

STREAM ASSESSMENT / WATERSHED MANAGEMENT PROGRAM

2.1 OVERVIEW

Henrico County has developed and adopted a watershed management approach to improving water quality. The County's Watershed Management Program addresses water quality at the watershed level and provides opportunities to improve degraded streams while complying with stormwater controls mandated and authorized by state and federal programs. The various components of the County's stormwater programs are authorized by the Chesapeake Bay Preservation Act (§ 10.1-2100 et seq of the Code of Virginia) and the Virginia Stormwater Management Law (§ 10.1-603.1 et seq of the Code of Virginia).

2.2 BACKGROUND

Prior to the adoption of the Stream Assessment / Watershed Management Program, water quality requirements for all development were met by providing on-site best management practices (BMPs). From 1991-2000, approximately 500 on-site BMPs were constructed in the County. Although many larger BMPs were determined to be successful in achieving their pollutant removal goal, many small ineffective BMPs were also constructed. In addition, the County's prior approach provided little if any, improvement to degraded stream systems present in the County because the requirements were based on the needs of the site, not the needs of the watershed. Many of the problem areas are within previously developed areas where new development activity has no significant impacts on the problem area. Like most local ordinance requirements, the application of the County's stormwater management (SWM) requirements is accomplished through the plan of development (POD) and subdivision plan review process. Since only proposed development goes through this review, the previous SWM program offered little opportunity to address stormwater problems in the areas of existing, older development.

Having identified these two program inadequacies, the County pursued a regional/watershed SWM program, but not in the traditional sense. Generally, traditional regional programs have become synonymous with regional basins. The County's approach is much broader, involving channel restoration, channel protection, buffer establishment, urban stormwater retrofits, and regional stormwater controls. Although the County's watershed approach is different than other programs, the County will continue to provide the level of stormwater control intended by the various state and federal programs.

The watershed program still requires effective on-site BMP facilities; however, the program will reduce the number of ineffective BMPs by providing an alternative approach to address SWM on a watershed level, resulting in more effective facilities. The program strikes a balance between the need to protect those resources not yet degraded and the desire to restore those that have been impacted by development. In order to accomplish this

balance, the type of development, as well as the condition of the watershed in which the development is located, was considered in developing the program. In some situations, such as where development occurs adjacent to streams that are not yet impacted, onsite BMP facilities for moderate to high intensity development may be the appropriate management choice to protect the stream. However, there will be situations where greater benefit can be derived from a contribution to a watershed effort as opposed to providing on-site treatment. It is important to note that even under the watershed approach, the individual site will meet the intent and goals of the state and federal mandates by contributing to the overall improvement of water quality in the Commonwealth.

The County's watershed program will achieve some of the goals of Virginia's Tributary Strategy for the Middle James River. Some of the suggested strategies to achieve these goals are buffer establishment, stream restoration, and urban stormwater retrofits - all of which are components of the County's program. The County's program will also benefit the Riparian Forest Buffer Initiative. One of the management methods included in the County's program is the establishment of buffer areas along channels and streams where they don't currently exist. An integral part of the County's program is the establishment of forested buffers along the stream network.

The County Watershed program will also aid in addressing one of the most important but overlooked, aspects of SWM - the maintenance of the facilities and management practices. Typically, private entities or individuals do not focus on maintenance of stormwater facilities. The program will encourage, and when necessary, require needed maintenance. The program will also reduce the number of small, privately owned on-site facilities constructed in the future and therefore, the maintenance of all the facilities will become less burdensome.

2.3 STREAM ASSESSMENTS

In order to develop a Watershed Management Program that was responsive to needs of the streams and watersheds, an evaluation of the streams throughout the County was necessary. The field evaluations were conducted by two person teams performing habitat assessments and stream corridor inventories while walking approximately 440 miles of streams within the County. The assessments were conducted on all streams in the County with 100 acres or more of drainage area.

2.3.1 HABITAT ASSESSMENTS

To evaluate the physical characteristics of the streams, the County used a variation of the habitat assessment included in the Georgia Rapid Bioassessment Protocol that was based on the Environmental Protection Agency's Rapid Bioassessment Protocol. The protocol provides a dual assessment system based on stream energy – one for higher energy,

riffle/run systems and one for lower energy, glide/pool systems. For each of these systems, 10 habitat parameters are evaluated.

For high energy, riffle/run systems the following parameters were studied:

1. Instream cover
2. Epifaunal substrate
3. Embeddedness
4. Channel alteration
5. Sediment deposition
6. Frequency of riffles
7. Channel flow status
8. Bank vegetative protection
9. Bank stability
10. Vegetated buffer zone width

For low energy, glide/pool systems the following parameters were studied:

1. Bottom substrate
2. Pool substrate
3. Pool variability
4. Channel alteration
5. Sediment deposition
6. Channel sinuosity
7. Channel flow status
8. Bank vegetative protection
9. Bank stability
10. Vegetated buffer zone width

Using these parameters, streams reaches were evaluated and scored accordingly. Data collected using the habitat assessment provided a relative comparison of the potential for a stream reach to support a diverse biological community. More details about the habitat assessments can be found in the Appendix of this Manual.

2.3.2 STREAM CORRIDOR INVENTORY

While conducting habitat assessments for the streams, an inventory of other stream influences and conditions was also collected. Many of these items can and are having a negative impact on the streams within the County. These included illicit discharges, streambank erosion, dump sites, lack of stream buffers, exposed and possibly leaking sanitary sewer lines, and stream blockages. Identifying these problem areas is an important component of the overall watershed program. Undiscovered and subsequently unaddressed, these problem areas will continue to impact the stream systems, often causing significant physical, biological and chemical degradation.

2.3.3 OTHER STREAM INFORMATION

Certain segments of the waterways within the County are listed in various state and federal programs for not meeting current water quality standards. The waterways (or segments of waterways) currently listed on the Department of Environmental Quality's *Schedule for Development of TMDLs through 2010* are identified as follows:

Stream	Stream Segment	Length (miles)	Square Miles	Impairment
Almond Creek		3.3		Fecal Coliform
Tuckahoe Creek	Route 6 bridge to James River	4.7		Dissolved oxygen Fecal Coliform
James River	Boulevard bridge to Fall line	3.2		Fecal Coliform General Standard (Benthic)
James River			10.8	Nonpoint Source Combined Sewer Overflow
White Oak Swamp	White Oak Swamp Creek to Chickahominy River	6.7		pH Fecal Coliform
Upham Brook	Upham Brook Pump Station to Chickahominy River	5.8		Fecal Coliform
Fourmile Creek	Deerlick Branch to Grigg's Pond	3.2		pH Fecal Coliform

Although impairment scores are not identified, it is reasonable to conclude that possible sources of the impairment(s) could be addressed by the Stream Assessment / Watershed Management Program. However, there is information available that indicates certain impairments could be due to a natural occurrence. Therefore, certain stream segments warrant further investigation to determine the cause of the impairment and their watersheds have been designated as Special Study Areas. These areas are shown on Map 2.1.

2.4 WATERSHED MANAGEMENT AREA DESIGNATIONS

Once the stream assessments were completed and supporting information gathered, a Watershed Management Area designation was assigned to each watershed. Within each Watershed Management Area, different Watershed Management Practices are applied to address stream conditions, water quality and levels of development. These management categories and practices provide a basis for targeting resources to address water quality problems using a focused watershed based approach. The four Watershed Management Area Designations are:

1. Watershed Preservation Areas
2. Watershed Enhancement Areas
3. Watershed Restoration Areas
4. Urban Management Areas

The Watershed Management Area delineations are shown on Map 2.2.

2.4.1 WATERSHED PRESERVATION AREAS

Watershed Preservation Areas are watersheds in which the streams are predominantly in good condition when measured by the habitat assessments and inventory of other stream

influences. Generally, the streams within these areas have habitat assessment scores greater than 152 and experience minimal degradation due to problem areas (i.e. illicit discharges, streambank erosion, etc.). Therefore, very few corrective actions are needed within the stream corridors in these watersheds.

This designation is based upon the results of the stream assessments and inventories and is not subject to change until a watershed-wide re-assessment is conducted.

