4.0 Stormwater Management and Site Planning and Design Criteria

4.1 Overview

This Section presents a comprehensive set of post-construction stormwater management and site planning and design criteria that can be applied to new development and redevelopment activities occurring within the Coastal Nonpoint Source Management Area and Area of Special Interest. The criteria provide the foundation for the integrated, green infrastructure-based approach to natural resource protection, stormwater management and site design detailed in this Coastal Stormwater Supplement (CSS). When used in combination with one another, they promote an integrated approach to natural resource protection, stormwater management and site design that involves:

- Identifying the valuable natural resources found on a development site prior to the start of any land disturbing activities
- Protecting these valuable natural resources from the direct impacts of the land development process through the use of better site planning techniques
- Limiting land disturbance and the amount of impervious and disturbed pervious cover created on development sites through the use of better site design techniques
- *Reducing* post-construction stormwater runoff rates and volumes, through the use of better site planning and design techniques and low impact development practices, to:
    - Help maintain pre-development site hydrology
    - Help prevent downstream water quality degradation
    - Help prevent downstream flooding and erosion
- *Managing* post-construction stormwater runoff rates, through the use of stormwater management practices, to:
    - Help prevent downstream water quality degradation
    - Help prevent downstream flooding and erosion

The post-construction stormwater management and site planning and design criteria presented here are *recommended* for use throughout the Coastal Nonpoint Source Management Area and Area of Special Interest. They have been designed to help balance the protection of coastal Georgia's valuable terrestrial and aquatic resources with land development and economic growth. They have also been designed to help communities located within Georgia's 24-county coastal region comply with the requirements of various state and federal environmental policies, programs and regulations, including the National Pollution Discharge Elimination System (NPDES) Municipal Stormwater Program and Section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA). Communities may adapt the criteria "as-is" or may review and modify them to meet local natural resource protection and stormwater management goals and objectives.

4.2 Applicability and Exemptions

4.2.1 Applicability

It is *recommended* that the post-construction stormwater management and site planning and design criteria presented below be applied to any new development or redevelopment activity that meets one or more of the following criteria:

(1) New development that involves the creation of 5,000 square feet or more of impervious cover or that involves other land disturbing activities of one acre or more.

(2) Redevelopment that involves the creation, addition or replacement of 5,000 square feet or more of impervious cover or that involves other land disturbing activities of one acre or more.

(3) New development or redevelopment, regardless of size, that is part of a larger common plan of development, even though multiple, separate and distinct land disturbing activities may take place at different times and on different schedules.

(4) New development or redevelopment, regardless of size, that involves the creation or modification of a stormwater hotspot, as defined in the Glossary.

4.2.2 Exemptions

The following activities may be exempted from the post-construction stormwater management and site planning and design criteria presented below:

(1) New development or redevelopment that involves the creation, addition or replacement of less than 5,000 square feet of impervious cover and that involves less than one acre of other land disturbing activities.

(2) New development or redevelopment activities on individual residential lots that are not part of a larger common plan of development and that do not meet any of the applicability criteria listed above.

(3) Additions or modifications to existing single-family homes and duplex residential units that do not meet any of the applicability criteria listed above.

4.3 Site Planning and Design Criteria

Using the integrated approach to natural resource protection, stormwater management and site design detailed in this CSS involves considering natural resource protection and post-construction stormwater management *throughout* the site planning and design process. In order to help ensure that they are, it is *recommended* that the following site planning and design criteria (SP&D Criteria) be applied to any new development or redevelopment activity that meets one or more of the applicability criteria listed above (Section 4.2). These SP&D Criteria are briefly summarized in Table 4.1 below.

Table 4.1: Summary of the Site Planning and Design Criteria

Criteria	Description
SP&D Criteria #1: Natural Resources Inventory	Prior to the start of any land disturbing activities (including any clearing and grading activities), acceptable site reconnaissance and surveying techniques should be used to complete a thorough assessment of the natural resources, both terrestrial and aquatic, found on a development site.
SP&D Criteria #2: Use of Green Infrastructure Practices	Green infrastructure practices, in the form of better site planning and design techniques and low impact development practices, should be used to the *maximum extent practical* during the creation of a stormwater management concept plan for a proposed development project.

