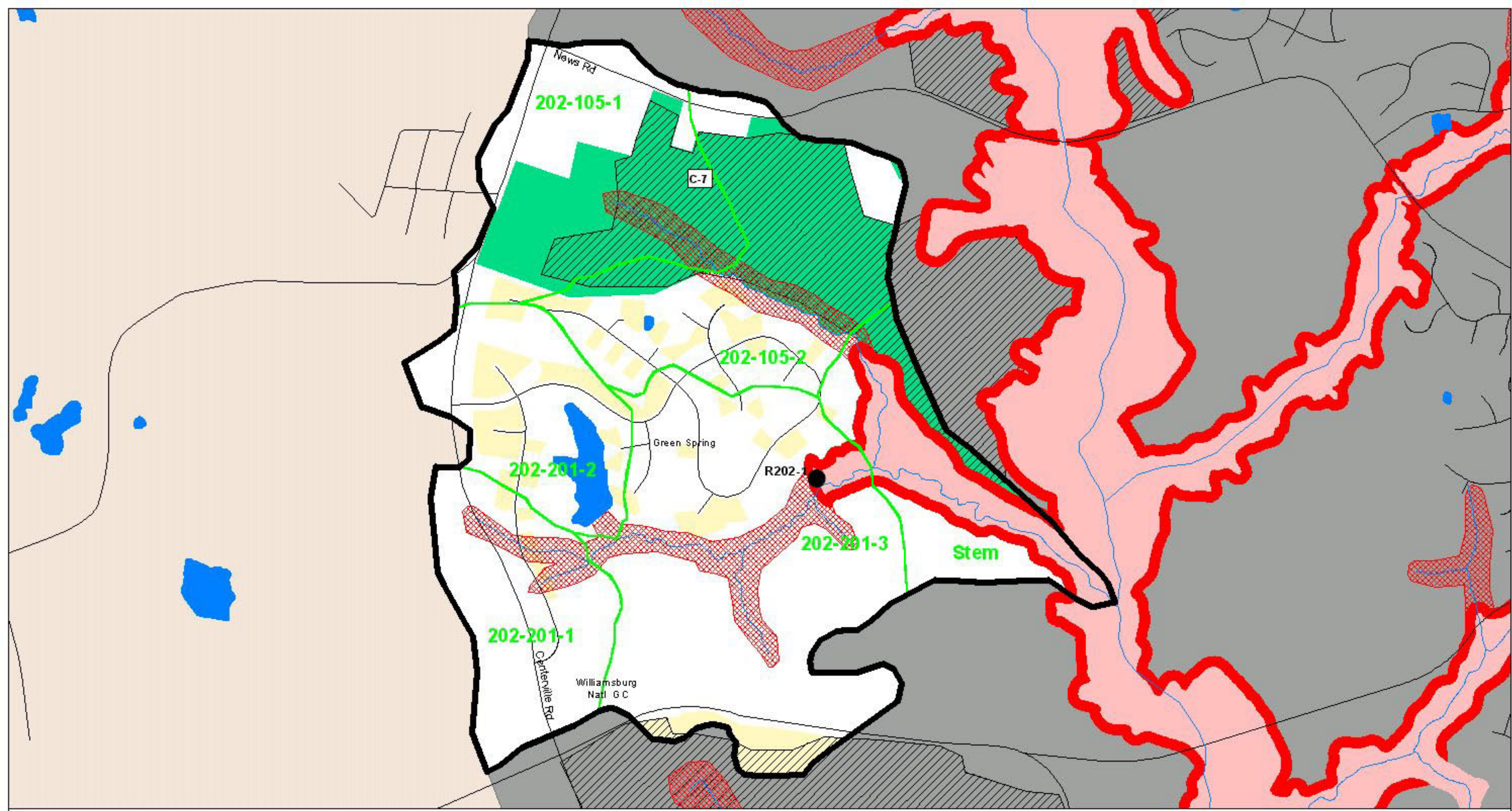
Recommendations for Subwatershed 201

Land Conservation

- Allowances in the zoning to cluster down while still maintaining the same density. (See Land Use Planning Section). Specifically, cluster development on the east side of C-4 and near the Paleochannel (C-1) to preserve as much of the contiguous forest and buffer as possible.
- Acquisition or easement of some of the contiguous tract adjacent to the park service land and continued protection of the Paleochannel and Mainland farm.
- Acquisition/easement of the tract associated with the recent bald eagle nesting site (C-6)
- Continued designation of low density zoning.

Restoration

- Recommended wetland/stream restoration of the ditched stream on park service land



LEGEND

Powhatan Creek Watershed	Proposed RPA Extension	Proposed Conservation Areas	Undeveloped Land
Subwatershed Boundary	Priority Regional Stormwater Management Sites	Conservation Area ID	Low Density Residential
Rpa	Priority Retrofit Sites	Bald Eagle Nest	Medium Density Residential
Rpa buffer	Potential Retrofit Sites ID	Blue Heron Colony	High Density Residential
Hydrology	Catchment Boundaries	RTE Plants	Mixed Use
Roads	Catchment Boundaries ID	Historical Points of Interest	Limited Industry/Business
	Potential Streams Rehabilitation Area		Rural

Powhatan Creek Watershed Subwatershed 202



Subwatershed No. 202

OVERALL PROGNOSIS:

Currently classified as borderline **SENSITIVE**, this small subwatershed is likely to become **IMPACTED** in the near future, based on the intensity of the current development and the amount of developable land remaining in the subwatershed. The recommendation is to preserve the mid sized contiguous forest in the northern portion of the watershed and use Special Stormwater Criteria to preserve the high quality northern tributary. Significant floodplain wetlands are present in this watershed and the potential exists for the presence of RTE plant species. Stream habitat conditions rank fourth overall in the watershed.

See Figure

Drainage Area: 0.94 sq. miles (601.4 acres)

Land Use in Subwatershed 202

	<i>Percentage</i>	<i>Subwatershed Category</i>
2000 Impervious Cover	6.4 %	Sensitive
Future impervious cover (with buildout)	12.2 %	Impacted
Target Watershed Classification		Sensitive

Developable area in subwatershed: 174.2 acres or 29% of subwatershed area

Priority Conservation Areas in 202

<i>Table 202-1. Priority Conservation Areas in Subwatershed 202</i>			
<i>Conservation Area</i>	<i>Description</i>	<i>Conservation Area Ranking</i>	<i>Acquisition Ranking</i>
<i>C-7</i>	<i>Contiguous Forest Tract with high quality stream</i>	<i>16 of 21</i>	<i>14 of 17</i>

Wetland areas: Floodplain wetlands associated with the stream.

Stream Conditions in 202

<i>Table 202-2. General Stream Condition in Subwatershed 202</i>		
<i>Stream Quality</i>	<i>Description</i>	<i>Rank</i>
<i>Good</i>	<i>Tributary in C-7 ranked excellent and the southern tributary ranked good.</i>	<i>5 of 11</i>

Powhatan Creek Watershed Management Report

Habitat assessment: The initial stream assessment scores for the streams in the subwatershed indicate generally good stream and floodplain conditions, yet there were noticeable impacts in terms of in-stream habitat and sediment deposition. Scores for streams in subwatershed 202 were the fifth highest in the entire watershed. Both the streams and associated floodplains are generally intact in the upper headwaters, except for encroachment into the RPA by a golf course. While impervious cover is low in this subwatershed, land development activities have been concentrated adjacent to the stream valley. This may be exerting a more direct impact on stream quality than if the development were evenly distributed throughout the watershed. In addition, a significant fraction of the stream mileage has been impounded by on-line stormwater ponds and beaver activity.

Stormwater Management in 202

Subwatershed 202 has been divided into six catchments between two major stems. The drainage area to the lower stem is largely built out, whereas the drainage area to the upper stem is mainly forested. This upper stem is a recommended Stream Protection Area and a preferred conservation area. Major stormwater management strategies include the application of the Special Stormwater Criteria to the catchments draining to the upper stem, and a retrofit of an existing facility to provide better channel protection.

<i>Table 202-3. Priority Stormwater Retrofit Areas</i>			
<i>Retrofits</i>	<i>Type of Retrofit and Rank</i>		<i>Benefit</i>
	<i>Regional Ponds for Future Development</i>	<i>Stormwater Retrofit</i>	
202-1	--	2 of 17	Retrofit of dry pond to provide channel protection.

Recommendations for Subwatershed 202

Land Conservation

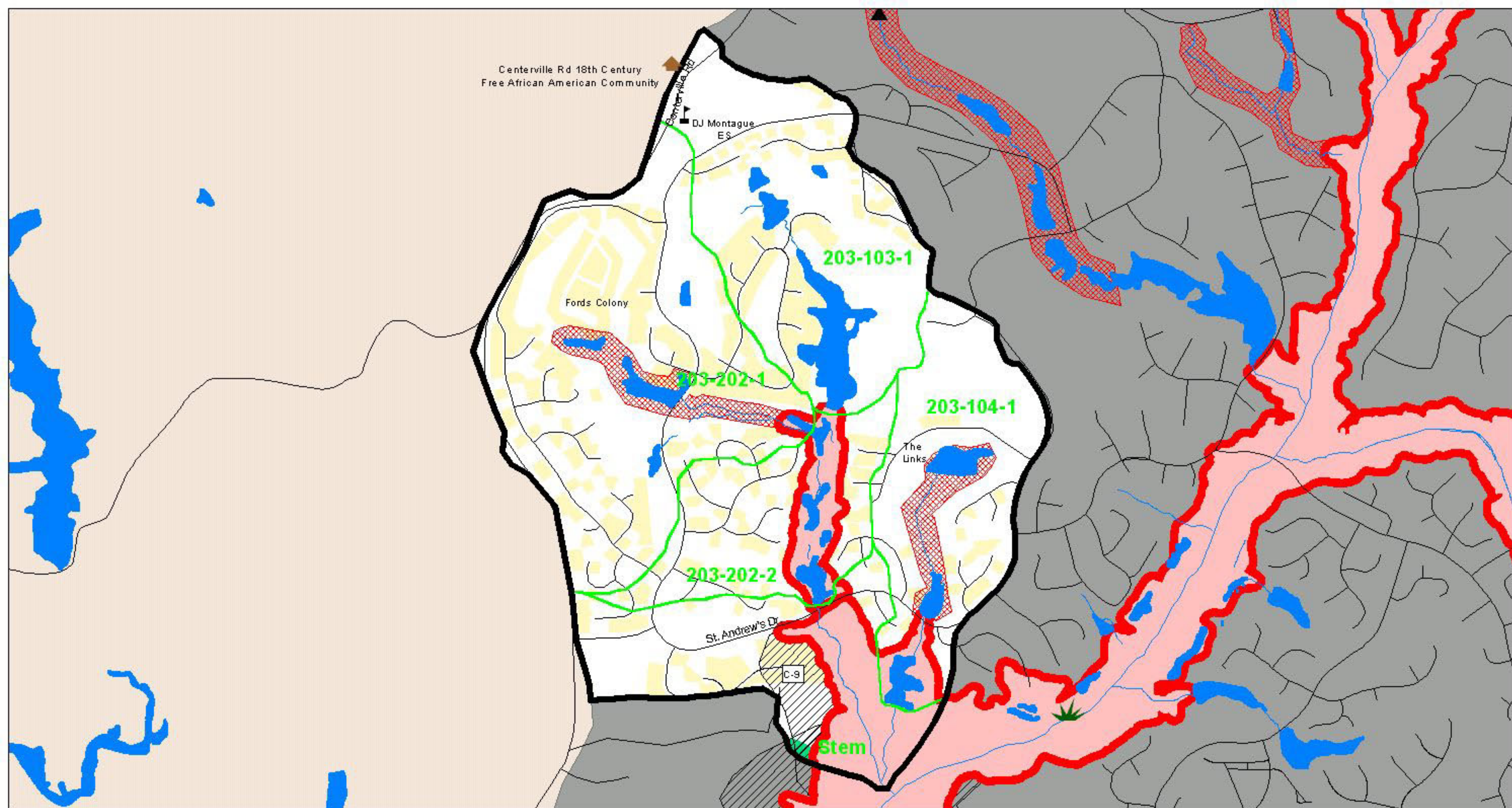
- Conservation easement or acquisition of the C-7 tract
- Continued agricultural zoning of the C-7 tract

Aquatic Buffers

- Concentrate required open space along streams and wetlands.

Stormwater Management

- Special Stormwater Criteria (SSC) for additional development draining to the northern tributary of 202
- One priority stormwater retrofit (202-1)



Centerville Rd 18th Century
Free African American Community

DJ Montague
ES

203-103-1

Fords Colony

203-202-1

203-104-1

The Links

203-202-2

St. Andrew's Dr

C-9

Stem

LEGEND

- | | | | |
|--------------------------|---|-------------------------------|----------------------------|
| Powhatan Creek Watershed | Proposed RPA Extension | Proposed Conservation Areas | Undeveloped Land |
| Subwatershed Boundary | Priority Regional Stormwater Management Sites | Conservation Area ID | Low Density Residential |
| Rpa | Priority Retrofit Sites | Bald Eagle Nest | Medium Density Residential |
| Rpa buffer | Potential Retrofit Sites ID | Blue Heron Colony | High Density Residential |
| Hydrology | Catchment Boundaries | RTE Plants | Mixed Use |
| Roads | Catchment Boundaries ID | Historical Points of Interest | Limited Industry/Business |
| | Potential Stream Rehabilitation Area | | Rural |

**Powhatan Creek Watershed
Subwatershed 203**



Subwatershed No. 203

OVERALL PROGNOSIS:

This subwatershed, which spans part of the Fords Colony planned unit development, has shifted from SENSITIVE to IMPACTED in the last two years. About 10% of the subwatershed is protected by RPAs where several high quality floodplain wetlands exist. Few upland forest areas remain. Stream habitat conditions were only rated as Fair, which reflects the influence of channel alteration, and the presence of nine golf course and stormwater ponds constructed in the stream network. Fords Colony is nearing completion in this subwatershed; consequently, less than 20% of the subwatershed can be developed in the future. This may be a watershed that is appropriate for continued growth because of the existing stormwater management in almost 100% of the watershed, low stream habitat scores and only one significant conservation area. However, this conservation area (adjacent to the blue heron rookery) should be preserved and subject to Special Stormwater Criteria (SSC).