2.4.2 WATERSHED ENHANCEMENT AREAS

Watershed Enhancement Areas are watersheds in which the streams are predominantly in fair condition when measured by the habitat assessments and inventory of other stream influences. Generally, the streams within these areas have habitat assessment scores between 100 and 151 and experience moderate degradation due to problem areas (i.e. illicit discharges, streambank erosion, stream blockages etc.). Consequently, corrective actions are needed within the stream corridors.

This designation is based upon the results of the stream assessments and inventories and is not subject to change until a watershed-wide re-assessment is conducted.

2.4.3 WATERSHED RESTORATION AREAS

Watershed Restoration Areas are watersheds in which the streams are predominantly in poor condition when measured by the habitat assessments and inventory of stream influences. Generally, the streams within these areas have a habitat assessment score less than 100 and experience a significant amount of degradation due to problem areas (i.e. illicit discharges, streambank erosion, stream blockages, dumpsites etc.). Consequently, extensive corrective action is needed within the stream corridors.

This designation is based upon the results of the stream assessments and inventories and is not subject to change until a watershed-wide re-assessment is conducted.

2.4.4 URBAN MANAGEMENT AREAS

Urban Management Areas are corridors of intensely developed sites. The stream segments are predominantly in fair to poor condition when measured by the habitat assessments and inventory of stream influences. Generally, the streams within these areas experience a significant amount of degradation due to problem areas (i.e. illicit discharges, streambank erosion, stream blockages, dumpsites etc.). In many cases the streams have been altered by piping or paving. Consequently, extensive corrective action is needed within the stream corridors.

These areas were delineated along road corridors in the County and were based on developed parcels of office, commercial, and industrial land uses that existed at the time of program development. However, projects meeting one of the following may “opt into” an Urban Management Area:

1. Either the project is located on a previously developed parcel that is immediately adjacent to a mapped Urban Management Area; or
2. The project is located on an undeveloped parcel less than or equal to two (2.00) acres in size and is immediately adjacent to a mapped Urban Management Area.

Note that the mapped Urban Management Areas depicted on Map 2.2 do not change based on parcels that “opt into” the area.

2.5 WATERSHED MANAGEMENT PRACTICES

The Stream Assessment / Watershed Management Program includes many practices that address various aspects of water quality throughout the stream systems in the County. These Watershed Management Practices range from activities applied to individual projects to large stream restoration projects the County will conduct.

2.5.1 STREAM PROTECTION AREA

A Stream Protection Area (SPA) is an area adjacent to both sides of a stream that extends upstream from the Resource Protection Area (RPA) boundary into all tributaries with a drainage area of one hundred (100) acres or more. The Stream Protection Area is fifty (50) feet in width and is applied to each side of the stream channel. Unlike Resource Protection Areas (RPAs), the SPA is measured from the streambank or, if the streambank is not definable, is measured from the limits of the two-year storm flow or, for waterbodies, from the water’s edge.

Like the RPA, allowable activities in the SPA are limited. Generally, there shall be no land disturbance in the SPA other than for the following:

1. Water-dependent uses which satisfy the following conditions:
 - a. The use does not conflict with the Comprehensive Plan; and
 - b. Any non-water dependent components are located outside the SPA; and
 - c. Access will be provided with the minimum disturbance necessary. Where possible, a single point of access will be provided; and
 - d. All other applicable requirements are met.
2. Redevelopment activities which satisfy the following conditions:
 - a. The activity results in no further encroachment into the SPA; and

- b. Where possible, an area outside the SPA equal to the encroachment will be designated as SPA and forested; and
 - c. All other applicable requirements are met.
3. Roads and driveways may be constructed within or across the SPA provided the following conditions are met:
 - a. There are no reasonable alternatives for the alignment; and
 - b. The proposal minimizes disturbance of the SPA; and
 - c. All other applicable requirements are met; and
 - d. The proposed road or driveway is reviewed and approved through the appropriate land development process.
4. Utility lines and associated structures may be constructed within or across the SPA provided the following conditions are met:
 - a. There are no reasonable alternatives for the alignment; and
 - b. The proposal minimizes disturbance of the SPA; and
 - c. All other applicable requirements are met; and
 - d. The proposed construction is reviewed and approved through the appropriate land development process.
5. Passive recreation uses such as paths and picnic areas, provided the natural and forested characteristics of the SPA are maintained.
6. Removal of vegetation to provide reasonable sight lines, paths and general woodlot management, provided the natural and forested characteristics of the SPA are maintained.
7. BMPs may be constructed within the landward (upper) fifteen (15) feet of the SPA provided the following conditions are met:
 - a. There are no reasonable alternate locations for the BMP; and
 - b. Land disturbance in the SPA is minimized; and
 - c. All other applicable requirements are met.

Designation of the SPA is required for all development activities conducted through the plan of development (POD) or subdivision plan processes. In addition, all development activities with a pollutant removal requirement in accordance with the Stormwater Pollutant Removal requirements (see Chapter 3 of this Manual) must provide a forested SPA in accordance with Minimum Design Standard 9.10 found in Chapter 9 of this Manual. A maintenance agreement must be recorded providing for continued maintenance of the SPA.

As part of the Stream Assessment / Watershed Management Program, the County will also encourage the designation and forestation of the SPA in areas of existing development. Through cooperative efforts with homeowner associations, community groups and landowners, the County will use a portion of the Environmental Fund to establish a forested SPA along streams that currently lack a forested buffer.

2.5.2 ENERGY DISSIPATOR

In order to maximize the benefit of the SPA, all development activities conducted through the plan of development (POD) or subdivision plan processes must provide an energy

dissipator at all points of concentrated stormwater discharge (pipes or channels) in accordance with Minimum Design Standard 9.01 found in Chapter 9 of this Manual. These devices serve to reduce discharge velocities and distribute the stormwater in sheetflow through the SPA. Energy dissipators must be fully contained in a drainage easement.

2.5.3 ON-SITE BEST MANAGEMENT PRACTICES

On-site BMPs will continue to be required for certain development activities depending on the Watershed Management Area where the project is located and the project's existing and proposed impervious cover to address the project's required pollutant removal requirement. Acceptable BMPs are listed in the Removal Efficiency Table in Chapter 3 (Table 3.1), and minimum design standards for these BMPs can be found in Chapter 9 of this Manual. Acceptable BMPs include grassed swales, extended detention basins, retention basins, bioretention basins, sand filters, and infiltration trenches. Other proposed structures and/or facilities must be approved on a case-by-case basis by the Director of Public Works.

2.5.4 REGIONAL BEST MANAGEMENT PRACTICES

A regional BMP is a facility (or combination of facilities) that is designed to provide stormwater pollutant removal for a specific watershed. In order to qualify as a regional BMP, the BMP should have a contributing drainage area of 100 acres or more and must provide the required level of stormwater pollutant removal for multiple projects. In addition, the facility must meet other applicable minimum design standards included in Chapter 9.

Typically, regional BMPs are constructed as a result of large development activities and serve areas of new development. As in the past, the County's involvement in these privately-owned regional BMPs continues to be the review and approval of BMP construction and administrative tracking of pollutant removal credits. Although the County has no maintenance responsibility for these BMPs, the County continues to encourage these privately owned regional BMPs as long as necessary maintenance and responsibility issues are addressed.

In addition to the privately-owned regional BMPs, the County will begin to develop publicly-owned regional BMPs as part of the Stream Assessment / Watershed Management Program. In order to finance these BMPs, a portion of the Environmental Fund will be set aside each year. It is the County's intent to design and construct publicly-owned regional BMPs as funding is accumulated over a five to seven year period.

2.5.5 REGIONAL AND OFFLINE CONSTRUCTED WETLANDS

The County will use data collected during the stream assessments to identify areas within the floodplain where wetlands can be constructed to intercept stormwater flows from

development areas. In many areas of the County, stormwater pipes convey storm flows from development areas to the floodplain. The stormwater then flows through an open channel to the receiving stream. In some of these areas, it may be possible to construct wetland systems to intercept this stormwater prior to its release into the stream channel. Such a system would provide a method for pollutant and sediment load reduction in areas not otherwise served by stormwater quality facilities. The County will design and construct these features using a portion of the Environmental Fund.