Table 4.1: Summary of the Site Planning and Design Criteria	
Criteria	**Description**
SP&D Criteria #3: Stormwater Management Concept Plan	A stormwater management concept plan should be prepared for all proposed development projects. The stormwater management concept plan should illustrate the layout of the proposed development project and should show, in general, how post-construction stormwater runoff will be managed on the development site.
SP&D Criteria #4: Stormwater Management Design Plan	A stormwater management design plan should be prepared for all proposed development projects. The stormwater management design plan should detail how post-construction stormwater runoff will be managed on the development site and should include maps, narrative descriptions and design calculations (e.g., hydrologic and hydraulic calculations) that show how the stormwater management and site planning and design criteria that apply to the development project have been met.
SP&D Criteria #5: Downstream Analysis	A downstream analysis should be performed to identify any additional overbank or extreme flooding that may result from an increase in stormwater runoff rates and volumes on a development site.
SP&D Criteria #6: Stormwater Management System Inspection and Maintenance Plan	Comprehensive inspection and maintenance plans should be developed for all post-construction stormwater management systems in order to help ensure that they will continue to function as designed over time.
SP&D Criteria #7: Erosion and Sediment Control Plan	An erosion and sediment control plan should be prepared for all proposed development projects. All erosion and sediment control plans should be prepared in accordance with requirements of the *Georgia Erosion and Sediment Control Act* (O.C.G.A. §12-7-1 through §12-7-22) and the state's National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges Associated with Construction Activities.
SP&D Criteria #8: Landscaping Plan	A landscaping plan should be prepared for all proposed development projects.
SP&D Criteria #9: Stormwater Pollution Prevention Plan	A stormwater pollution prevention plan should be developed for all proposed development projects involving the creation or modification of a stormwater hotspot.

4.3.1 SP&D Criteria #1: Natural Resources Inventory

Prior to the start of any land disturbing activities, including any clearing and grading activities, acceptable site reconnaissance and surveying techniques should be used to complete a thorough assessment of the natural resources, both terrestrial and aquatic, found on a development site. The natural resources inventory should be used to identify and map the natural resources listed in Table 4.2, as they exist prior to the start of any land disturbing activities.

The identification, and subsequent preservation and/or restoration of these natural resources, through the use of green infrastructure practices (SP&D Criteria #2), helps reduce the negative impacts of the land development process "by design."

Table 4.2: Resources to be Identified and Mapped During the Natural Resources Inventory	
Resource Group	**Resource Type**
General Resources	• Topography • Natural Drainage Divides • Natural Drainage Patterns • Natural Drainage Features (e.g., Swales, Basins, Depressional Areas) • Soils • Erodible Soils • Steep Slopes (i.e., Areas with Slopes Greater Than 15%) • Trees and Other Existing Vegetation
Freshwater Resources	• Rivers • Perennial and Intermittent Streams • Freshwater Wetlands
Estuarine Resources	• Tidal Rivers and Streams • Tidal Creeks • Coastal Marshlands • Tidal Flats • Scrub-Shrub Wetlands
Marine Resources	• Near Coastal Waters • Beaches
Groundwater Resources	• Groundwater Recharge Areas • Wellhead Protection Areas
Terrestrial Resources	• Dunes • Maritime Forests • Marsh Hammocks • Evergreen Hammocks • Canebrakes • Bottomland Hardwood Forests • Beech-Magnolia Forests • Pine Flatwoods • Longleaf Pine-Wiregrass Savannas • Longleaf Pine-Scrub Oak Woodlands
Other Resources	• Shellfish Harvesting Areas • Floodplains • Aquatic Buffers • Other High Priority Habitat Areas

The map that is created to illustrate the results of the natural resources inventory, known as a *site fingerprint*, should be used to prepare a stormwater management concept plan (SP&D Criteria #3) for the proposed development project.

4.3.2 SP&D Criteria #2: Use of Green Infrastructure Practices

Green infrastructure practices should be used to the *maximum extent practical* during the creation of a stormwater management concept plan (SP&D Criteria #3) for a proposed development project. Although the term *green infrastructure* can mean different things to different people (Box 4.1), in this CSS, the term *green infrastructure practices* has been succinctly defined as the combination of three complementary, but distinct, groups of natural resource protection and stormwater management practices and techniques:

Box 4.1: Green Infrastructure

Green infrastructure is a term that has been appearing more and more frequently in watershed and stormwater management discussions across coastal Georgia and the rest of the United States. The term, however, can mean different things to different people, depending on how it is used. Some use the term green infrastructure to refer to natural areas that provide ecological benefits in urban areas, while others use the term to refer to post-construction stormwater management practices that are designed to be "green" rather than "gray."