See Figure

Drainage Area: 1.33 sq. miles (849.4 acres)

Land Use in Subwatershed 203

	<i>Percentage</i>	<i>Subwatershed Category</i>
2000 Impervious Cover	10.5 %	Impacted
Future impervious cover (with buildout)	13.0 %	Impacted
Target Watershed Classification		Impacted

Developable area in subwatershed: 174.2 acres or 29% of subwatershed area

Priority Conservation Areas in 203

<i>Table 203-1. Priority Conservation Areas in Subwatershed 203</i>			
<i>Conservation Area</i>	<i>Description</i>	<i>Conservation Area Ranking</i>	<i>Acquisition Ranking</i>
C-9	<i>Extended protection of the blue heron colony and contiguous forest found between subwatershed 203 and the mainstem of Powhatan Creek.</i>	<i>7 of 21</i>	<i>5 of 17</i>

Wetland areas: Floodplain wetlands associated with the stream.

Historic Sites:

Centerville Road 18th Century Free African-American Community--In 1802, William Ludwell-Lee freed his slaves and gave them land on his Hot Water site (a subsidiary of Green Spring). It was the first community in Virginia developed solely for emancipated blacks. The tract remained under Lee-descendent control until the 1840s when it was sold to absentee owners. It dissolved after the 1860s.

Stream Conditions in 203

Powhatan Creek Watershed Management Report

Table 203-2. General Stream Condition in Subwatershed 203		
Stream Quality	Description	Rank
<i>Fair</i>	<i>Natural hydrology of streams is highly affected by ponds, golf courses and development in this subwatershed.</i>	<i>10 of 11</i>

Habitat assessment: Stream assessment scores indicate only Fair habitat conditions in free-flowing streams, which was the second lowest score recorded anywhere in the watershed. Streams appear to be enlarging in response to recent development. The streams are also affected by an adjacent golf course and recent beaver activity. The stream channels between the golf course ponds has been piped, and little natural stream channel exists above News Road. Below News Road, the stream is influenced by an extensive wetland complex. This may be a watershed that is appropriate for continued growth because of the existing stormwater management, low stream habitat scores and the absence of conservation areas.

Stormwater Management in 203

Subwatershed 203 has been divided into 5 catchments that all fall entirely within Ford's Colony where conservation concerns include the protection of the heron rookery at the bottom of the subwatershed, as well as preservation of the remaining contiguous forest. Stormwater management strategies include introducing the use of on-lot practices to reduce stormwater runoff and pollutant loading, pondscaping existing facilities with native wetland species, and reforestation of riparian areas. No retrofits are recommended for this subwatershed.

Recommendations for Subwatershed 203

Land Conservation

- Land acquisition or easement of C-9 tract associated with the heron colony and extensive wetland and contiguous forest system

Watershed Education

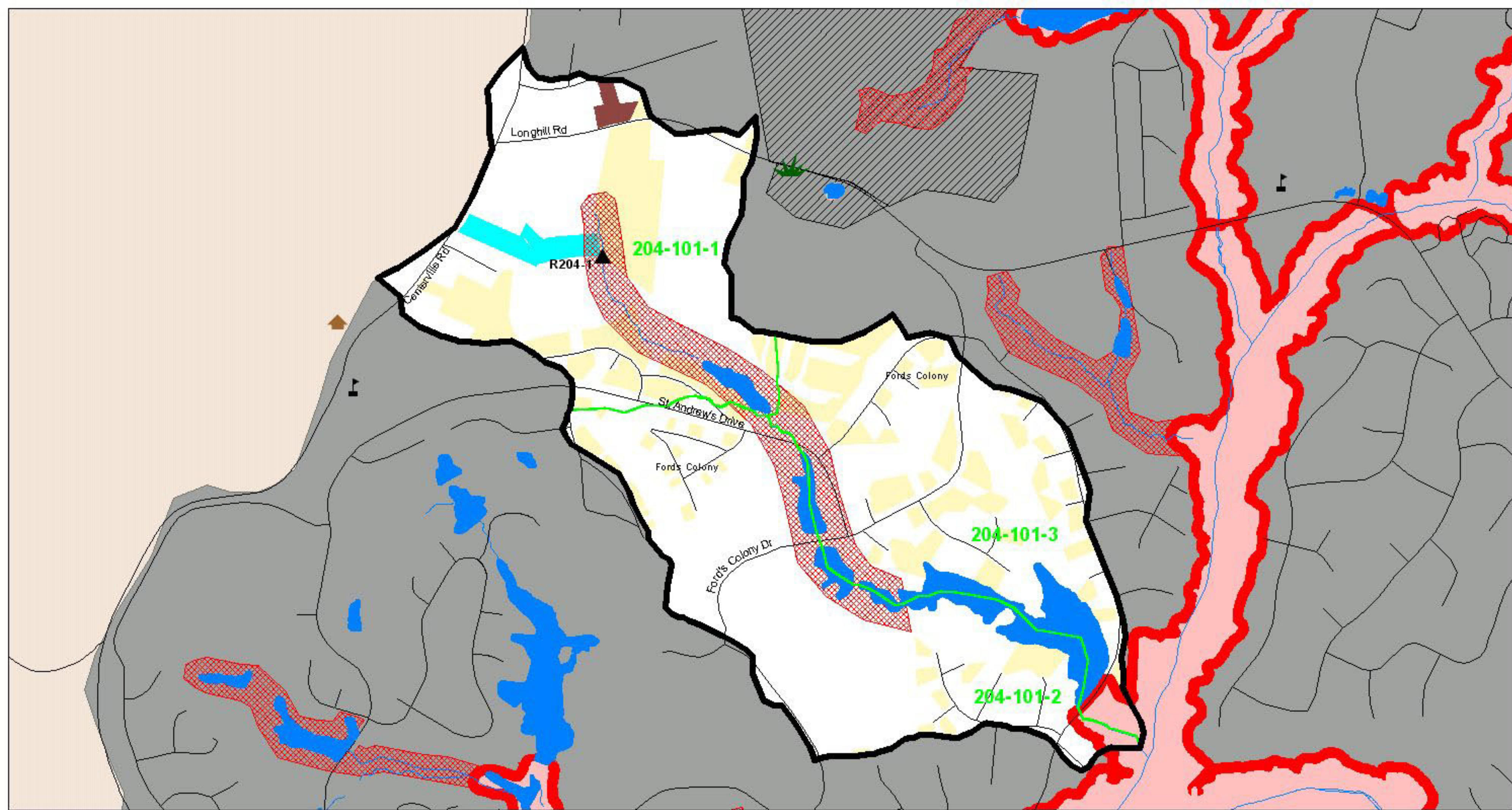
- Homeowner education on low impact lawn care, pet waste, and other water quality issues (See Appendix B and accompanying CD)
- Work with Drew Mulhare and Ford's Colony to examine turf nutrient management and buffer management on the golf course. These partnerships can lead to opportunities to reduce nutrient inputs and increase buffer widths.

Aquatic Buffers

- Look for opportunities to increase aquatic buffers on streams

Stormwater Management

- Naturescaping golf course ponds i.e. planting native wetland plants for better nutrient uptake and natural aesthetic
- Special Stormwater Criteria for the drainage associated with the C-9 conservation area



LEGEND

- | | | | |
|--------------------------|---|-------------------------------|----------------------------|
| Powhatan Creek Watershed | Proposed RPA Extension | Proposed Conservation Areas | Undeveloped Land |
| Subwatershed Boundary | Priority Regional Stormwater Management Sites | Conservation Area ID | Low Density Residential |
| Rpa | Priority Retrofit Sites | Bald Eagle Nest | Medium Density Residential |
| Rpa buffer | Potential Retrofit Sites ID | Blue Heron Colony | High Density Residential |
| Hydrology | Catchment Boundaries | RTE Plants | Mixed Use |
| Roads | Catchment Boundaries ID | Historical Points of Interest | Limited Industry/Business |
| | Potential Streams Rehabilitation Area | | Rural |

**Powhatan Creek Watershed
Subwatershed 204**



Subwatershed No. 204 (FORDS COLONY)

OVERALL PROGNOSIS:

This small subwatershed also encompasses portions of the Fords Colony PUD. Currently classified as borderline IMPACTED, it is presently shifting into the IMPACTED with current development. Less than 1% of the subwatershed is protected within the RPA, and few conservation areas are present. Few contiguous forests and wetlands exist and several sections of stream have been piped. The stream channel network is dominated by several large stormwater ponds which serve 100% of the existing development. Stream habitat scores reflect these conditions; Subwatershed 204 received the third lowest stream habitat scores recorded anywhere in the watershed. This may be a watershed that is appropriate for continued growth because of the existing stormwater management, low stream habitat scores and absence of conservation areas. Allowances for up-zoning should be considered for this subwatershed.

See Figure

Drainage Area: 0.85 sq. miles (540.9 acres)

Land Use in Subwatershed 204

	<i>Percentage</i>	<i>Subwatershed Category</i>
2000 Impervious Cover	10.0 %	Impacted
Future impervious cover (with buildout)	14.2 %	Impacted
Target Watershed Classification		Impacted

Developable area: 141.6 acres or 26% of subwatershed area

Conservation Areas in 204

No high priority conservation areas in subwatershed 206. There are opportunities for possible RPA Buffer extension

Wetland areas: Wetlands only exist between the lowermost golf course pond and the confluence with the mainstem of Powhatan Creek.

Powhatan Creek Watershed Management Report

Stream Conditions in 204

<i>Table 204-1. General Stream Condition in Subwatershed 204</i>		
<i>Stream Quality</i>	<i>Description</i>	<i>Rank</i>
<i>Fair</i>	<i>Natural hydrology of streams is highly affected by ponds, golf courses and development in this subwatershed.</i>	<i>8 of 11</i>

Habitat assessment: Stream assessment scores indicate only Fair/Good habitat conditions in free-flowing streams-- the third lowest score recorded anywhere in the watershed. The stream corridor has been heavily influenced by development, including in-stream stormwater and golf course ponds, as well as poor vegetation in portions of the RPA. As a result, significant stream mileage has been impounded. In addition, the stream channels between the ponds have been piped.

Stormwater Management in 204

Subwatershed 204 has been divided into 3 catchments. About two-thirds of Subwatershed 204 fall within Ford's Colony, whereas the remaining area lightly developed as rural residential, general agriculture, and limited business. Primary stormwater strategies for the subwatershed include on-site stormwater management for new development to limit disturbance to recommended conservation areas, introducing the use of on-lot practices to reduce stormwater runoff and pollutant loading, pondscaping existing facilities with native wetland species, and reforestation of riparian areas.

<i>Table 204-2. Potential Stormwater Retrofit Areas</i>			
<i>Potential Retrofits</i>	<i>Type of Retrofit and Rank</i>		<i>Benefit</i>
	<i>Regional Ponds for Future Development</i>	<i>Stormwater Retrofit</i>	
<i>204-1</i>	<i>5 of 9</i>	<i>--</i>	<i>Regional stormwater management pond for water quality and channel protection.</i>

Other Notes:

Much of the development in the subwatershed was built prior to the Chesapeake Bay Preservation Act, which explains the reduced buffers found in the area. On the positive side, the Ford's Colony development, which spans subwatersheds 203 and 204 and parts of 207, is managed as a single unit, which may make it easier to plan and implement future restoration plans.

Powhatan Creek Watershed Management Report

Recommendations for Subwatershed 204

Watershed Education

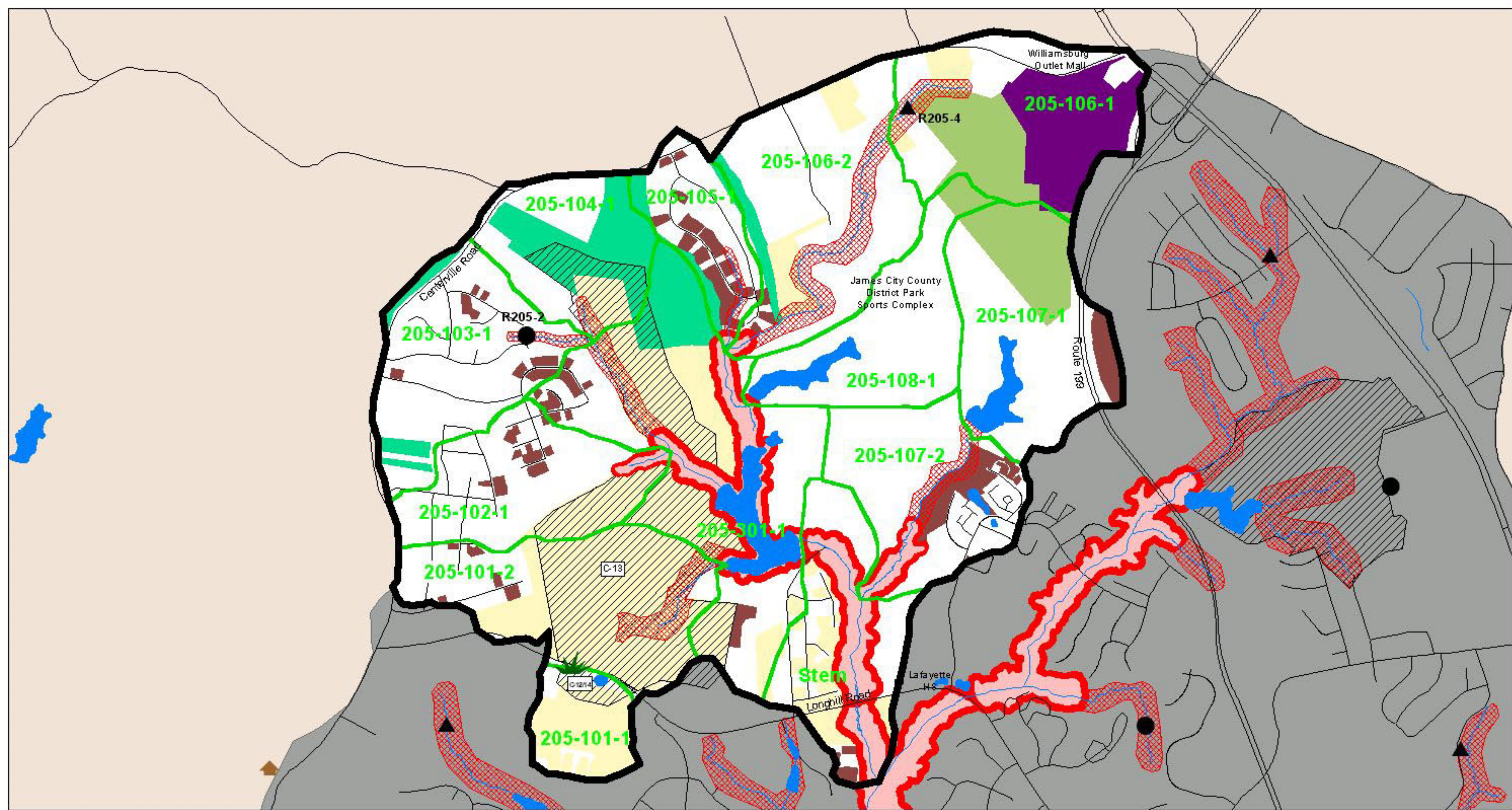
- Homeowner education on low impact lawn care, pet waste, and other water quality issues (Appendix 1-3)