2.5.6 STREAM RESTORATION AND STABILIZATION

In-stream channel erosion and stream degradation is a common problem in heavily developed watersheds. Developed areas include significant impervious cover that results in increased discharge and velocity of stormwater into receiving channels. This causes a myriad of problems such as stream bank erosion and failure; stream headcutting, downcutting, and straightening; excessive in-stream sediment deposition; and absence or collapse of riparian vegetation. Through stabilizing and restoring streams, the discharge of sediment throughout these watersheds, and ultimately the discharge to the Chesapeake Bay, can be greatly reduced and the overall physical and biological health of streams improved.

The County will use data obtained during the stream assessments to identify and prioritize stretches of streams in need of restoration measures. Based on detailed hydrologic and geomorphologic analysis to be conducted by the County or its agent(s), entire stream segments will be stabilized and restored using various bioengineering methods and materials.

In addition to stream restoration, streambank stabilization projects will also be conducted. Identified projects will range from minor streambank stabilization projects (which can be accomplished by County staff and volunteers) to major projects which will require detailed plans and will be constructed by firms specializing in streambank stabilization. A portion of the Environmental Fund will be used to fund stream restoration and streambank stabilization projects.

2.5.7 STREAM OBSTRUCTION REMOVAL

During the stream assessments, the County identified areas where stream obstructions are having or could have negative effects on the streams. The goal of removing stream obstructions is to prevent further erosion around the obstruction, reduce flooding outside of the floodplain and restore fish passage. These projects will be funded using a portion of the Environmental Fund.

2.5.8 PUBLIC EDUCATION AND AWARENESS

Public stewardship of County streams is an important aspect of stream protection, and a major step is creating citizen awareness. Providing informational materials and sponsoring meetings will foster community awareness and create a connection with area streams. The County and/or its agent(s) will publish and disseminate educational materials using several forms of media. These educational materials may include information on proper residential lawn care, water quality do's and don'ts, the storm sewer system, household hazardous waste management, and illicit discharges. These educational materials may be supplemented with speaking engagements at area schools, libraries, civic clubs, etc., to encourage community participation in restoring our streams.

2.6 ENVIRONMENTAL FUND

A component of the Stream Assessment / Watershed Management Program is the Environmental Fund (Fund). The Fund was established to provide a funding source for the water quality projects conducted within the County in the James River and Chickahominy River watersheds. These watersheds are shown on Map 2.3. The County will administer the Fund and use the monies to finance projects such as streambank stabilization, stream restoration, removal of stream obstructions, buffer establishment, regional best management practices (BMPs), and constructed wetlands.

Depending on a project's impervious percentages and the Watershed Management Area designation where the project is located, contribution to the Fund may be required in lieu of constructing an on-site best management practice (BMP). The contribution is based on a cost of \$8,000.00 per pound of pollutant removal required to be achieved by the project. Pollutant loading and removal calculations are done in accordance with the Simple Method described in Chapter 3 of this Manual and must be performed using the worksheets included in Chapter 3.

Contributions to the Fund are based on a pro-rata share of the pollutant removal requirement expected over a year of development activity within the County. The current \$8,000.00 per pound of pollutant removal requirement was derived from the annual cost of providing an equivalent level of pollutant removal based on the previous "site-by-site" approach. The \$8,000.00 per pound cost may be adjusted periodically to allow for inflation and changes in construction costs. Although contributions resulting from development projects are expected to be the largest source of funding for the Fund, grants and other sources are possible and will be pursued. However, these additional funding sources will not affect the \$8,000.00 per pound cost basis. When required, contributions to the Environmental Fund must be made according to the following:

1. For subdivisions, contribution to the Environmental Fund is required prior to recordation of the subdivision. Contributions to the Fund must be submitted

to the Department of Public Works and checks must be made payable to the County of Henrico.

2. For other projects (PODs and road projects), contribution to the Environmental Fund is required prior to approval of the construction plans. Contributions to the Fund must be submitted to Department of Public Works and checks must be made payable to the County of Henrico.

In addition, contributions to the Environmental Fund are reduced if energy dissipators and a forested SPA are provided where appropriate. These adjustments are calculated on Worksheet 2.3.

2.7 IMPLEMENTATION

Compliance with the requirements of the Stream Assessment / Watershed Management Program depends upon:

1. The Watershed Management Area in which the project is located (refer to Map 2.2); and
2. The size of the parcel on which the project is located; and
3. The pre and post-developed impervious cover percentages (I_{pre} and I_{post}) and the pollutant removal requirement (RR) of the project (calculated in accordance the methods and worksheets in Chapter 3 of this Manual); and
4. The type of project proposed (subdivision, POD, or road project).

To aid in determining the project requirements, several worksheets are provided and must be completed and submitted with a plan submittal. The worksheets are:

Worksheet 2.1 - Program Implementation

This worksheet is required for all projects and summarizes applicable information such as project location, Watershed Management Area, impervious percentages, removal requirement, and required Watershed Management Practices.

Worksheet 2.2 – Urban Management Area Opt-In

This worksheet is required for projects “opting-into” an Urban Management Area. Information is provided on this worksheet that is needed to evaluate whether or not the project is eligible to “opt-into” an Urban Management Area.

Worksheet 2.3 – Environmental Fund Contribution

This worksheet is required for projects contributing to the Environmental Fund in lieu of providing a best management practice to achieve the required level of pollutant removal. In addition to considering the pollutant removal requirement, the

worksheet also provides for reductions for projects that provide energy dissipators and forested Stream Protection Areas.

In addition, applicants are encouraged to contact the Environmental Division of the Department of Public Works in order to verify project requirements prior to finalizing site design.

The following sections discuss the required Watershed Management Practices within each of the four Watershed Management Areas. These sections should be consulted to determine the Watershed Management Practices required of the proposed project.

Please note there are several Watershed Management Practices included in the program that will be conducted by the County using the funds generated by the program and are not requirements of individual projects. These include stream restoration, streambank stabilization, removal of stream obstructions, and the creation of wetlands and regional best management practices. Pollutant removal achieved by these practices will provide the “equivalent water quality protection” needed to satisfy the County’s regulatory requirement of the Chesapeake Bay Preservation Area Designation and Management Regulations.

2.7.1 REQUIREMENTS IN WATERSHED PRESERVATION AREAS

The following items will assist the applicant in completing the Applicable Requirements section of Worksheet 2.1 for subdivision and POD projects. In addition, Figure 2.1 provides a flowchart for determining project requirements and Figure 2.2 is a requirement table for Watershed Preservation Areas.

Designation of Stream Protection Area(s)

- All projects that contain or are adjacent to a “program stream” must designate an SPA.

Forestation of Stream Protection Area(s)