In its broadest and, perhaps, truest sense, the term green infrastructure refers to an interconnected network of undisturbed natural areas and open space that helps preserve the ecological function of our watersheds (Benedict and McMahon, 2006). This interconnected network of aquatic and terrestrial resources (Figure 4.1) supports a wide range of resident and migratory organisms, maintains air and water quality and contributes greatly to a community's natural beauty, economic well-being and quality of life.

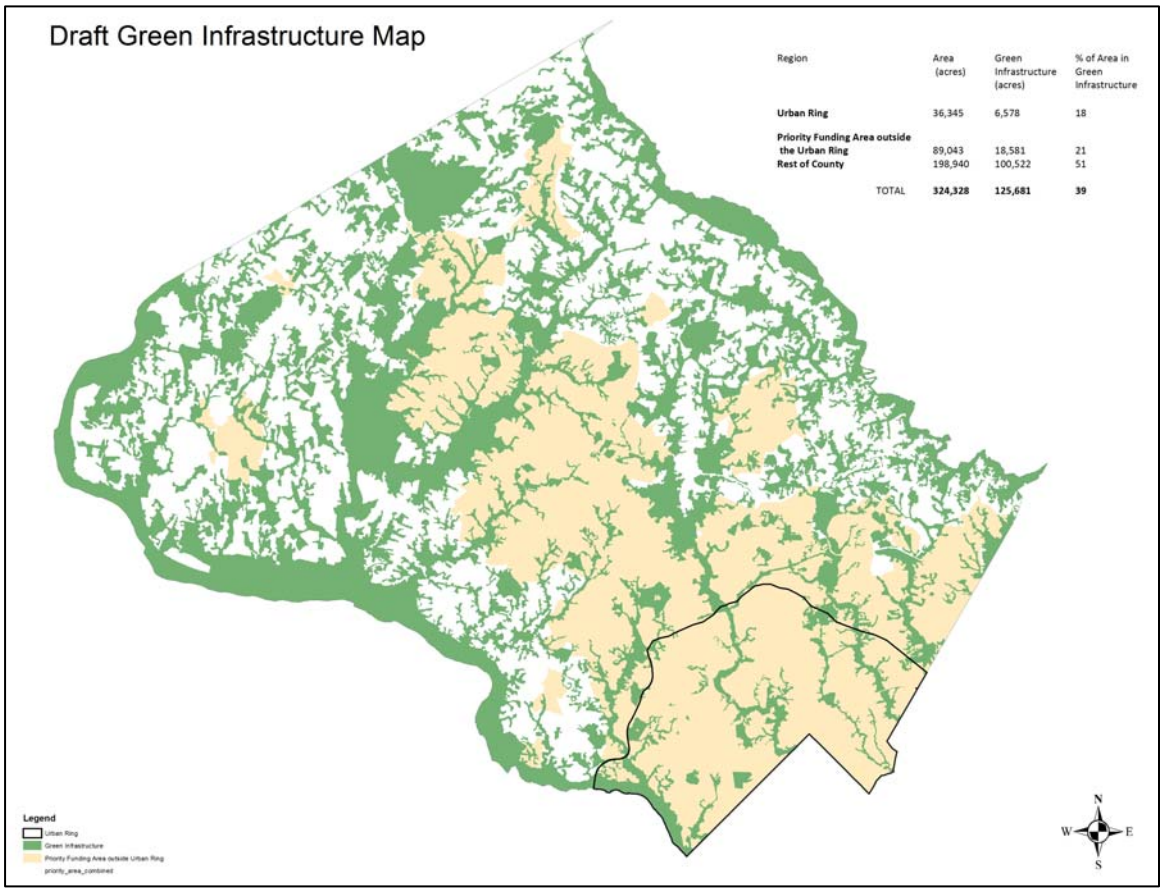

Figure 4.1: Green Infrastructure: An Interconnected Network of Undisturbed Natural Areas and Open Spaces
(Source: Montgomery Co., MD Planning Department)

Many readers may have used the term green infrastructure to describe "greenspace" or "greenway" planning, which typically involves networks of human-oriented conservation areas and managed open spaces. True green infrastructure planning, however, looks beyond the anthropogenic value of these "greenspaces" and takes a more comprehensive approach to

Box 4.1: Green Infrastructure

preserving the ecology and functionality of our watersheds. In this respect, true green infrastructure planning requires a comprehensive, watershed-based approach to balancing land development and economic growth with the protection and/or restoration of our valuable natural resources. In other words, true green infrastructure planning requires an effort to identify and protect our aquatic and terrestrial resources from the impacts of the land development process before the process even begins.