Aquatic Buffers

- Look for opportunities to increase stream buffers

Stormwater Management

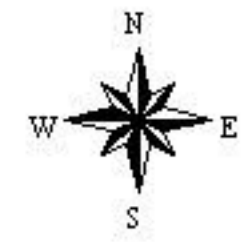
- Naturescaping golf course ponds (i.e. planting native wetland plants for better nutrient uptake and natural aesthetics)



LEGEND

Powhatan Creek Watershed	Proposed RPA Extension	Proposed Conservation Areas	Undeveloped Land
Subwatershed Boundary	Priority Regional Stormwater Management Sites	Conservation Area ID	Low Density Residential
Rpa	Priority Retrofit Sites	Bald Eagle Nest	Medium Density Residential
Rpa buffer	Potential Retrofit Sites ID	Blue Heron Colony	High Density Residential
Hydrology	Catchment Boundaries	RTE Plants	Mixed Use
Roads	Catchment Boundaries ID	Historical Points of Interest	Limited Industry/Business
	Potential Streams Rehabilitation Area		Rural

**Powhatan Creek Watershed
Subwatershed 205**



Subwatershed No. 205

OVERALL PROGNOSIS:

Currently, this subwatershed has the highest quality of any subwatershed in the Powhatan Creek watershed, and is classified as SENSITIVE. The streams are rated as having the best stream habitat in the watershed and a small wetland contains two RTE species. Subwatershed 205 also has the greatest growth potential of any subwatershed, as more than 50% of its area remains developable under current zoning. The Center recommends that this subwatershed Given its modest RPA protection (less than 4% of total area), and projected impervious cover (11%), this subwatershed is projected to shift into the IMPACTED category without effective watershed management.

See Figure

Drainage Area: 2.53 sq. miles (1,619.2 acres)

Land Use in Subwatershed 205

	<i>Percentage</i>	<i>Subwatershed Category</i>
2000 Impervious Cover	6.4 %	Sensitive
Future impervious cover (with buildout)	13.3 %	Impacted
Target Watershed Classification		Sensitive

Developable area: 867 acres or 54% of subwatershed area

Priority Conservation Areas in 205

<i>Table 205-1. Priority Conservation Areas in Subwatershed 205</i>			
<i>Conservation Area</i>	<i>Description</i>	<i>Conservation Area Ranking</i>	<i>Acquisition Ranking</i>
C-12/14	<i>Small pocket wetland with rare species -- the drainage is currently under development</i>	<i>3 of 21</i>	<i>--</i>
C-13	<i>Excellent quality streams and a small tract of mature hardwood contiguous forest</i>	<i>11 of 21</i>	<i>15 of 17</i>

Presence of RTE species: Confirmed populations of New Jersey Rush and historically Torreys Peat Moss (VA Natural Heritage).

Wetland areas: One exceptional wetland (about 0.5 to 0.7 acres in size) is the home to the RTE plant population. This wetland and its contributing drainage is a prime candidate for immediate land conservation, better site design and innovative stormwater practices. Adjacent development has the potential to adversely influence this important wetland.

Powhatan Creek Watershed Management Report

In addition, the lower portions of this subwatershed contain the upper reaches of Longhill Branch Swamp, which is one of the largest wetland complexes in the entire watershed.

Stream Conditions in 205

<i>Table 205-2. General Stream Condition in Subwatershed 205</i>		
<i>Stream Quality</i>	<i>Description</i>	<i>Rank</i>
<i>Excellent</i>	<i>Highest Quality streams in the watershed</i>	<i>1 of 11</i>

Habitat assessment: Stream assessment scores indicate streams in this subwatershed have the best habitat scores within the entire Powhatan Creek watershed. Typical characteristics include an intact forested stream valley, stable streambanks, good to excellent in-stream habitat and little or no evidence of channel instability.

Stormwater Management in 205

Subwatershed 205 has been divided into 13 catchments. The streams within subwatershed 205 received the highest rating in the stream assessment and are recommended Stream Protection Areas. Also, the subwatershed is considered the best candidate for preservation in the watershed. The major stormwater management strategy involves using on-site stormwater management per the recommended Special Stormwater Criteria, in conjunction with cluster or open space design, to limit disturbance to recommended conservation areas and stream valleys.

<i>Table 205-3. Priority Stormwater Retrofit Areas</i>			
<i>Retrofits</i>	<i>Type of Retrofit and Rank</i>		<i>Benefit</i>
	<i>Regional Ponds for Future Development</i>	<i>Stormwater Retrofit</i>	
<i>205-2</i>		<i>3 of 17</i>	<i>Retrofit of existing dry pond to provide channel protection and possibly water quality treatment..</i>
<i>205-4</i>	<i>4 of 9</i>	<i>--</i>	<i>Potential regional facility to manage runoff from future development as well as from the existing rural residential development.</i>

Powhatan Creek Watershed Management Report

Other Observations in Subwatershed 205

Evidence of poor logging practices within and near the stream valley, which generates erosion and fragments remaining forests.

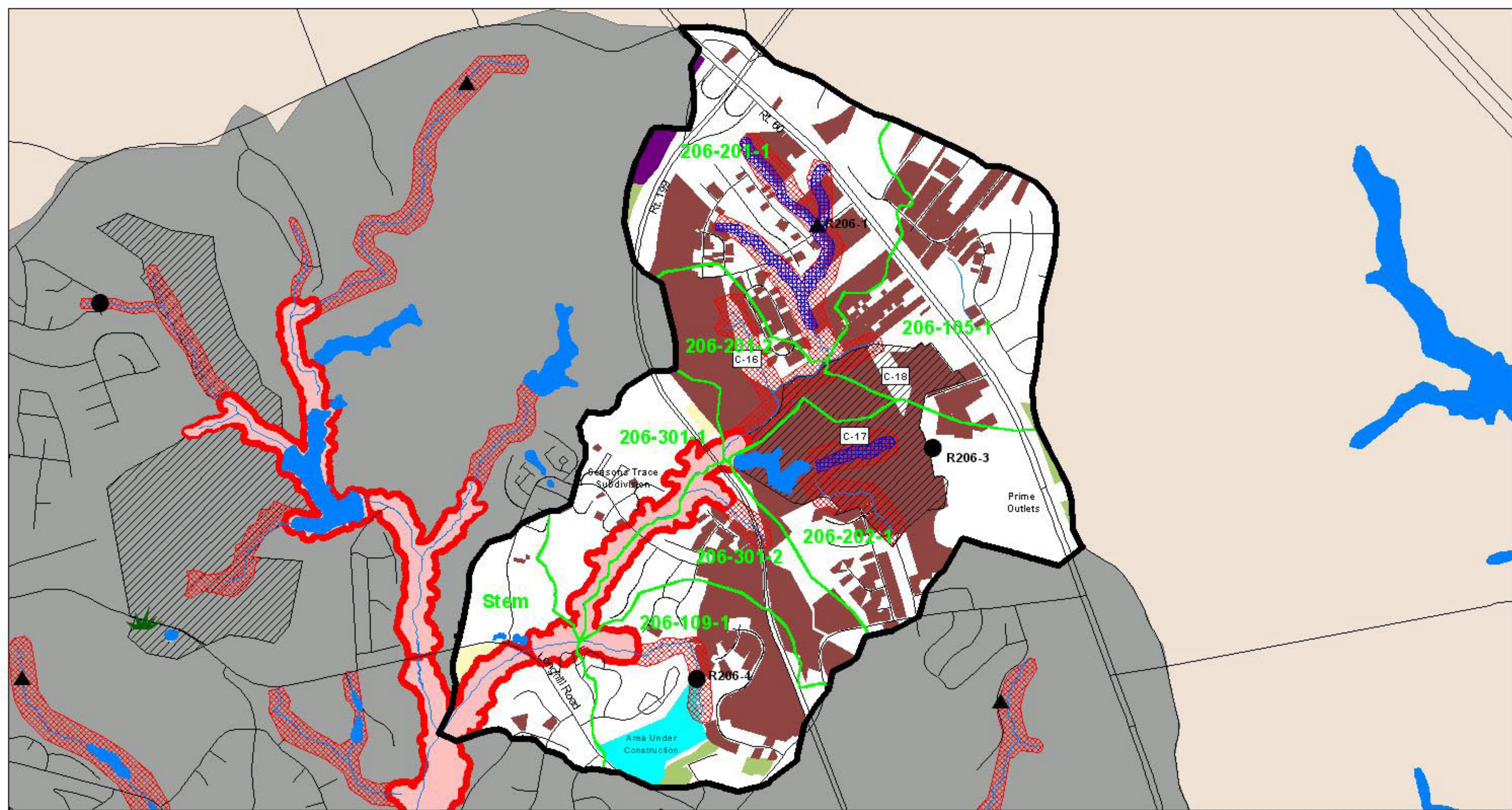
Recommendations for Subwatershed 205

Land Conservation

- Acquisition/easement of C-13 parcel
- Continued agricultural zoning adjacent to C-13
- Possible down zone of limited industry/commercial area not draining to regional pond
- Impervious cover cap for the subwatershed

Stormwater Management

- Special Stormwater Criteria for sites not draining to a regional facility (see catchment 205-106-1)
- Special Stormwater Criteria for site draining to a the small pocket wetland (see conservation areas C-12/14)



LEGEND

- | | | | |
|--|---|--|---|
| <ul style="list-style-type: none"> Powhatan Creek Watershed Subwatershed Boundary Rpa Rpa buffer Hydrology Roads | <ul style="list-style-type: none"> Proposed RPA Extension Priority Regional Stormwater Management Sites Priority Retrofit Sites Potential Retrofit Sites ID Catchment Boundaries Catchment Boundaries ID Potential Stream Rehabilitation Area | <ul style="list-style-type: none"> Proposed Conservation Areas Conservation Area ID Bald Eagle Nest Blue Heron Colony RTE Plants Historical Points of Interest | <p>Undeveloped Land</p> <ul style="list-style-type: none"> Low Density Residential Medium Density Residential High Density Residential Mixed Use Limited Industry/Business Rural |
|--|---|--|---|

Powhatan Creek Watershed Subwatershed 206



Powhatan Creek Watershed Management Report

Subwatershed No. 206 (UPPER LONGHILL SWAMP)

OVERALL PROGNOSIS:

This subwatershed has seen the greatest growth in the last few years, and is currently classified as IMPACTED. Given that 39% of the subwatershed could still be developed under current zoning, this subwatershed's impervious cover may approach 22% in the future. Significant findings within the subwatershed include: remaining contiguous forest tracts have been logged or cleared, current RPA protection is limited (only 3% of subwatershed area), and stream habitat scores indicate recent degradation and channel incision in several reaches. This subwatershed is a candidate for intensive restoration.

See Figure

Drainage Area: 2.06 sq. miles (1,316.7 acres)

Land Use in Subwatershed 206

	<i>Percentage</i>	<i>Subwatershed Category</i>
2000 Impervious Cover	16.9 %	Impacted
Future impervious cover (with buildout)	22.4 %	Impacted
Target Watershed Classification		Impacted

Developable area in subwatershed: 515.4 acres or 39% of subwatershed area

Conservation Areas in 206

No high priority conservation areas in subwatershed 206. There are opportunities for expansion and protection of stream buffers.

Stream Conditions in 206

<i>Table 206-1. General Stream Condition in Subwatershed 206</i>		
<i>Stream Quality</i>	<i>Description</i>	<i>Rank</i>
<i>Fair</i>	<i>high incidence of floodplain impairment, good candidate for stream restoration</i>	<i>9 of 11</i>

Habitat assessment: Stream assessment scores indicate streams in upper headwaters of the subwatershed were in the fair/good habitat condition, and overall ranked seventh out of the ten subwatersheds. Several individual stream reaches were showing signs of stream degradation and head cutting, particularly in headwater areas close to intense development or construction. These reaches which could be candidates for stream restoration are located in catchments 201-1 and 202-1.

Powhatan Creek Watershed Management Report

Stormwater Management in 206

Divided into 8 catchments, this subwatershed is highly developed compared to other subwatersheds in the Powhatan Creek watershed, and is considered a candidate for restoration. Primary stormwater strategies include the use of stormwater management per the current James City County standards for new development in combination with stormwater retrofitting. Catchments that are fully or almost fully developed may require no additional stormwater action.