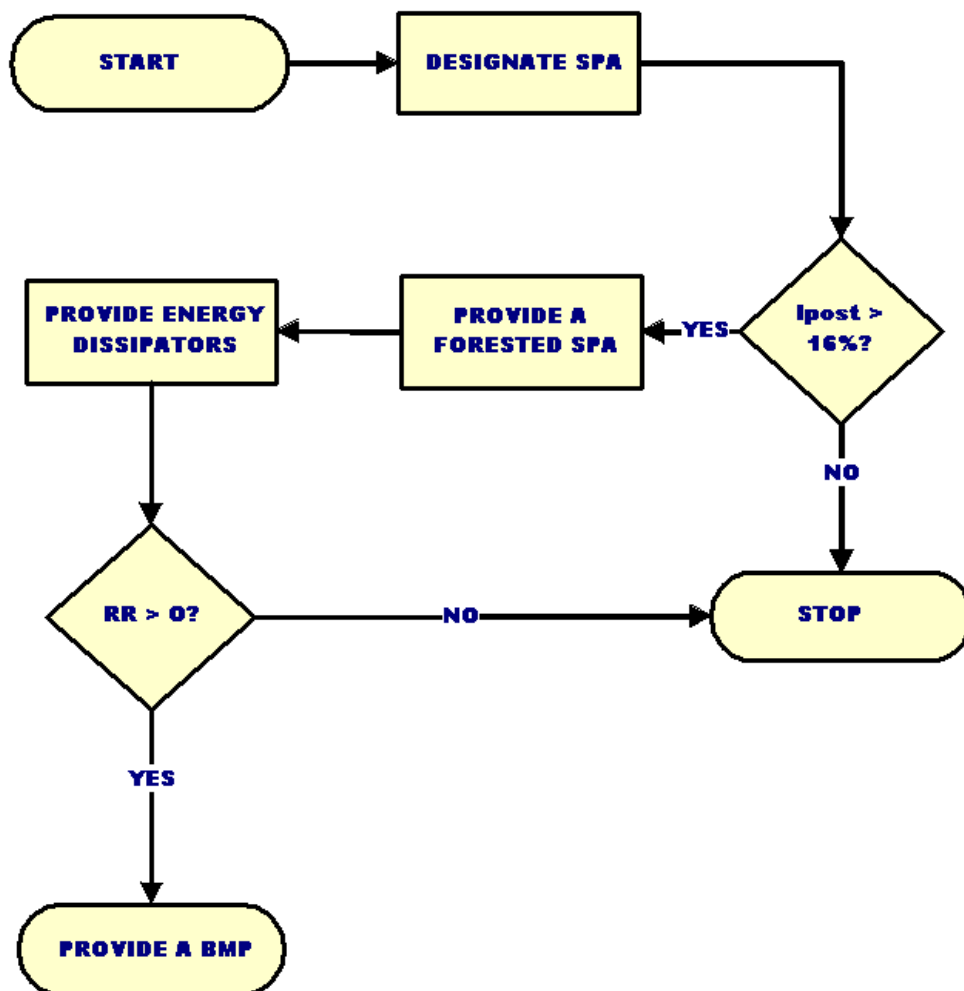
- Projects resulting in greater than 16% impervious cover must provide a forested SPA in accordance with Minimum Design Standard 9.10 found in Chapter 9 of this Manual.

Provide Energy Dissipators

- Projects resulting in greater than 16% impervious cover must provide energy dissipators at all points of concentrated stormwater discharges in accordance with Minimum Design Standard 9.01 found in Chapter 9 of this Manual.

Provide a BMP or Contribute to the Environmental Fund

- ❑ Development projects resulting in less than or equal to 16% impervious cover have no pollutant removal requirement.
- ❑ Projects resulting in greater than 16% impervious cover must address the pollutant removal requirement by providing a BMP.



**IMPLEMENTATION IN WATERSHED PRESERVATION AREAS
FIGURE 2.1**

Project Characteristics	Applicable Requirements (✓ = Required)				
	Designate the Stream Protection Area	Provide Forested Stream Protection Area	Provide Energy Dissipators	Address Pollutant Removal Requirement with a BMP	Address Pollutant Removal Requirement with a Fund Contribution
$I_{post} \leq 16\%$	✓				
$I_{post} > 16\%$	✓	✓	✓	✓	

**PROJECT REQUIREMENTS IN WATERSHED PRESERVATION AREAS
FIGURE 2.2**

2.7.2 REQUIREMENTS IN WATERSHED ENHANCEMENT AREAS

The following items will assist the applicant in completing the Applicable Requirements section of Worksheet 2.1 for subdivision and POD projects. In addition, Figure 2.3 provides a flowchart for determining project requirements and Figure 2.4 is a requirement table for Watershed Enhancement Areas.

Designation of Stream Protection Area(s)

- All projects that contain or are adjacent to a “program stream” must designate an SPA.

Forestation of Stream Protection Area(s)

- Projects resulting in greater than 16% impervious cover must provide a forested SPA in accordance with Minimum Design Standard 9.10 found in Chapter 9 of this Manual.

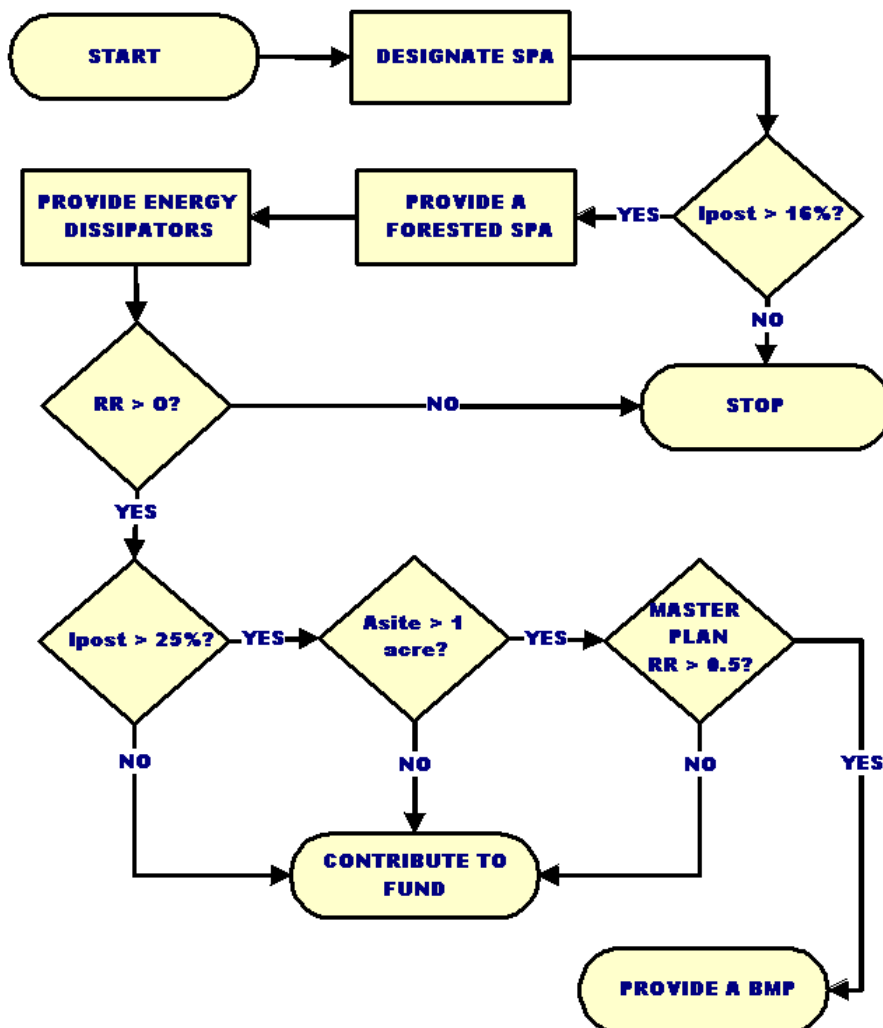
Provide Energy Dissipators

- Projects resulting in greater than 16% impervious cover must provide energy dissipators at all points of concentrated stormwater discharges in accordance with Minimum Design Standard 9.01 found in Chapter 9 of this Manual.

Provide a BMP or Contribution to the Environmental Fund?

- Development projects resulting in less than or equal to 16% impervious cover have no pollutant removal requirement.

- Projects located on parcels 1 acre or less in size must address the calculated pollutant removal requirement by contributing to the Environmental Fund.
- Projects resulting in greater than 16% impervious cover but less than or equal to 25% impervious cover must address the calculated pollutant removal requirement by contributing to the Environmental Fund.
- Projects located on parcels greater than one acre in size that result in greater than 25% impervious cover must address the calculated pollutant removal requirement by constructing a BMP. However, if the proposed project and all future projects as shown on an approved master plan result in a total removal requirement of one-half pound of phosphorus per year (0.5 lb P / yr) or less, the pollutant removal requirement must be addressed by contributing to the Environmental Fund.