Effective green infrastructure planning requires the support of federal, state and local policies, programs and regulations that encourage the use of innovative watershed and stormwater management techniques. The innovative techniques that can be found in this green infrastructure "toolbox" include: (1) using comprehensive land use planning and zoning to direct growth away from sensitive aquatic and terrestrial resources; (2) using land acquisition and better site planning techniques to protect and conserve valuable natural resources; (3) using better site design techniques to minimize land disturbance; and (4) using small-scale stormwater management practices to reduce post-construction stormwater runoff rates, volumes and pollutant loads. The last three "tools" in this green infrastructure "toolbox" are the *green infrastructure practices* detailed in this CSS.

- Better Site Planning Techniques: Techniques that are used to protect valuable aquatic and terrestrial resources from the direct impacts of the land development process.

- Better Site Design Techniques: Techniques that are used to minimize land disturbance and the creation of new impervious and disturbed pervious cover.

- Low Impact Development Practices: Small-scale stormwater management practices that are used to disconnect impervious and disturbed pervious surfaces from the storm drain system and reduce post-construction stormwater runoff rates, volumes and pollutant loads.

Together, these *green infrastructure practices* can be used to not only help protect coastal Georgia's valuable terrestrial and aquatic resources from the direct impacts of the land development process, but also help maintain pre-development site hydrology and reduce post-construction stormwater runoff rates, volumes and pollutant loads. They also provide a number of other environmental and economic benefits, including (US EPA, 2008):

- Reduced Sanitary and Combined Sewer Overflow Events: By reducing stormwater runoff rates and volumes, green infrastructure practices help reduce the magnitude and frequency of combined and sanitary sewer overflow events.

- Urban Heat Island Mitigation: The trees, shrubs and other vegetation associated with green infrastructure practices create shade, reflect solar radiation and emit water vapor, all of which create cooler temperatures in urban environments and help mitigate the impacts of urban heat islands.

- Reduced Energy Demand: The trees, shrubs and other vegetation associated with green infrastructure practices help lower ambient air temperatures in urban areas and, when incorporated on and around buildings, help insulate buildings from temperature swings, decreasing the amount of energy used for heating and cooling.

- Improved Air Quality: The trees, shrubs and other vegetation associated with green infrastructure practices improve air quality by removing many airborne pollutants from the atmosphere through the processes of leaf uptake and contact removal.

- Increased Carbon Sequestration: The trees, shrubs and other vegetation associated with green infrastructure practices are able to capture and remove carbon from the atmosphere through the processes of photosynthesis and respiration.

- Improved Aesthetics: The trees, shrubs and other vegetation associated with green infrastructure practices improve aesthetics, provide recreational opportunities and wildlife habitat and increase property values (MacMullan and Reich, 2007, US EPA, 2007, Winer-Skonovd et al., 2006).

- Improved Human Health: An increasing number of studies suggest that the trees, shrubs and other vegetation associated with green infrastructure practices can have a positive impact on human health. Recent research has linked the presence of trees, plants and other vegetation to reduced levels of crime and violence, a stronger sense of community, improved academic performance and even reductions in the symptoms associated with attention deficit and hyperactivity disorders (Faber-Taylor and Kuo, 2006, Kuo, 2003, Sullivan et al., 2003, Kuo and Sullivan, 2001, Taylor et al., 1998).

These other environmental and economic benefits are particularly valuable in urban and suburban areas where green space and undisturbed natural areas may be few and far between.

In order to satisfy this criteria, it is *recommended* that:

(1) Better site planning techniques be used to protect the following primary conservation areas (Table 4.3), which provide habitat for high priority plant and animal species (Appendix A) and are considered to be high priority habitat areas (WRD, 2005), from the direct impacts of the land development process.