<i>Table 206-2. Priority Stormwater Retrofit Areas</i>			
<i>Retrofits</i>	<i>Type of Retrofit and Rank</i>		<i>Benefit</i>
	<i>Regional Ponds for Future Development</i>	<i>Stormwater Retrofit</i>	
206-1	1 of 9	--	Regional pond to manage stormwater runoff from new development as well as from uncontrolled, existing development. This may be constructed in conjunction with the potential stream rehabilitation.
206-3	--	5 of 17	Retrofit of the dry pond serving the Prime Outlets, for channel protection. This may be done in conjunction with stream rehabilitation.
206-4	--	6 of 17	Retrofit of dry pond for channel protection and water quality treatment.

Recommendations for Subwatershed 206

Land Conservation

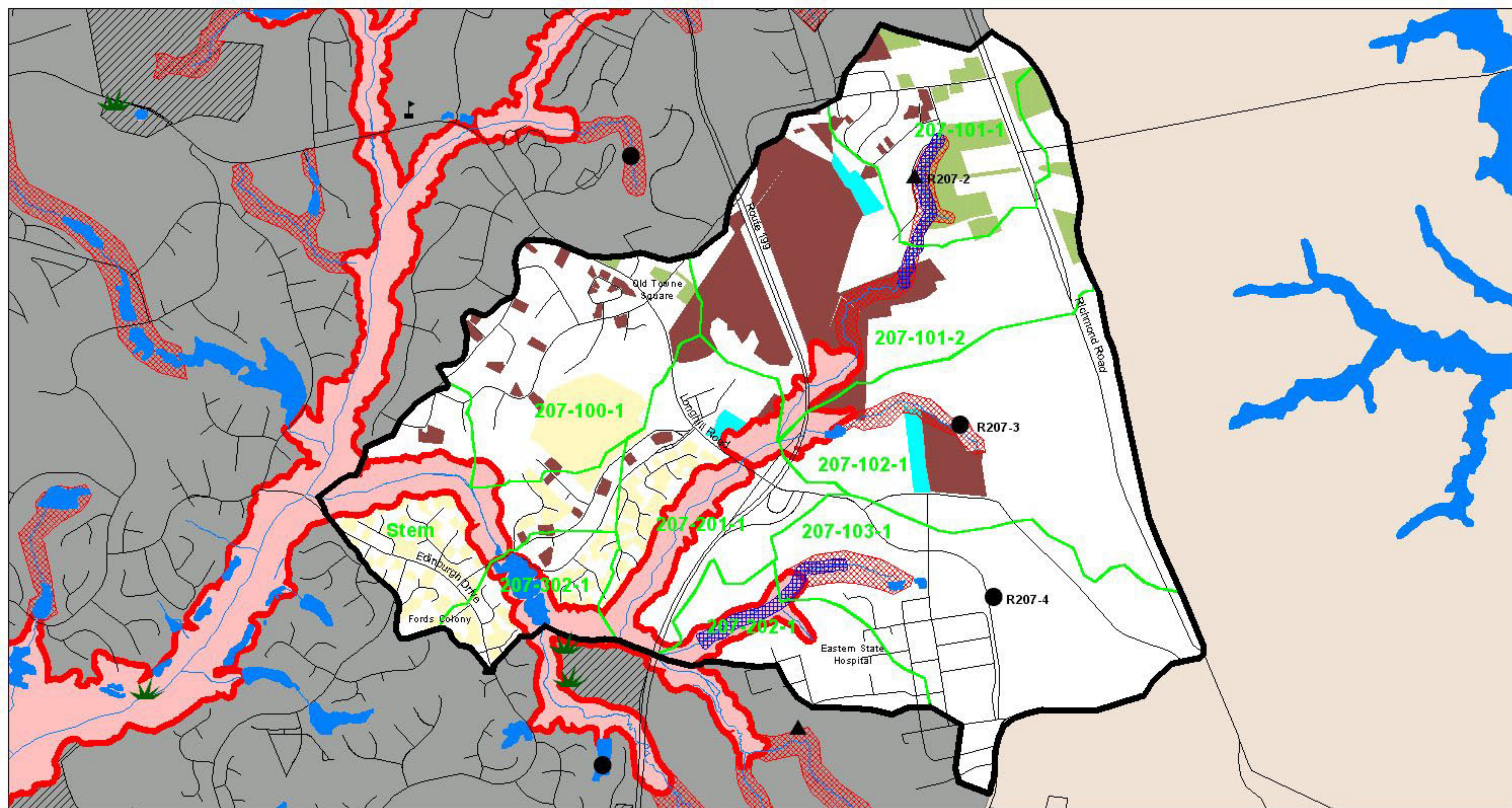
- Consider allowing the 30%/40% open space requirement to be acquired elsewhere in the Powhatan Creek watershed within one of the conservation areas or within the expanded mainstem buffer (open space trading).

Restoration

- Stream restoration associated with the Prime Outlets retrofit
- Stream restoration associated with the degraded stream channel conditions found in the northern tributary of subwatershed 206 (catchment 201-1).

Stormwater Management

- Retrofit of the dry pond draining Prime Outlets to minimize erosion and downcutting of the downstream channel
- Possible regional pond to address future medium density development



LEGEND

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|--------------------------|---|-------------------------------|----------------------------|
| Powhatan Creek Watershed | Proposed RPA Extension | Proposed Conservation Areas | Undeveloped Land |
| Subwatershed Boundary | Priority Regional Stormwater Management Sites | Conservation Area ID | Low Density Residential |
| Rpa | Priority Retrofit Sites | Bald Eagle Nest | Medium Density Residential |
| Rpa buffer | Potential Retrofit Sites ID | Blue Heron Colony | High Density Residential |
| Hydrology | Catchment Boundaries | RTE Plants | Mixed Use |
| Roads | Catchment Boundaries ID | Historical Points of Interest | Limited Industry/Business |
| | Potential Stream Rehabilitation Area | | Rural |

Powhatan Creek Watershed Subwatershed 207



Subwatershed No. 207 (UPPER CHISEL RUN)

OVERALL PROGNOSIS:

The Upper Chisel Run has experienced a great amount of development and is currently classified as IMPACTED. RTE populations are largely absent in the subwatershed and stream habitat scores are only Fair/Good. Additionally, current RPA protection is limited (only 2% of subwatershed area) and wetlands are of low quality.

See Figure

Drainage Area: 3.2 sq. miles (2,051 acres)

Land Use in Subwatershed 207

	<i>Percentage</i>	<i>Subwatershed Category</i>
2000 Impervious Cover	16.4 %	Impacted
Future impervious cover (with buildout)	21.7 %	Impacted
Target Watershed Classification		Impacted

Developable area in subwatershed: 392.1 acres or 19% of subwatershed area

Conservation Areas in 207

No surveyed RTE species.

Contiguous forest areas: No significant contiguous forest areas.

Wetland areas: Least trillium commonly associated with stream-side seeps, but channel incision has noticeably reduced the quality of these micro habitats in the Upper Chisel Run.

Beaver dam complexes: Extensive old and new beaver activity just upstream of Route 199.

Stream Conditions in 207

<i>Table 207-1. General Stream Condition in Subwatershed 207</i>		
<i>Stream Quality</i>	<i>Description</i>	<i>Rank</i>
<i>Fair</i>	<i>good candidate for restoration</i>	<i>8 of 11</i>

Powhatan Creek Watershed Management Report

Habitat assessment: Stream assessment evaluation indicates that stream reaches in the Upper Chisel Run are in the Fair range. The stream reaches exhibited impacts related to an increase in impervious cover. These impacts included a reduction of the in-stream habitat quality, an increase in sediment transport and deposition, channel widening and incision, and streambank instability.

Stormwater Management in 207

Divided into eight catchments, this subwatershed is also highly developed-a candidate for stream restoration. Primary stormwater strategies include the use of stormwater management per the current James City County standards for new development in combination with stormwater retrofitting. Catchments that are fully or almost fully developed may require no additional stormwater action.

Table 207-2. Priority Stormwater Retrofit Areas			
Retrofits	Type of Retrofit and Rank		Benefit
	Regional Ponds for Future Development	Stormwater Retrofit	
207-2	3 of 9	--	Regional facility to control drainage from future development as well as from existing development. This retrofit may be constructed in conjunction with rehabilitation of the stream.
207-3	--	4 of 17	Small pond to control stormwater runoff from developed land.
207-4	--	1 of 17	Pond to control unmanaged development upstream of proposed stream rehabilitation site.

Recommendations for Subwatershed 207

Aquatic Buffers

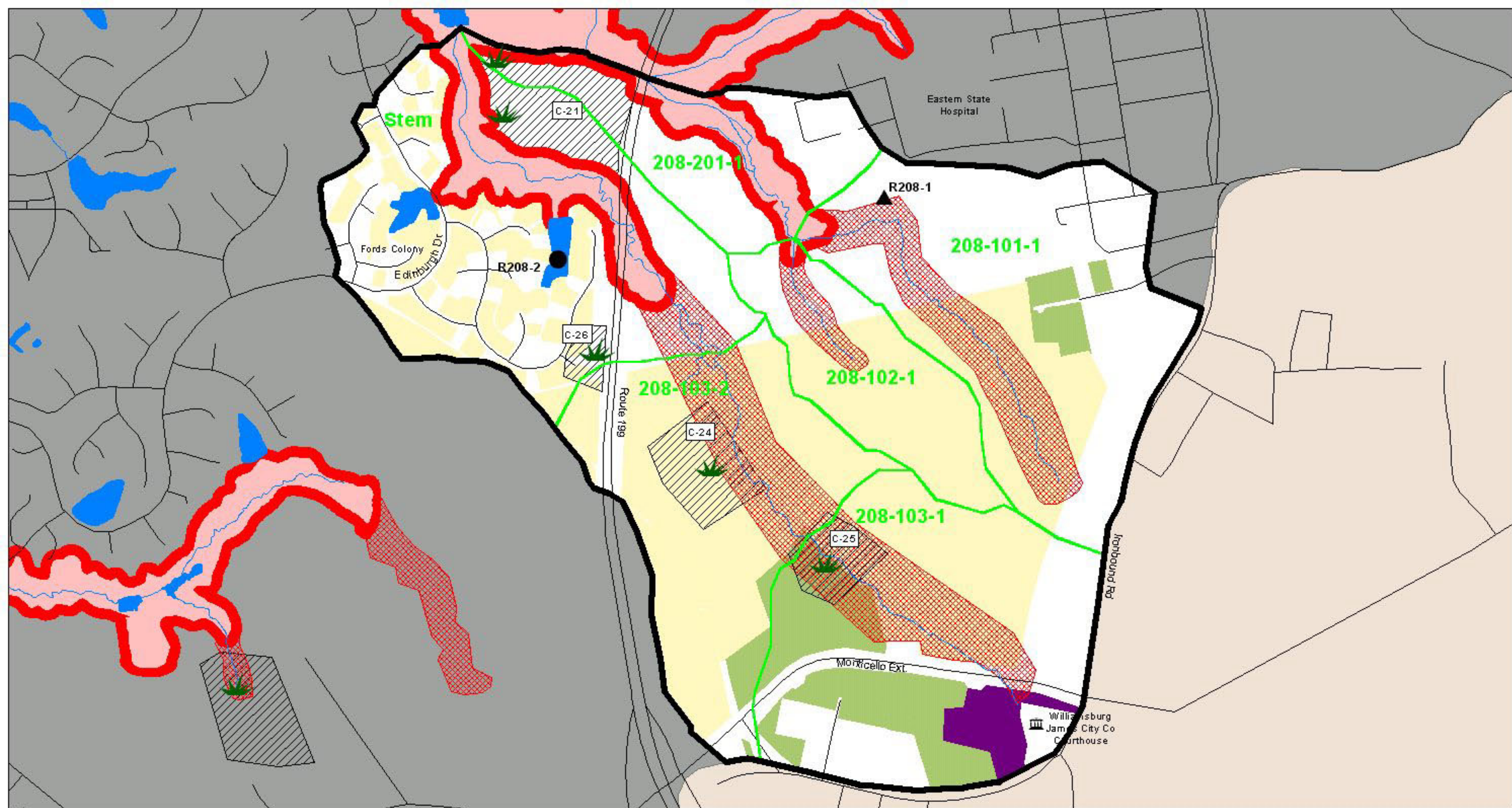
- Use the open space requirement to increase the aquatic buffers including 1st order and intermittent streams or allow for off-site protection of open space to protect identified conservation and buffer areas

Restoration

- Two potential stream restoration sites, both are associated with stormwater retrofits.

Stormwater Management

- Several stormwater retrofits are proposed to address unmanaged stormwater and to control runoff from future development.



LEGEND

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|--------------------------|---|-------------------------------|----------------------------|
| Powhatan Creek Watershed | Proposed RPA Extension | Proposed Conservation Areas | Undeveloped Land |
| Subwatershed Boundary | Priority Regional Stormwater Management Sites | Conservation Area ID | Low Density Residential |
| Rpa | Priority Retrofit Sites | Bald Eagle Nest | Medium Density Residential |
| Rpa buffer | Potential Retrofit Sites ID | Blue Heron Colony | High Density Residential |
| Hydrology | Catchment Boundaries | RTE Plants | Mixed Use |
| Roads | Catchment Boundaries ID | Historical Points of Interest | Limited Industry/Business |
| | Potential Stream Rehabilitation Area | | Rural |

Powhatan Creek Watershed Subwatershed 208



Subwatershed No. 208 (LOWER CHISEL RUN)

OVERALL PROGNOSIS:

Lower Chisel Run is clearly the most threatened subwatershed in all of the Powhatan Creek watershed. Currently, classified as SENSITIVE, it contains large population of RTE species (small whorled pogonia and Virginia least trillium), large contiguous forest tracts, excellent stream habitat scores and extensive floodplain wetlands. With 49% remaining developable land, this subwatershed is expected to shift to IMPACTED in the coming years, as a result of large planned developments in the headwaters, unless extraordinary watershed protection measures are implemented. Some indication of the future of Lower Chisel Run can be seen in the current condition of the Upper Chisel Run.