**IMPLEMENTATION IN WATERSHED ENHANCEMENT AREAS
FIGURE 2.3**

Project Characteristics	Applicable Requirements (✓ = Required)				
	Designate the Stream Protection Area	Provide Forested Stream Protection Area	Provide Energy Dissipators	Address Pollutant Removal Requirement with a BMP	Address Pollutant Removal Requirement with a Fund Contribution
$I_{post} \leq 16\%$	✓				
$16\% < I_{post} \leq 25\%$	✓	✓	✓		✓
$I_{post} > 25\%$, and $A_{parcel} \leq 1$ acre	✓	✓	✓		✓
$I_{post} > 25\%$, $A_{parcel} > 1$ acre, and Master Plan RR > 0.5 lb	✓	✓	✓	✓	
$I_{post} > 25\%$, $A_{parcel} > 1$ acre, and Master Plan RR ≤ 0.5 lb	✓	✓	✓		✓

**PROJECT REQUIREMENTS IN WATERSHED ENHANCEMENT AREAS
FIGURE 2.4**

2.7.3 REQUIREMENTS IN WATERSHED RESTORATION AREAS

The following items will assist the applicant in completing the Applicable Requirements section of Worksheet 2.1 for subdivision and POD projects. In addition, Figure 2.5 provides a flowchart for determining project requirements and Figure 2.6 is a requirement table for Watershed Restoration Areas.

Designation of a Stream Protection Area

- All projects that contain or are adjacent to a “program stream” must designate an SPA.

Forestation of the Stream Protection Area(s)

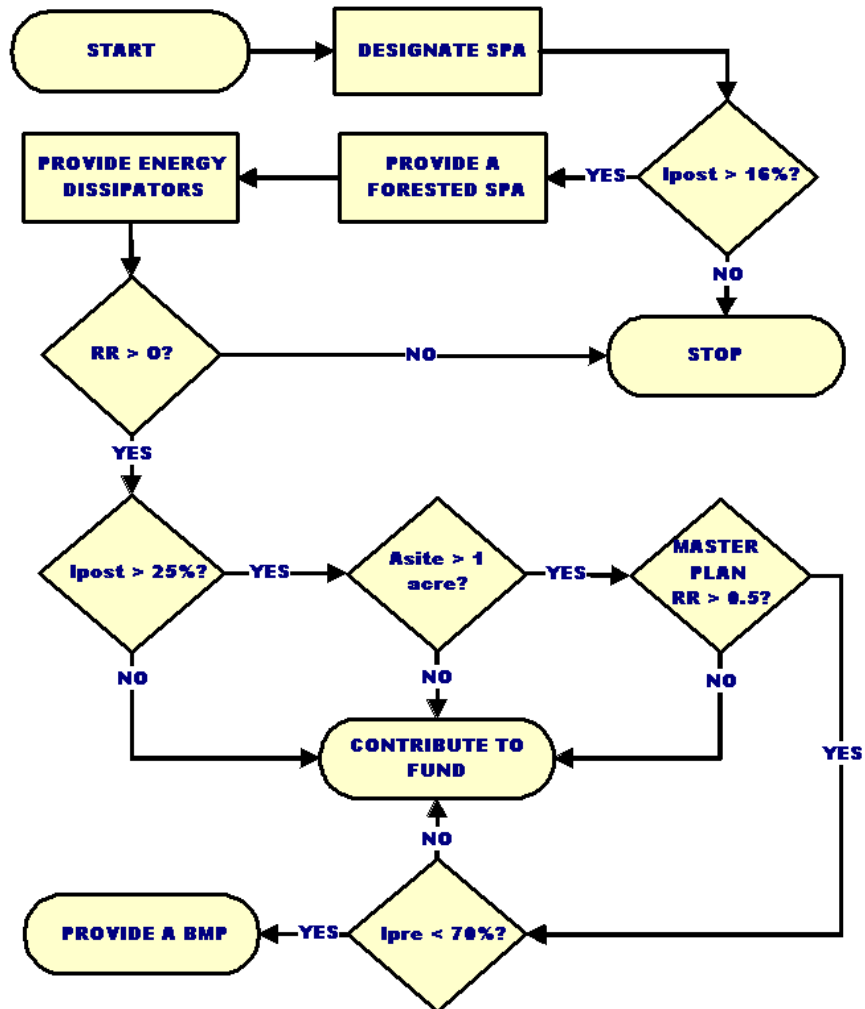
- Projects resulting in greater than 16% impervious cover must provide a forested SPA in accordance with Minimum Design Standard 9.10 found in Chapter 9 of this Manual.

Provide Energy Dissipators

- ❑ Projects resulting in greater than 16% impervious cover must provide energy dissipators at all points of concentrated stormwater discharges in accordance with Minimum Design Standard 9.01 found in Chapter 9 of this Manual.

Provide a BMP or Contribution to the Environmental Fund?

- ❑ Development projects resulting in less than or equal to 16% impervious cover have no pollutant removal requirement.
- ❑ Projects located on parcels 1 acre or less in size must address the calculated pollutant removal requirement by contributing to the Environmental Fund.
- ❑ Projects resulting in greater than 16% impervious cover but less than or equal to 25% impervious cover must address the calculated pollutant removal requirement by contributing to the Environmental Fund.
- ❑ Projects located on parcels greater than one acre in size with impervious cover currently greater than 25% and less than 70% and resulting in greater than 25% impervious cover must address the calculated pollutant removal requirement by constructing a BMP. However, if the proposed project and all future projects as shown on an approved master plan result in a total removal requirement of one-half pound of phosphorus per year (0.5 lb P / yr) or less, the pollutant removal requirement must be addressed by contributing to the Environmental Fund.
- ❑ Projects with impervious cover currently greater than or equal to 70% must address the calculated pollutant removal requirement by contributing to the Environmental Fund.



**IMPLEMENTATION IN WATERSHED RESTORATION AREAS
FIGURE 2.5**

Project Characteristics	Applicable Requirements (✓ = Required)				
	Designate the Stream Protection Area	Provide Forested Stream Protection Area	Provide Energy Dissipators	Address Pollutant Removal Requirement with a BMP	Address Pollutant Removal Requirement with a Fund Contribution
$I_{post} \leq 16\%$	✓				
$16\% < I_{post} \leq 25\%$	✓	✓	✓		✓
$25\% < I_{pre} < 70\%$, $I_{post} > 25\%$, and $A_{parcel} \leq 1$ acre	✓	✓	✓		✓
$25\% < I_{pre} < 70\%$, $I_{post} > 25\%$, $A_{parcel} > 1$ acre, and Master Plan RR ≤ 0.5 lb	✓	✓	✓		✓
$25\% < I_{pre} < 70\%$, $I_{post} > 25\%$, $A_{parcel} > 1$ acre, and Master Plan RR > 0.5 lb	✓	✓	✓	✓	
$I_{pre} \geq 70\%$	✓	✓	✓		✓

**PROJECT REQUIREMENTS IN WATERSHED RESTORATION AREAS
FIGURE 2.6**

2.7.4 REQUIREMENTS IN URBAN MANAGEMENT AREAS

The following will assist the applicant in completing the Applicable Requirements section of Worksheet 2.1 for subdivision and POD projects. In addition, Figure 2.7 provides a flowchart for determining project requirements and Figure 2.8 is a requirement table for Urban Management Areas.

Designation of a Stream Protection Area

- All projects that contain or are adjacent to a “program stream” must designate an SPA.

Forestation of the Stream Protection Area(s)

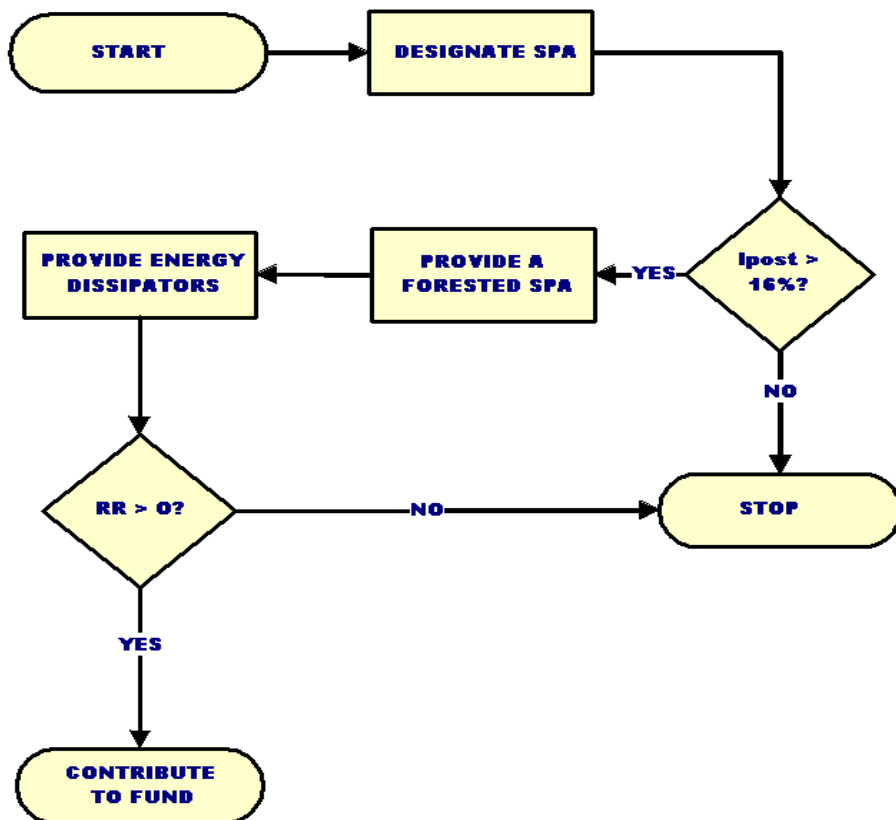
- Projects resulting in greater than 16% impervious cover must provide a forested SPA in accordance with Minimum Design Standard 9.10 found in Chapter 9 of this Manual.

Provide Energy Dissipators

- ❑ Projects resulting in greater than 16% impervious cover must provide energy dissipators at all points of concentrated stormwater discharges in accordance with Minimum Design Standard 9.01 found in Chapter 9 of this Manual.

Provide a BMP or Contribution to the Environmental Fund?

- ❑ Development projects resulting in less than or equal to 16% impervious cover have no pollutant removal requirement.
- ❑ Projects resulting in greater than 16% impervious cover must address the calculated pollutant removal requirement by contributing to the Environmental Fund.



**IMPLEMENTATION IN URBAN MANAGEMENT AREAS
FIGURE 2.7**

Project Characteristics	Applicable Requirements (✓ = Required)				
	Designate the Stream Protection Area	Provide Forested Stream Protection Area	Provide Energy Dissipators	Address Pollutant Removal Requirement with a BMP	Address Pollutant Removal Requirement with a Fund Contribution
$I_{post} \leq 16\%$	✓				
$I_{post} > 16\%$	✓	✓	✓		✓

**PROJECT REQUIREMENTS IN URBAN MANAGEMENT AREAS
FIGURE 2.8**

2.7.5 COUNTY AND STATE ROAD PROJECTS

Public road projects that are required to comply with state stormwater standards and are constructed by the Virginia Department of Transportation, the Henrico County Department of Public Works, or their subcontractors must comply with the following requirements in the various Watershed Management Areas:

Watershed Preservation Areas

- ❑ All projects that contain or are adjacent to a “program stream” must designate an SPA.
- ❑ The SPA must be forested in accordance with Minimum Design Standard 9.10 found in Chapter 9 of this Manual.
- ❑ Projects resulting in greater than 16% impervious cover must provide energy dissipators at all points of concentrated stormwater discharges in accordance with Minimum Design Standard 9.01 found in Chapter 9 of this Manual.
- ❑ Projects resulting in greater than 16% impervious cover must address the pollutant removal requirement by providing a BMP.

Watershed Enhancement Areas

- ❑ All projects that contain or are adjacent to a “program stream” must designate an SPA.

- ❑ The SPA must be forested in accordance with Minimum Design Standard 9.10 found in Chapter 9 of this Manual.
- ❑ Projects resulting in greater than 16% impervious cover must provide energy dissipators at all points of concentrated stormwater discharges in accordance with Minimum Design Standard 9.01 found in Chapter 9 of this Manual.
- ❑ Projects resulting in greater than 16% impervious cover must address the pollutant removal requirement by contributing to the Environmental Fund.

Watershed Restoration Areas

- ❑ All projects that contain or are adjacent to a “program stream” must designate an SPA.
- ❑ The SPA must be forested in accordance with Minimum Design Standard 9.10 found in Chapter 9 of this Manual.
- ❑ Projects resulting in greater than 16% impervious cover must provide energy dissipators at all points of concentrated stormwater discharges in accordance with Minimum Design Standard 9.01 found in Chapter 9 of this Manual.
- ❑ Projects resulting in greater than 16% impervious cover must address the pollutant removal requirement by contributing to the Environmental Fund.

Urban Management Areas

- ❑ All projects that contain or are adjacent to a “program stream” must designate an SPA.
- ❑ The SPA must be forested in accordance with Minimum Design Standard 9.10 found in Chapter 9 of this Manual.
- ❑ Projects resulting in greater than 16% impervious cover must provide energy dissipators at all points of concentrated stormwater discharges in accordance with Minimum Design Standard 9.01 found in Chapter 9 of this Manual.
- ❑ Projects resulting in greater than 16% impervious cover must address the pollutant removal requirement by contributing to the Environmental Fund.

2.7.6 50/10 STORMWATER DETENTION AREAS

In Watershed Management Areas where 50/10 stormwater detention is required, there will be situations in which a contribution to the Environmental Fund is required based on the applicable requirements of the Watershed Management Area. However, in accordance with the § 15.2-2243 of the Code of Virginia, credit is given for “the effect of all on-site stormwater facilities or best management practices constructed or required to be constructed”. Therefore, in cases where contribution to the Environmental Fund is required

and 50/10 stormwater detention or other quantity controls are also required, the applicant may either provide appropriate modifications to the 50/10 or quantity facilities to address the required pollutant removal requirement or make a contribution to the Environmental Fund. If the pollutant removal requirement cannot be fully achieved by modifying the 50/10 or quantity facility, the remainder of the pollutant removal requirement can be addressed through a contribution to the Environmental Fund as outlined in Section 2.6. Refer to Chapter 4 of this manual for details concerning 50/10 stormwater detention areas.

2.7.7 EXISTING BMPS

There will be projects for which a contribution to the Environmental Fund is required and a BMP exists that was required to be constructed as part of a previous project. In accordance with the § 15.2-2243 of the Code of Virginia, credit is given for “the effect of all on-site stormwater facilities or best management practices constructed or required to be constructed”. Therefore, in cases where contribution to the Environmental Fund is required and a BMP exists on the parcel, the applicant may either provide appropriate modifications to the existing BMP to address the required pollutant removal requirement or make a contribution to the Environmental Fund. If the pollutant removal requirement cannot be fully achieved by modifying the existing BMP, the remainder of the pollutant removal requirement can be addressed through a contribution to the Environmental Fund as outlined in Section 2.6.

2.8 EXEMPTIONS

The following activities shall be exempt from the Stream Assessment / Watershed Management Program:

1. Minor land disturbing activities involving less than 2,500 square feet of land disturbance.
2. Agricultural and silvicultural operations as outlined in Article II of Chapter 10 (Erosion and Sediment Control) and Chapter 24 (Zoning) of the Code of the County of Henrico, Virginia.
3. Surface mining, exploration, or drilling operations as outlined in Article II of Chapter 10 (Erosion and Sediment Control) of the Code of the County of Henrico, Virginia.
4. Individual utility connections and/or the maintenance of utility lines.
5. Other exemptions as identified in Article II of Chapter 10 (Erosion and Sediment Control) of the Code of the County of Henrico, Virginia.

2.9 WAIVERS

Unless otherwise noted, all requests for waivers to the requirements of the Stream Assessment / Watershed Management Program must be made in accordance with the following criteria:

1. All requests for waivers must be made in writing to the Director of Public Works and submitted to the project review engineer.
2. The waiver request must identify the requirement from which relief is being requested, discuss the nature of the relief necessary, and state the reason for which the relief is necessary.
3. Waivers may be granted provided that the exception is the minimum necessary to afford relief and reasonable and appropriate conditions are imposed as needed to preserve the purpose and intent of the requirements.