See Figure

Drainage Area: 1.25 sq. miles (799.8 acres)

Land Use in Subwatershed 208

	<i>Percentage</i>	<i>Subwatershed Category</i>
2000 Impervious Cover	5.8 %	Sensitive
Future impervious cover (with buildout)	15.2 %	Impacted
Target Watershed Classification		Sensitive

Developable area in subwatershed: 394.2 acres or 49% of subwatershed area

Conservation Areas in 208

<i>Table 208-1. Priority Conservation Areas in Subwatershed 208</i>			
<i>Conservation Area</i>	<i>Description</i>	<i>Conservation Area Ranking</i>	<i>Acquisition Ranking</i>
C-21	<i>Potential RTE, small contiguous forest</i>	<i>8 of 21</i>	<i>--</i>
C-24	<i>RTE population near New Town</i>	<i>4 of 21</i>	<i>2 of 17</i>
C-25	<i>RTE population sensitive to hydrology</i>	<i>1 of 21</i>	<i>--</i>
C-26	<i>RTE population in Ford's Colony</i>	<i>10 of 21</i>	<i>8 of 17</i>

The largest populations of small whorled pogonia and Virginia least trillium can be found along the slopes and floodplains of lower Chisel Run and have been confirmed by the Virginia Natural Heritage and our field survey. Several of these populations are located within the planned New Town development.

Powhatan Creek Watershed Management Report

Contiguous forest areas: Several tracts of contiguous forest are located along lower Chisel Run, both within and adjacent to the existing RPA.

Wetland areas: Least trillium is commonly associated with stream-side seeps. The seeps found in subwatershed 208 are in good condition.

Stream Conditions in 208

<i>Table 208-2. General Stream Condition in Subwatershed 208</i>		
<i>Stream Quality</i>	<i>Description</i>	<i>Rank</i>
<i>Excellent</i>	<i>High quality stream channels; shows minimal impacts at present; vulnerable due to future planned development</i>	<i>3 of 11</i>

Habitat assessment: Streams in Lower Chisel Run are currently in excellent condition and rank among the best in the watershed. These streams, however, are likely to be influenced by extensive planned development in the headwaters (i.e., New Town).

Stormwater Management in 208

Subwatershed 208 is divided into six catchments. It is a sensitive subwatershed and the streams received the third highest quality rating in the watershed. The proposed New Town Center is located in the lower portion of the subwatershed. Stormwater strategies for the subwatershed include the application of the Special Stormwater Criteria for Stream Protection Areas to new development, as well as minimizing hydrologic impacts to RTE species by using parallel piping to the regional pond.

<i>Table 208-3. Priority Stormwater Retrofit Areas</i>			
<i>Retrofits</i>	<i>Type of Retrofit and Rank</i>		<i>Benefit</i>
	<i>Regional Ponds for Future Development</i>	<i>Stormwater Retrofit</i>	
<i>208-1</i>	<i>2 of 9</i>	<i>--</i>	<i>Potential regional facility to treat stormwater runoff from uncontrolled development, as well as any potential future development.</i>
<i>208-2</i>	<i>--</i>	<i>8 of 17</i>	<i>Retrofit of wet pond to provide channel protection.</i>

Powhatan Creek Watershed Management Report

Recommendations for Subwatershed 208

Conservation Areas

- Acquisition or easement of lands associated with rare plant species (C-24, 25, and 26).

Better Site Design

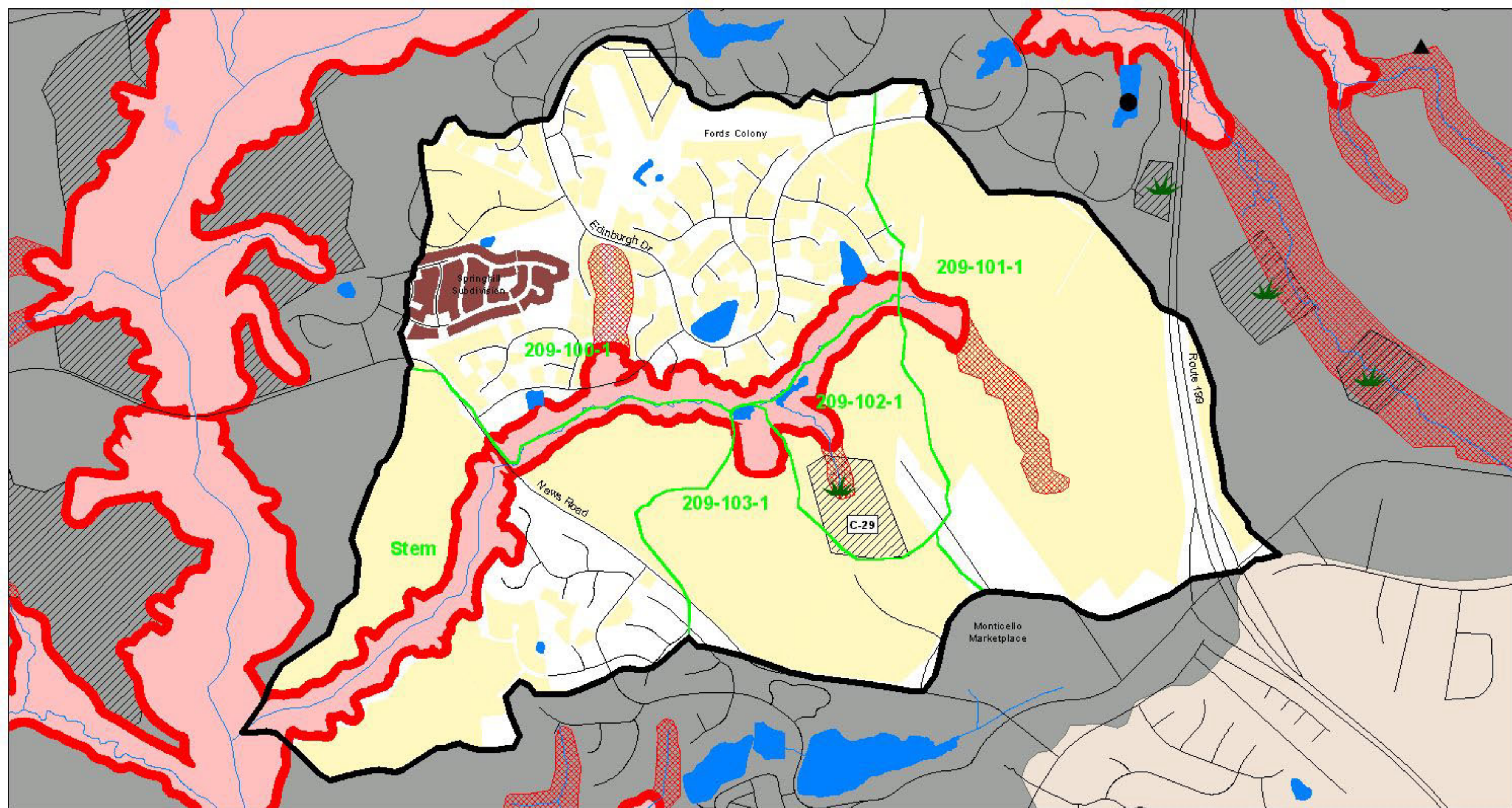
- The use of better site design to reduce the amount of impervious cover. These techniques reduce the amount and frequency of stormwater runoff that adversely impact streams.

Forest Retention

- Retain as much forest cover as possible by minimizing clearing and grading and reducing the development footprint.

Stormwater Management

- The use of Special Stormwater Criteria to minimize the impacts of new development on natural channels and to rare wetland plant species. One option is to pipe frequent channel erosion causing storms down to a regional facility.



LEGEND

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| <ul style="list-style-type: none"> Powhatan Creek Watershed Subwatershed Boundary Rpa Rpa buffer Hydrology Roads | <ul style="list-style-type: none"> Proposed RPA Extension Priority Regional Stormwater Management Sites Priority Retrofit Sites Potential Retrofit Sites ID Catchment Boundaries Catchment Boundaries ID Potential Streams Rehabilitation Area | <ul style="list-style-type: none"> Proposed Conservation Areas Conservation Area ID Bald Eagle Nest Blue Heron Colony RTE Plants Historical Points of Interest | <p>Undeveloped Land</p> <ul style="list-style-type: none"> Low Density Residential Medium Density Residential High Density Residential Mixed Use Limited Industry/Business Rural |
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Powhatan Creek Watershed Subwatershed 209



Subwatershed No. 209

OVERALL PROGNOSIS:

This subwatershed is classified as **SENSITIVE**, and is a fine example of a high quality headwater streams in the watershed, as indicated by its excellent stream habitat scores, expansive floodplain wetlands, and contiguous forests. However, the subwatershed is under considerable development pressure. Impervious cover has increased by 19% in the last two years, and almost 50% of the remaining area of the subwatershed could be developed under current zoning. Consequently, in the absence of extraordinary watershed management efforts, it is likely that this subwatershed will shift into the **IMPACTED** category within the next decade.

See Figure

Drainage Area: 1.69 sq. miles (1,083.2 acres)

Land Use in Subwatershed 209

	<i>Percentage</i>	<i>Subwatershed Category</i>
2000 Impervious Cover	5.3 %	Sensitive
Future impervious cover (with buildout)	12 %	Impacted
Target Watershed Classification		Sensitive

Developable area in subwatershed: 521.8 acres or 48% of subwatershed area

Conservation Areas in 209

<i>Table 209-1. Priority Conservation Areas in Subwatershed 209</i>			
<i>Conservation Area</i>	<i>Description</i>	<i>Conservation Area Ranking</i>	<i>Acquisition Ranking</i>
C-29	<i>RTE population near Jesters Lane, sensitive to hydrological changes</i>	<i>6 of 21</i>	<i>4 of 17</i>

Presence of RTE species: Some potential based on proximity to other populations in adjacent subwatershed (208-Lower Chisel Run).

Contiguous forest areas: Yes, some small forest tracts are located outside of the RPA.

Wetland areas: Several high quality wetlands are located in the floodplain and are within the RPA.

Beaver dam complexes: There is a moderate amount of complexes that have caused some inundation in the upper reaches of the stream.

Powhatan Creek Watershed Management Report

Stream Conditions in 209

<i>Table 209-2. General Stream Condition in Subwatershed 209</i>		
<i>Stream Quality</i>	<i>Description</i>	<i>Rank</i>
<i>Excellent/Good</i>	<i>Intact forested stream valleys present; vulnerable to future planned development</i>	<i>4 of 11</i>

Habitat assessment: Stream assessment evaluation indicates that stream reaches in this subwatershed are in currently in excellent condition, and rank second among all the subwatersheds within the watershed.

Stormwater Management in 209

Subwatershed 209 is divided into 5 catchments. The streams in Subwatershed 209 are of high quality, but the subwatershed is under considerable development pressure, including a portion of the proposed New Town development. Primary stormwater strategies include the use of on-site stormwater management and Special Stormwater Criteria (SSC) to minimize the impact to recommended conservation areas.

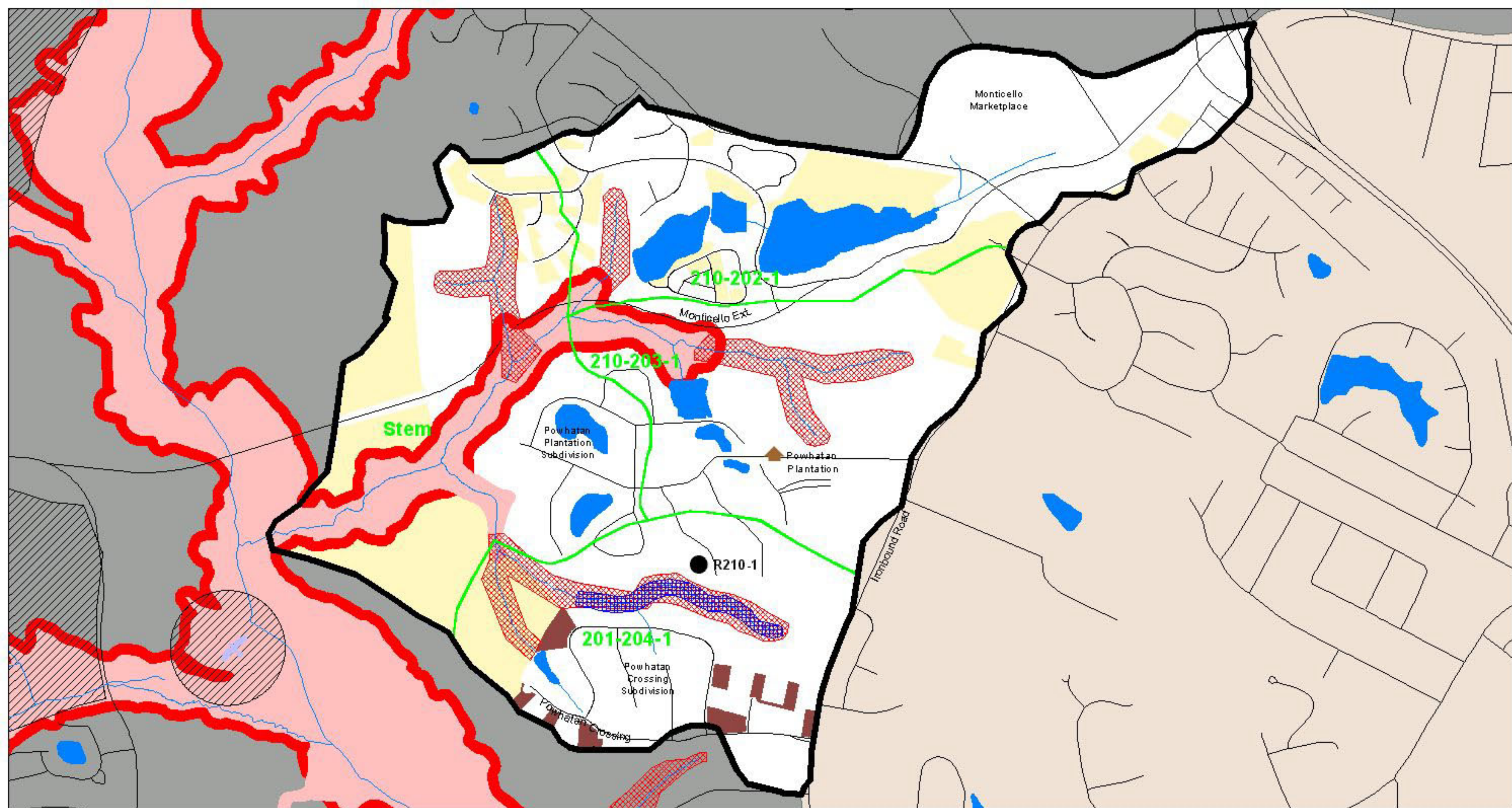
Recommendations for Subwatershed 209

Land Conservation

- Attempt to keep the watershed in the sensitive category. Perhaps by establishing a subwatershed impervious cover cap of 9 %.
- Concentrate required open space along streams and wetlands.
- Allowances in the zoning to cluster down - maintaining the same density. This would increase the amount of land left in the natural condition.