Encroachment in the Stream Protection Area (SPA) may be allowed by the Director of Public Works in accordance with the following additional criteria:

1. The encroachment will be allowed only if application of the SPA will produce an undue hardship (see Section 11.1).
2. Encroachments in the SPA shall be the minimum necessary to achieve a reasonable buildable area for a principal structure and necessary utilities.
3. Where possible, an area equal to the encroachment must be established elsewhere on the lot in a location that maximizes stream protection.
4. In no case shall the unmodified portion of the SPA be less than 35 feet in width.
5. The waiver must be pursued in accordance with the criteria in Section 2.9.

2.10 PLAN SUBMITTAL REQUIREMENTS

The following items and information must be included with all plan of development and subdivision plan submittals:

- Worksheet 2.1 must be completed, signed and submitted. In addition, this worksheet must be on the plan of development or subdivision plan.
- If “opting into” an Urban Management Area, Worksheet 2.2 must be completed, signed and submitted. In addition, this worksheet must be on the plan of development or subdivision plan.
- If contributing to the Environmental Fund, Worksheet 2.3 must be completed, signed and submitted. In addition, this worksheet must be on the plan of development or subdivision plan.

- The plans must show the location of all required SPAs and specify any necessary plantings in a detailed planting plan to satisfy Minimum Design Standard 9.10 found in Chapter 9 of this Manual.
- The plans must show the location of all required energy dissipators and construction details in accordance with Minimum Design Standard 9.01 found in Chapter 9 of this Manual.

STREAM ASSESSMENT / WATERSHED MANAGEMENT PROGRAM

WORKSHEET 2.1 – PROGRAM IMPLEMENTATION

PROJECT NAME		<input type="checkbox"/> Subdivision <input type="checkbox"/> POD
PROJECT DESCRIPTION		Tax Parcel

WATERSHED (circle one)	JAMES RIVER	CHICKAHOMINY RIVER
SUB-WATERSHED		

STREAM PRESENT ON-SITE?	PARCEL SIZE (acres)	PRE-DEVELOPMENT IMPERVIOUS COVER (%)	POST-DEVELOPMENT IMPERVIOUS COVER (%)	POLLUTANT REMOVAL REQUIREMENT
YES / NO				

WATERSHED MANAGEMENT AREA (circle one)	APPLICABLE REQUIREMENTS				
	DESIGNATE STREAM PROTECTION AREAS	PROVIDE FORESTED STREAM PROTECTION AREAS	PROVIDE ENERGY DISSIPATORS AT OUTFALLS THAT DISCHARGE TO STREAM PROTECTION AREAS	ADDRESS POLLUTANT REMOVAL REQUIREMENT WITH A BMP	ADDRESS POLLUTANT REMOVAL REQUIREMENT WITH A FUND CONTRIBUTION
WATERSHED PRESERVATION AREA					
WATERSHED ENHANCEMENT AREA					
WATERSHED RESTORATION AREA					
URBAN MANAGEMENT AREA					

Submitted by:		Date:	
Approved by:		Date:	

STREAM ASSESSMENT / WATERSHED MANAGEMENT PROGRAM

WORKSHEET 2.2 - URBAN MANAGEMENT AREA OPT IN

PROJECT NAME		<input type="checkbox"/> Subdivision <input type="checkbox"/> POD
PROJECT DESCRIPTION		Tax Parcel

WATERSHED (circle one)	JAMES RIVER	CHICKAHOMINY RIVER
SUB-WATERSHED		

URBAN MANAGEMENT AREA NAME	PARCEL SIZE (acres)

IS PARCEL PREVIOUSLY DEVELOPED?	YES / NO
IS PARCEL IMMEDIATELY ADJACENT TO A MAPPED URBAN MANAGEMENT AREA?	YES / NO

PROJECT QUALIFIES TO OPT INTO AN URBAN MANAGEMENT AREA BECAUSE: (circle A or B)	
A	Project is located adjacent to a mapped Urban Management Area, is undeveloped, and is less than 2 acres in size.
OR	
B	Project is located adjacent to a mapped Urban Management Area and was previously developed.

Submitted by:		Date:	
Approved by:		Date:	

STREAM ASSESSMENT / WATERSHED MANAGEMENT PROGRAM

WORKSHEET 2.3 – ENVIRONMENTAL FUND CONTRIBUTION

PROJECT NAME		<input type="checkbox"/> Subdivision <input type="checkbox"/> POD
PROJECT DESCRIPTION		Tax Parcel

POLLUTANT REMOVAL REQUIREMENT (from WORKSHEET 3.10)	(A)
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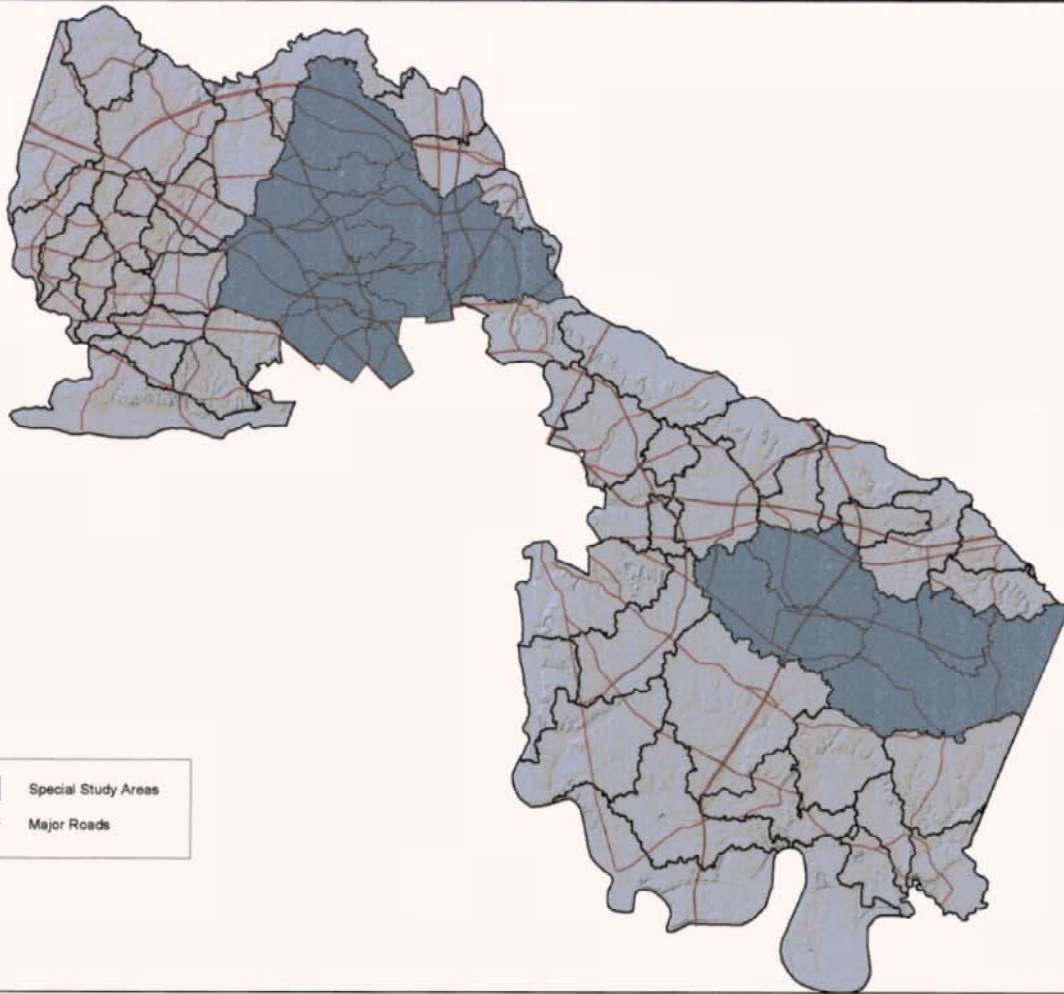
IS FORESTED STREAM PROTECTION AREA PROVIDED IN ACCORDANCE WITH MINIMUM DESIGN STANDARD 9.10?	YES / NO
LENGTH OF FORESTED STREAM PROTECTION AREA PROVIDED (feet)	(B)
ARE ENERGY DISSIPATORS PROVIDED IN ACCORDANCE WITH MINIMUM DESIGN STANDARD 9.01?	YES / NO
NUMBER OF ENERGY DISSIPATORS PROVIDED	(C)