Stormwater Management

- The use of Special Stormwater Criteria to minimize the impacts to the C-29 Conservation Area.



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| <ul style="list-style-type: none"> Powhatan Creek Watershed Subwatershed Boundary Rpa Rpa buffer Hydrology Roads | <ul style="list-style-type: none"> Proposed RPA Extension Priority Regional Stormwater Management Sites Priority Retrofit Sites Potential Retrofit Sites ID Catchment Boundaries Catchment Boundaries ID Potential Streams Rehabilitation Area | <ul style="list-style-type: none"> Proposed Conservation Areas Conservation Area ID Bald Eagle Nest Blue Heron Colony RTE Plants Historical Points of Interest | <p>Undeveloped Land</p> <ul style="list-style-type: none"> Low Density Residential Medium Density Residential High Density Residential Mixed Use Limited Industry/Business Rural |
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Powhatan Creek Watershed Subwatershed 210



Subwatershed No. 210

OVERALL PROGNOSIS:

This IMPACTED subwatershed has seen rapid growth in just the last two years, and has a current impervious cover of nearly 19%. If current zoning is built out, impervious cover is expected to climb to 24%. Stream habitat scores are in the Fair/Good range, but the uppermost reaches have recently experienced extensive degradation and incision. Contiguous forests or RTE species are absent. Some high quality wetlands exist in floodplain areas, but not all of these are fully protected by the RPA. This subwatershed is a candidate for watershed restoration and targeted watershed education efforts.

See Figure

Drainage Area: 1.12 sq. miles (716.8 acres)

Land Use in Subwatershed 210

	<i>Percentage</i>	<i>Subwatershed Category</i>
2000 Impervious Cover	18.6 %	Impacted
Future impervious cover (with buildout)	24.7 %	Impacted
<i>Target Watershed Classification</i>		Impacted

Developable area in subwatershed: 134.9 acres or 19% of subwatershed area

Conservation Areas in 210

Low potential for RTE species.

Contiguous forest areas: No.

Wetland areas: Several high quality floodplain wetlands are present in the subwatershed; but are not fully protected by the RPA.

Beaver dam complexes: Little activity until the confluence of the stream with the mainstem. At this point, there is extensive beaver activity and inundation.

Historic Sites:

Powhatan Plantation--In 1684 almost 2000 acres were patented to the east and south of Powhatan Creek and Drinking Swamp (a branch of Powhatan Creek). In the 18th century, it became the family seat of Richard Taliferro (pronounced "Toliver"), one of Virginia's 100 Richest families in the 1780s.

Powhatan Creek Watershed Management Report

Stream Conditions in 210

<i>Table 210-1. General Stream Condition in Subwatershed 210</i>		
<i>Stream Quality</i>	<i>Description</i>	<i>Rank</i>
<i>Good/Fair</i>	<i>Evidence of channel widening, sediment deposition, incision and enlargement; high incidence of floodplain impairment; good candidate for stream restoration</i>	<i>7 of 11</i>

Habitat Assessment: Stream assessment scores indicate that the stream is in the Fair to Good category. Several headwater stream reaches were experiencing extensive degradation, and the lower stream reaches were impounded by beaver activity.

Stormwater Management in 210

Subwatershed 210, divided into 4 catchments, currently has the highest impervious cover in the watershed. Most of the development has incorporated stormwater management practices and only one priority stormwater retrofit area is located in the subwatershed. The limited developable areas should use on-site stormwater management.

<i>Table 210-2. Priority Stormwater Retrofit Areas</i>			
<i>Retrofits</i>	<i>Type of Retrofit and Rank</i>		<i>Benefit</i>
	<i>Regional Ponds for Future Development</i>	<i>Stormwater Retrofit</i>	
<i>210-1</i>	<i>--</i>	<i>9 of 17</i>	<i>Retrofit a the dry pond to provide C_{p_v}. This retrofit may be implemented in conjunction with stream rehabilitation.</i>

Recommendations for Subwatershed 210

Watershed Education

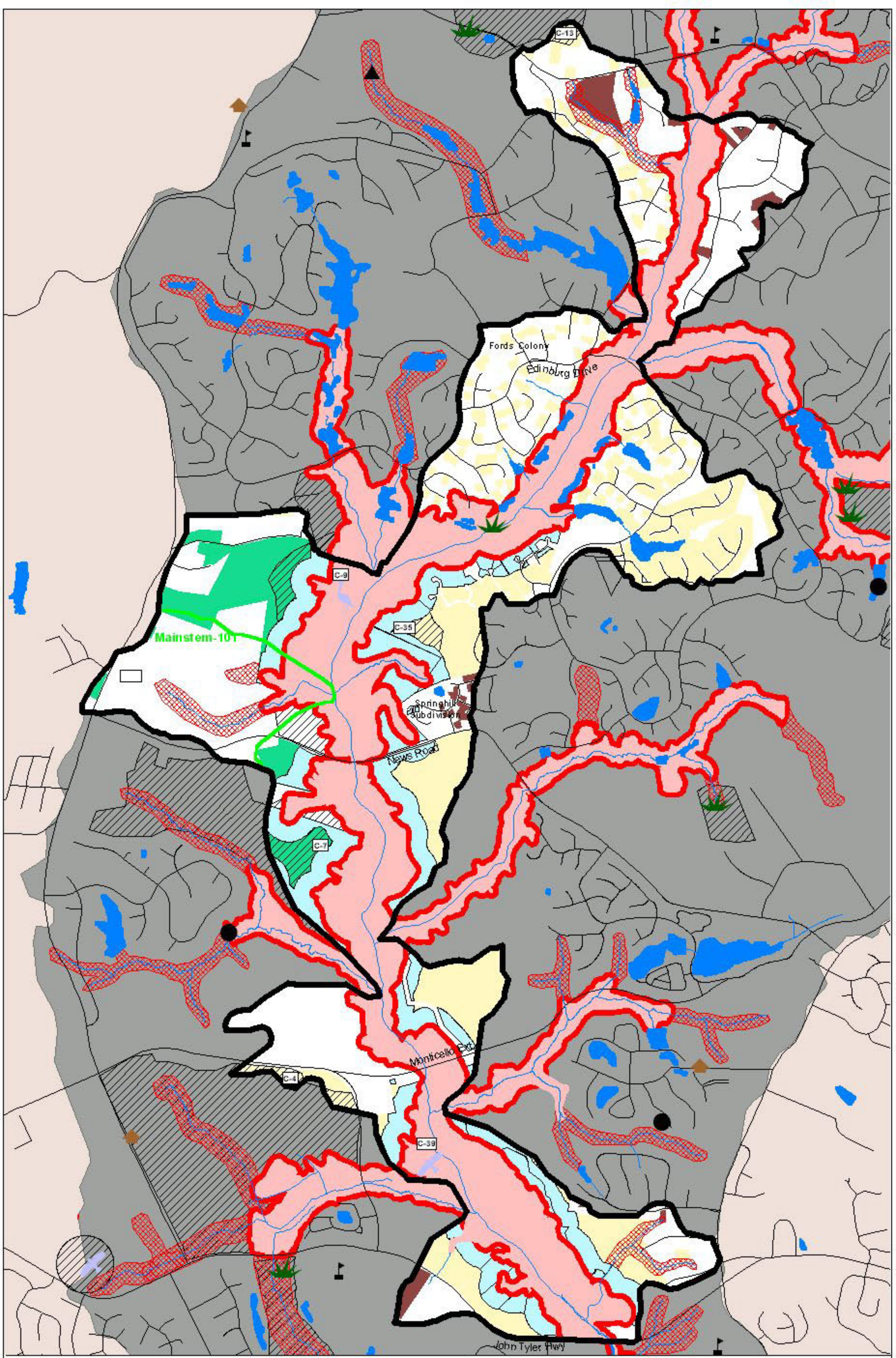
- Homeowner education on low impact lawn care, pet waste, and other water quality issues.

Aquatic Buffers

- Concentrate required open space along streams and wetlands or in the mainstem corridor.

Restoration

- Good candidate site for stream restoration



LEGEND

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| <ul style="list-style-type: none"> Powhatan Creek Watershed Subwatershed Boundary Rpa Rpa buffer Hydrology Roads Proposed 300ft Buffer Proposed RPA Extension Priority Regional Stormwater Management Sites Priority Retrofit Sites Potential Retrofit Sites ID Catchment Boundaries Catchment Boundaries ID Potential Stream Rehabilitation Area | <ul style="list-style-type: none"> Proposed Conservation Areas Conservation Area ID Bald Eagle Nest Blue Heron Colony RTE Plants Historical Points of Interest | <p>Undeveloped Land</p> <ul style="list-style-type: none"> Low Density Residential Medium Density Residential High Density Residential Mixed Use Limited Industry/Business Rural |
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**Powhatan Creek Watershed
Non-Tidal Mainstem**



Powhatan Creek Mainstem (Non-tidal)

OVERALL PROGNOSIS

Although hard to reach, the mainstem of Powhatan Creek is truly the jewel of the entire watershed. It contains extensive wetland complexes of outstanding quality, as well as the largest tract of contiguous floodplain forest in the watershed. About a fourth of this segment is influenced by beaver, which creates a diverse mosaic of wetland zones. Species of plants found there include smart weed, yellow coneflowers, sweetbay magnolia, black tupelo, black gum and bald cypress. The free-flowing creek still has good to excellent stream habitat scores, is home to several RTE species, and contains essential habitats for wildlife, waterfowl and wading birds. Currently classified as SENSITIVE, this segment is expected to be adversely influenced by greater stormwater flows and pollutant loadings as the Powhatan Creek watershed (19.5 sq. mile contributing area) continues to develop. Based on current zoning, the impervious cover for non-tidal mainstem area could climb from 4 to 12%.

See Figure

Segment Area: 3.43 sq. miles (2197.2 acres)

Land Use in Mainstem (non-tidal)

	<i>Percentage</i>	<i>Subwatershed Category</i>
2000 Impervious Cover	3.8 %	Sensitive
Future impervious cover (with buildout)	12.3 %	Impacted
Target Watershed Classification		Sensitive

Developable area: 688 acres or 31% of segment area

Conservation Areas in the Mainstem (non-tidal)

<i>Table MNT-1. Priority Conservation Areas in the Mainstem (non-tidal)</i>			
<i>Conservation Area</i>	<i>Description</i>	<i>Conservation Area Ranking</i>	<i>Acquisition Ranking</i>
C-34	<i>High quality stream above News Rd.</i>	<i>9 of 21</i>	<i>7 of 17</i>
C-35	<i>Contiguous forest and heron rookery</i>	<i>5 of 21</i>	<i>3 of 17</i>
C-39	<i>Eagles nest</i>	<i>14 of 21</i>	<i>12 of 17</i>

Presence of RTE species: Potential for bald eagle. Probable habitat of least trillium. Large blue heron rookery found in upper portion of segment.

Contiguous forest areas: The forests surrounding the Powhatan Creek constitute the largest contiguous tract within the watershed.

Wetland areas: Much of the segment contains wetlands of exceptional quality and diversity. Wetland types include mature forested wetlands, successional forest wetlands, standing snags, open water wetlands, emergent wetlands, submergent wetlands, mixed wetlands, and extensive floodplain wetlands. These

Powhatan Creek Watershed Management Report

contiguous wetlands support a diverse biological community including wood ducks, teal, black ducks, pileated woodpeckers and herons.

Five wetland areas within the segment were evaluated for functional value in relation to water quality and wildlife habitat. The average wetland score was 84% out of a possible 100%, which is an exceptionally high score for any non-tidal wetland.

Historic Places:

Powhatan Plantation--In 1684 almost 2000 acres were patented to the east and south of Powhatan Creek and Drinking Swamp (a branch of Powhatan Creek). In the 18th century, it became the family seat of Richard Taliferro (pronounced "Toliver"), one of Virginia's 100 Richest families in the 1780s.

Stream Conditions in the Mainstem (non-tidal)

<i>Table MNT-2. General Stream Condition in the Mainstem (non-tidal)</i>		
<i>Stream Quality</i>	<i>Description</i>	<i>Rank</i>
<i>Excellent</i>	<i>The mainstem contains both high quality stream habitat and high quality wetland habitat.</i>	<i>2 of 11</i>

Initial habitat assessment: According to stream assessment scores, the condition of the mainstem creek was generally excellent, with average scores in excess of 165. Both the stream channel and the adjoining floodplain were in good shape, with somewhat higher scores in the upper portion of the mainstem of the creek. As noted above, about a fourth of the mainstem segment is inundated by beaver activity, and could not be assessed by the stream assessment techniques.

In addition, several small first and second order creeks directly drain into the segment, and these are also in good/excellent condition.

Stormwater Management in the Mainstem (non-tidal)

One catchment (Mainstem 101) has been delineated and contains a high quality stream. The catchment is considered a priority for a Stream Protection Area and if further development takes place it should be under the Special Stormwater Criteria.

Area served by stormwater practices: 8% of segment area.

Retrofit candidates: None at this time.

Powhatan Creek Watershed Management Report

Other Observations on the Mainstem of Powhatan Creek (non-tidal)

Fish barriers: No obvious man-made fish barriers are present in the segment. An analysis of fisheries data suggests that anadromous fish do not extensively spawn in the creek, possibly because of upstream beaver dams (upstream of Route 5 crossing) or the proximity of larger creeks (e.g., Chickahominy). Further sampling during the spring may be needed to establish this fact.

Beaver dam complexes: About 1.5 miles of the mainstem of Powhatan Creek is influenced by beaver activity, which constitutes nearly 25% of its total length. Beaver continue to play a strong role in shaping the character and structure of this wetland complex.

Water quality conditions: Water quality conditions in this segment have been conducted by Virginia Department of Environmental Quality (VA DEQ) downstream of the bridge at Highway 613. A complete analysis of water quality data will be provided in final baseline report. More detailed longitudinal monitoring is being conducted within this segment, and preliminary results indicate high nutrient levels as well as occasional fecal coliform violations.

Fisheries: About 15 fish species have been collected in this segment, including largemouth bass, chain pickerel, bluegills, crappies, pirate perch and American eels.

Historic Places:

Three Ship Pier--Full size replicas of the ships that brought America's first English colonists to Virginia in 1607 are moored at Jamestown. They are the Susan Constant, the Godspeed, and the Discovery.

Jamestown Settlement--A living history indoor-outdoor museum that tells its story through multi-media presentations. Through these presentations the visitor explores the worlds of the settlers and the Native Americans.

Neck-O-Land--Across Back River from Jamestown Island. Artifacts recently recovered from a residential development site reveal that Neck-O-Land was a prosperous suburb between 1630 and 1650. Consisting of 1200 acres, with Powhatan Creek on the west, it was owned by Reverend Rich Buck in 1619 and inherited by his son Peleg. The neighborhood of Peleg's Point site on part of this tract.

Mainland Farm--Not long after 1607, the colonists realized that better farming opportunities awaited them on the mainland, or "Main." Mainland Farm is the oldest (1618) continuously running farm in America. Reflecting this fact, James City County has raised \$2 million needed to preserve this 217-acre historic treasure.

Powhatan Creek Watershed Management Report

Recommendations for Mainstem Non-Tidal

Land Conservation

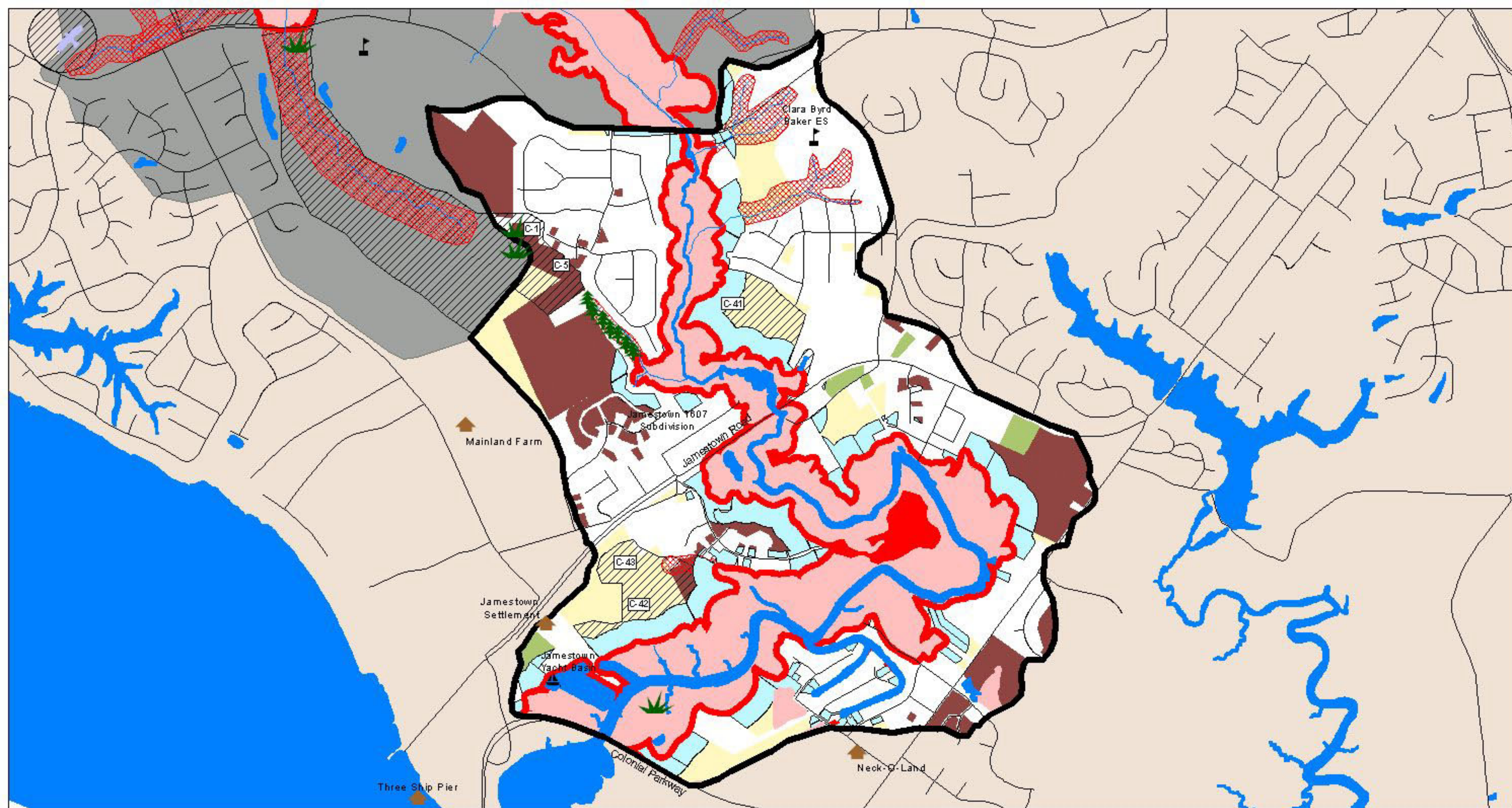
- Acquisition or easement of the large contiguous forest mainstem (C-35) above News Rd. containing a blue heron colony and a mature bald cypress stand.
- Acquisition or easement of the tract associated with the high quality stream (C-34)
- Acquisition or easement of the tract surrounding the bald eagle nest with recent activity (C-39).

Aquatic Buffers

- Increase the width of the buffer associated with the mainstem non-tidal to 300 ft to preserve the contiguous forest and limit the intrusion of invasive species into the high quality mainstem wetlands. This would also serve to limit impervious cover in the this subwatershed.

Better Site Design

- Allowances in the zoning to cluster down - maintaining the same density. This would result in the increased preservation of the mainstem contiguous forest without reducing the number of units built by the developer.



LEGEND

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| <ul style="list-style-type: none"> Powhatan Creek Watershed Subwatershed Boundary Rpa Rpa buffer Hydrology Roads Proposed 300ft Buffer | <ul style="list-style-type: none"> Proposed RPA Extension Priority Regional Stormwater Management Sites Priority Retrofit Sites Potential Retrofit Sites ID Catchment Boundaries Catchment Boundaries ID Potential Streams Rehabilitation Area | <ul style="list-style-type: none"> Proposed Conservation Areas Conservation Area ID Bald Eagle Nest Blue Heron Colony RTE Plants Historical Points of Interest | <p>Undeveloped Land</p> <ul style="list-style-type: none"> Low Density Residential Medium Density Residential High Density Residential Mixed Use Limited Industry/Business Rural |
|--|--|--|---|

Powhatan Creek Watershed Tidal Mainstem



Tidal Mainstem

OVERALL PROGNOSIS:

Based on the amount of impervious cover present, the tidal creek section can be classified as **IMPACTED**; however, given the importance of this estuarine habitat, special protection is warranted. The tidal mainstem is designated a Resource Protection Subwatershed. This scenic segment contains high quality tidal wetlands dominated by softstem bulrush, rice cut grass, pickerel weed, narrow leaved cattail, arrow arum and bald cypress. Twenty-two percent of this segment is protected by RPA. Several RTE species are found in the segment, including bald eagles, and the area is notable for waterfowl habitat. Water quality is generally good, except for violations of the fecal coliform standard, which prevents shell-fishing in portions of the tidal creek. Waterfront developments are intense in this segment and may ultimately increase impervious cover to 16% within the segment. This type of development also has resulted in significant alterations in the shoreline margins and forest cover. Stormwater pollutant loads from the increased waterfront development and from drainage of the entire 22 square mile watershed are likely to increase fecal coliform problems for this 303(d) listed water body.

See Figure

Segment Area: 2.5 sq. miles (1602 acres)

Land Use in the Mainstem (tidal)

	<i>Percentage</i>	<i>Subwatershed Category</i>
2000 Impervious Cover	13.6 %	Impacted
Future impervious cover (with buildout)	16.4 %	Impacted
Target Watershed Classification		Impacted

Developable area: 688 acres or 31% of segment area

Priority Conservation Areas in the Mainstem (tidal)

<i>Table MT-1. Priority Conservation Areas in the Mainstem (tidal)</i>			
<i>Conservation Area</i>	<i>Description</i>	<i>Conservation Area Ranking</i>	<i>Acquisition Ranking</i>
C-41	<i>Contiguous forest mid-tidal</i>	<i>12 of 21</i>	<i>10 of 17</i>
C-42/C-43	<i>Contiguous forest in the lower tidal</i>	<i>13 of 21</i>	<i>11 of 17</i>

Presence of RTE species: Both the tidal wetlands and non-tidal wetlands in this segment harbor a number of RTE species. Parkers pipewort is found in the tidal wetlands, and false hopsedge and sweet pinesap have been reported in the non-tidal wetlands. Bald eagles are routinely sited in this area, although there are no recent reports of nesting activity. The tidal wetlands are an important nursery and feeding area for fish, wading birds, ducks and osprey.

Powhatan Creek Watershed Management Report

Contiguous Forest Areas: Small tracts of contiguous forest exist, however, extensive stands of cypress, tupelo and other trees provide valuable habitat structure adjacent to the tidal wetlands.

Dominant Wetland Areas: Tidal wetlands dominate the segment, and include softstem bulrush, rice cut grass, pickerelweed, narrow leaf cattail, and arrow arum.

Historic Sites:

Three Ship Pier—Full size replicas of the ships that brought America’s first English colonists to Virginia in 1607 are moored at Jamestown. They are the Susan Constant, the Godspeed, and the Discovery.

Jamestown Settlement—A living history indoor-outdoor museum that tells its story through multi-media presentations. Through these presentations the visitor explores the worlds of the settlers and the Native Americans.

Neck-O-Land—Across Back River from Jamestown Island. Artifacts recently recovered from a residential development site reveal that Neck-O-Land was a prosperous suburb between 1630 and 1650. Consisting of 1200 acres, with Powhatan Creek on the west, it was owned by Reverend Rich Buck in 1619 and inherited by his son Peleg. The neighborhood of Peleg’s Point site on part of this tract.

Stream Conditions in the Mainstem (tidal)

<i>Table MT-2. General Stream Condition in the Mainstem (tidal)</i>		
<i>Stream Quality</i>	<i>Description</i>	<i>Rank</i>
<i>N/A - Tidal</i>	<i>Important fishery and the presence of closed shellfish beds</i>	<i>N/A</i>

Stormwater Management in the Mainstem (tidal)

Special design criteria for the tidal mainstem are suggested to help address the fecal coliform problem and to reduce local erosion from outfalls.

More detail is provided in the Stormwater Master Plan for the Powhatan Creek Watershed.

General Condition of Tidal Creek

Wetland Habitat: The stream assessment method used is not appropriate for evaluating the quality and function of the tidal wetlands. A functional wetland assessment was conducted within the tidal wetland, and it was rated as having good functional value for wildlife habitat, and good functional value for water quality. The functional value of the wetland was reduced by shoreline alteration at numerous points along the tidal creek.

Water Quality Conditions: Water quality conditions in this segment are routinely monitored By VA DEQ at the bridge over the Colonial National Historical parkway. A complete analysis of water quality data is provided in baseline report. Based on violations of fecal coliform standards, this segment has been listed

Powhatan Creek Watershed Management Report

as impaired by the State, and a TMDL is being prepared. More detailed longitudinal monitoring is being conducted within this segment.

Fisheries: The State has periodically collected fishery data at Jamestown Road. Thirty-four fish species have been reported in this segment, according to Virginia Department of Game and Inland Fisheries (DGIF) records.

Other Observations on the Tidal Segment of Powhatan Creek

The shoreline of the tidal creek has been bulkheaded or rip-rapped in about twenty locations.

Shell-fishing is prohibited at several points along the tidal creek due to occasional violations of fecal coliform standards.

Several RPA buffers are not maintained in a forested condition.

Recommendations for the Tidal Segment

Watershed Education

- Fecal coliform problem and source education -- septics, pets, natural sources
- The importance of natural buffers for wetlands and other aquatic resources.