CONTRIBUTION FOR POLLUTANT REMOVAL REQUIREMENT	=	\$8000.00	X	(A)	=	(D)
ADJUSTMENT FOR FORESTED STREAM PROTECTION AREA	=	\$2.30	X	(B)	=	(E)
ADJUSTMENT FOR ENERGY DISSIPATORS	=	\$800.00	X	(C)	=	(F)

(round (D) , (E), and (F) to nearest dollar)

TOTAL CONTRIBUTION TO ENVIRONMENTAL FUND	=	(D)	-	(E)	-	(F)	=	
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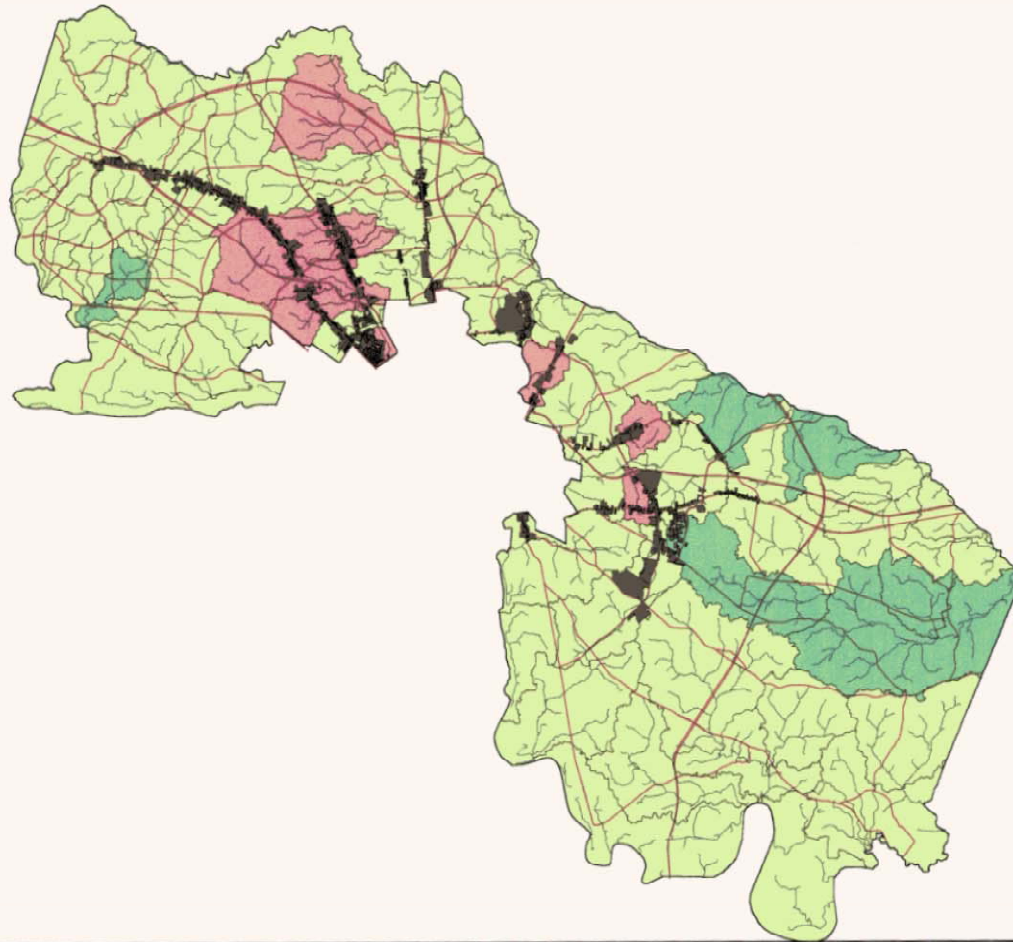
Submitted by:		Date:	
Approved by:		Date:	



Map 2.1
Special Study Areas

Henrico County, Virginia
Stream Assessment / Watershed Management Program





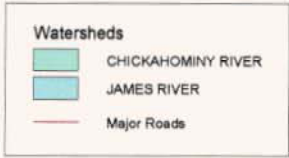
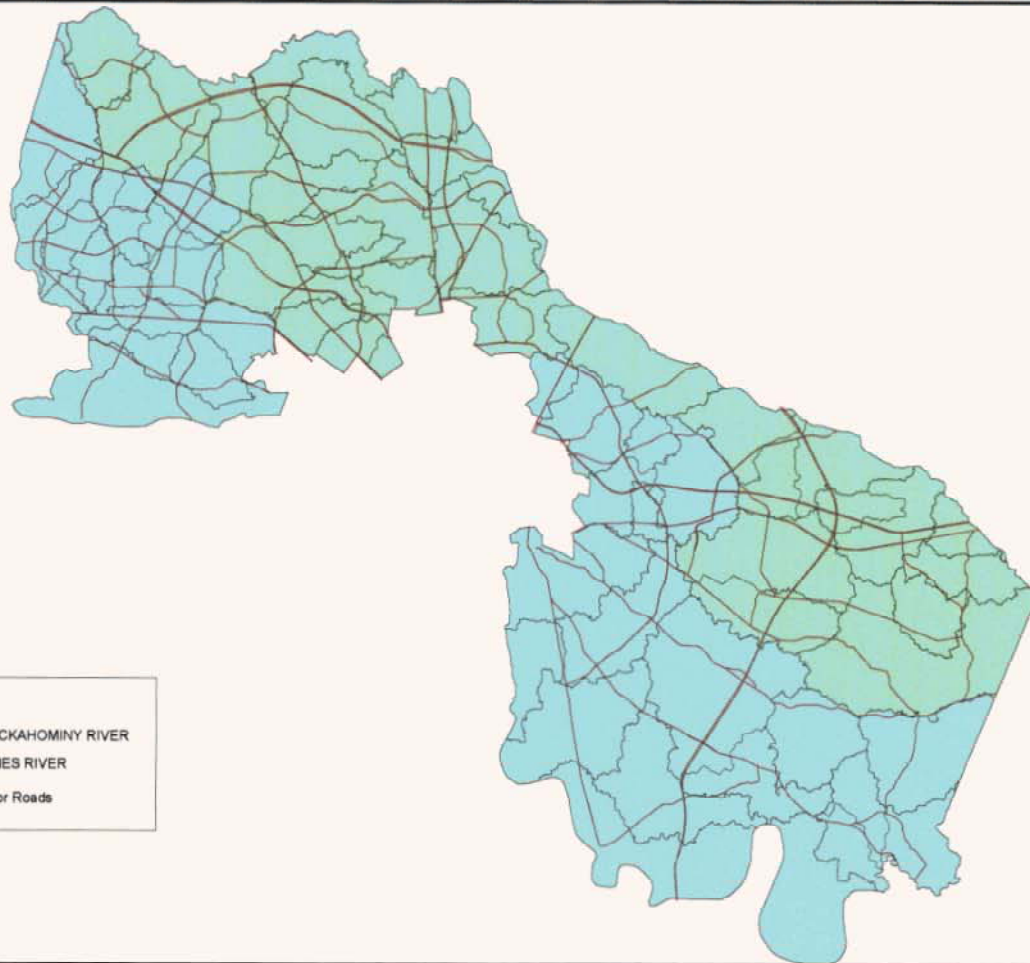
Watershed Management Areas

-  Watershed Preservation Area
-  Watershed Enhancement Area
-  Watershed Restoration Area
-  Urban Management Areas
-  Program Streams
-  Major Roads

Map 2.2
Watershed Management Areas

Henrico County, Virginia
Stream Assessment / Watershed Management Program





Map 2.3
James and Chickahominy River Watersheds

Henrico County, Virginia
Stream Assessment / Watershed Management Program