Aquatic Buffers

- Establishment of a program to assist landowners in the creation of buffer zones.
- Preservation of a larger existing natural buffer -- up to 300 ft. on new development to protect important marsh transition zones -- these are important to wildlife and marsh bird species as a refuge during high tide.
- Increased forest buffer on the Paleochannel wetlands on the south side of Mainland farm

Better Site Design

- Cluster type development to allow for the preservation of the marsh buffers.

Stormwater Management

- Stormwater management with an added focus on fecal coliform removal.

Powhatan Creek Watershed Management Report

References

Brown, K.B. 2001. Stream and Floodplain Assessment for Powhatan Creek Watershed. Report to James City County. Center for Watershed Protection.

Clark, K.H. 1993. Conservation Planning for the Natural Areas of the Lower Peninsula of Virginia. Natural Heritage Technical Report #93-4. Virginia Department of Conservation and Recreation, Division of Natural Heritage. 8 March 1993. 193 pp.

Sturm, P.E. 2001. Powhatan Creek Conservation Area Report. Report to James City County. Center for Watershed Protection.

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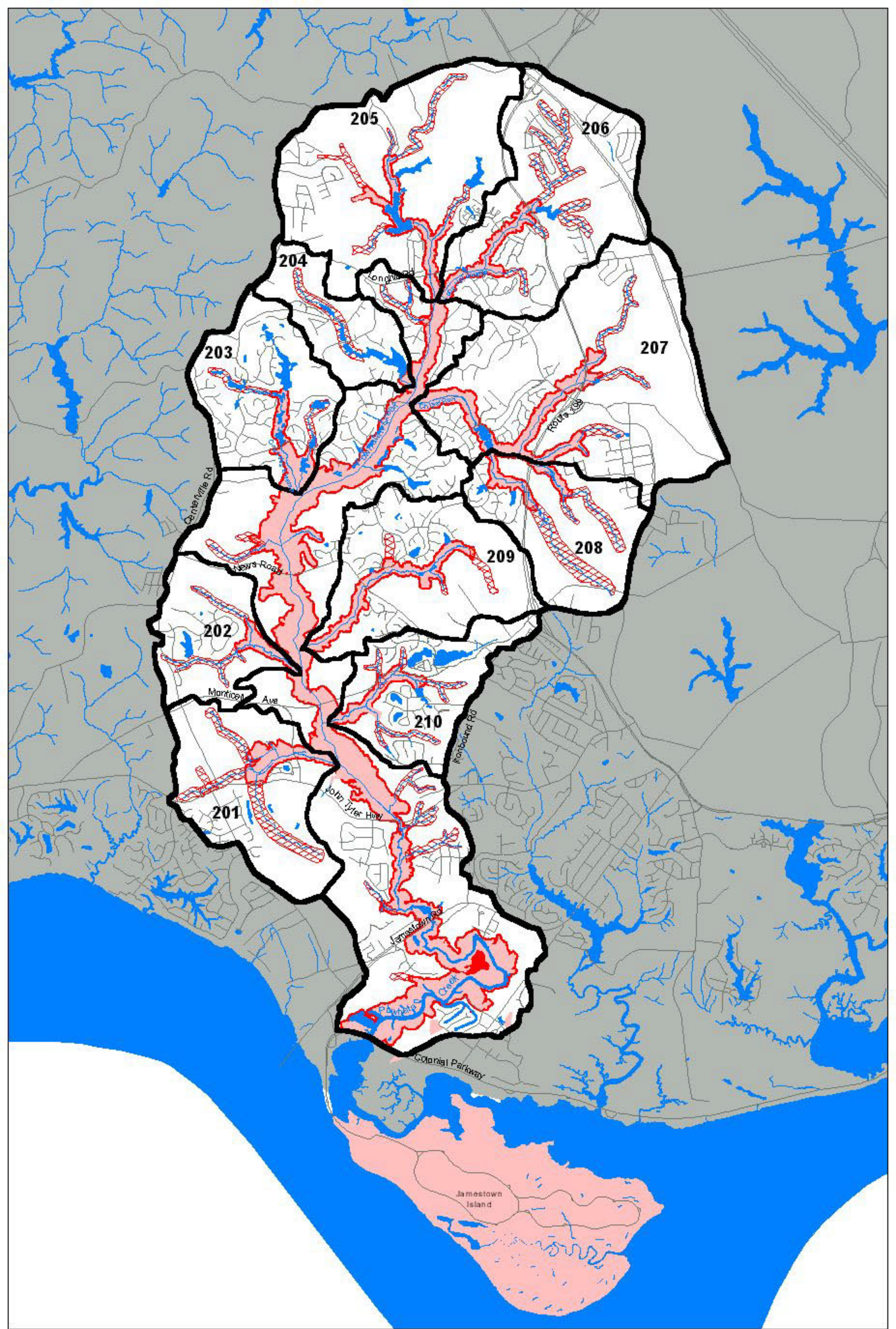
Zielinski, J.A. 2001. Stormwater MasterPlan for Powhatan Creek Watershed. Report to James City County. Center for Watershed Protection.

Appendix C

Resource Protection Area Extension Map

Non-Tidal Mainstream Map

Tidal Mainstream Map



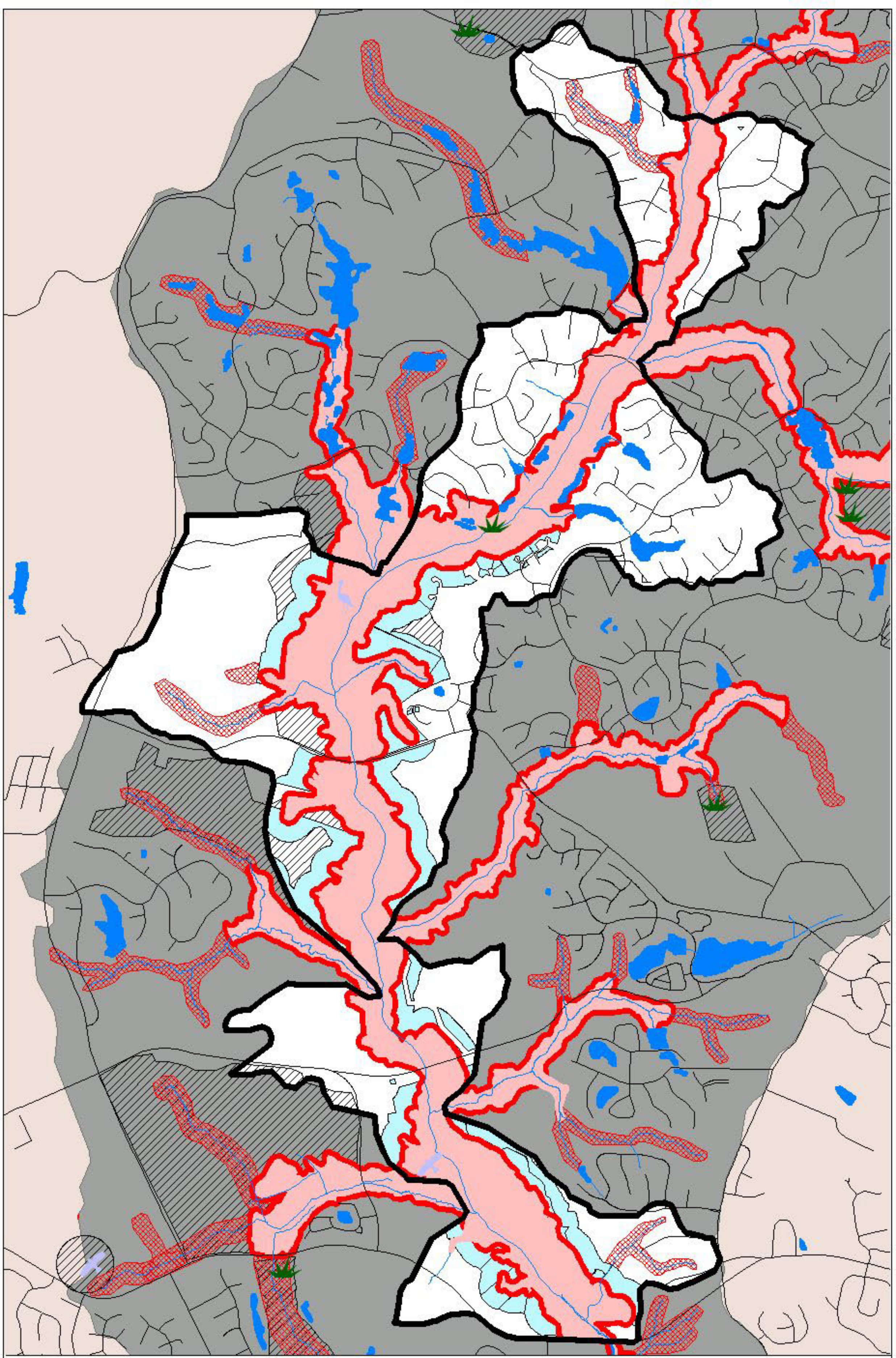
LEGEND

- Watershed Boundary
- Subwatershed Boundary
- Current RPA and RPA Buffer
- Recommended RPA Extension
- Hydrology

Powhatan Creek Watershed

4000 0 4000 Feet

A north arrow is located to the right of the scale bar. The scale bar shows a range from 0 to 4000 feet, with a midpoint at 2000 feet.



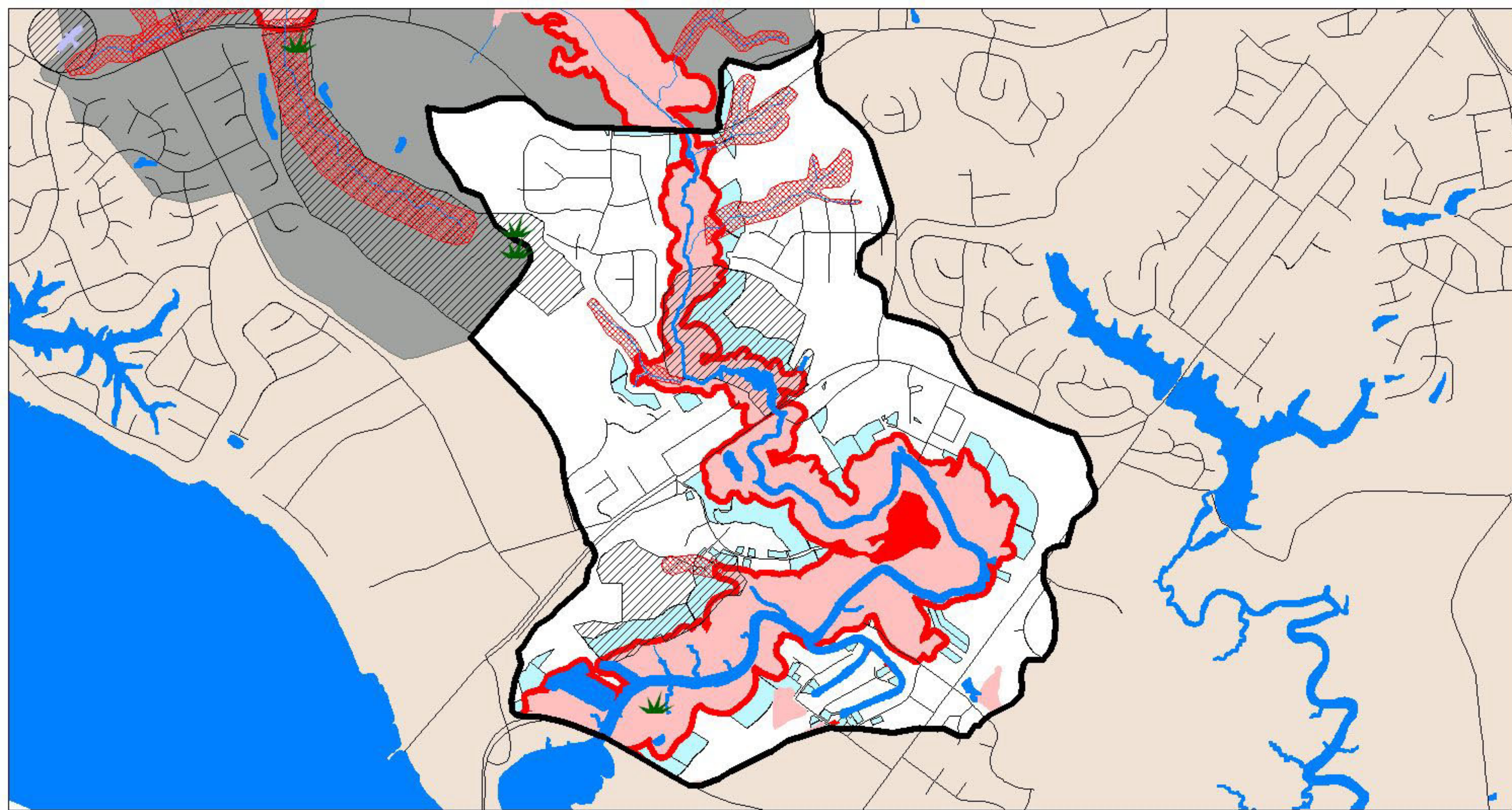
LEGEND

- | | | |
|--------------------------|--------------------------------------|-----------------------|
| Powhatan Creek Watershed | Proposed RPA Extension | Proposed 300ft Buffer |
| Subwatershed Boundary | Potential Stream Rehabilitation Area | |
| Rpa | Proposed Conservation Areas | |
| Rpa buffer | Bald Eagle Nest | |
| Hydrology | Blue Heron Colony | |
| Roads | RTE Plants | |

**Powhatan Creek Watershed
Non-Tidal Mainstem
300ft Buffer**

0 2000 Feet





Powhatan Creek Watershed
Tidal Mainstem
300 ft Buffer

LEGEND

Powhatan Creek Watershed	Proposed RPA Extension	Proposed 300ft Buffer
Subwatershed Boundary	Proposed Conservation Areas	
Rpa	Bald Eagle Nest	
Rpa buffer	Blue Heron Colony	
Hydrology	RTE Plants	
Roads	Potential Stream Rehabilitation Area	