Table 4.3: Primary Conservation Areas

Resource Group	Resource Type
Aquatic Resources	• Rivers • Perennial and Intermittent Streams • Freshwater Wetlands • Tidal Rivers and Streams • Tidal Creeks • Coastal Marshlands • Tidal Flats • Scrub-Shrub Wetlands • Near Coastal Waters • Beaches
Terrestrial Resources	• Dunes • Maritime Forests • Marsh Hammocks • Evergreen Hammocks • Canebrakes • Bottomland Hardwood Forests • Beech-Magnolia Forests • Pine Flatwoods • Longleaf Pine-Wiregrass Savannas • Longleaf Pine-Scrub Oak Woodlands

Table 4.3: Primary Conservation Areas	
Resource Group	**Resource Type**
Other Resources	• Shellfish Harvesting Areas • Aquatic Buffers • Other High Priority Habitat Areas

(2) Consideration be given to using better site planning techniques to protect the following secondary conservation areas (Table 4.4), from the direct impacts of the land development process.

Table 4.4: Secondary Conservation Areas	
Resource Group	**Resource Type**
General Resources	• Natural Drainage Features (e.g., Swales, Basins, Depressional Areas) • Erodible Soils • Steep Slopes (i.e., Areas with Slopes Greater Than 15%) • Trees and Other Existing Vegetation
Aquatic Resources	• Groundwater Recharge Areas • Wellhead Protection Areas
Other Resources	• Floodplains

(3) Consideration be given to using better site design techniques to minimize land disturbance and limit the creation of new impervious and disturbed pervious cover.

(4) Low-impact development practices be used, to the *maximum extent practical*, to reduce post-construction stormwater runoff rates, volumes and pollutant loads, and help satisfy the post-construction stormwater management criteria presented in this CSS (Section 4.4).

4.3.3 SP&D Criteria #3: Stormwater Management Concept Plan

A stormwater management concept plan should be prepared for all proposed development projects. The stormwater management concept plan should be created using the results of the natural resources inventory (SP&D Criteria #1). It should illustrate the layout of the proposed development project and should show, in general, how post-construction stormwater runoff will be managed on the development site.

It is *recommended* that the stormwater management concept plan include the following information:

- Project narrative, which includes:
  - Common address of site
  - Legal description of site
  - Vicinity map
- *Site fingerprint*, which illustrates the results of the natural resources inventory (SP&D Criteria #1)
- Existing conditions map, which includes all of the information shown on the *site fingerprint*, plus:
  - Existing roads, buildings, parking areas and other impervious surfaces
  - Existing utilities (e.g., water, sewer, gas, electric) and utility easements
  - Existing primary and secondary conservation areas
  - Existing low impact development and stormwater management practices
  - Existing storm drain infrastructure (e.g., inlets, manholes, storm drains)

    - Existing channel modifications (e.g., bridge or culvert installations)
- Proposed conditions map, which includes:
    - Proposed topography (minimum two-foot contours recommended)
    - Proposed drainage divides and patterns
    - Proposed roads, buildings, parking areas and other impervious surfaces
    - Proposed utilities (e.g., water, sewer, gas, electric) and utility easements
    - Proposed limits of clearing and grading
    - Proposed primary and secondary conservation areas
    - Proposed low impact development and stormwater management practices
    - Proposed storm drain infrastructure (e.g., inlets, manholes, storm drains)
    - Proposed channel modifications (e.g., bridge or culvert installations)
- Post-construction stormwater management system narrative, which includes:
    - Information about how post-construction stormwater runoff will be managed on the development site, including a list of the low impact development and stormwater management practices that will be used
    - Calculations showing how initial estimates of the post-construction stormwater management criteria that apply to the development project were obtained, including information about the existing and proposed conditions of each of the drainage areas found on the development site (e.g., size, soil types, land cover characteristics)
- List of expected waiver requests

The stormwater management concept plan should be submitted to the local development review authority prior to the preparation and submittal of a stormwater management design plan (SP&D Criteria #4).

4.3.4 SP&D Criteria #4: Stormwater Management Design Plan

A stormwater management design plan should be prepared for all proposed development projects. The stormwater management design plan should detail how post-construction stormwater runoff will be managed on the development site and should include maps, narrative descriptions and design calculations (e.g., hydrologic and hydraulic calculations) that show how the stormwater management and site planning and design criteria that apply to the development project have been met.

It is *recommended* that the stormwater management design plan include all of the information included in the stormwater management concept plan (SP&D Criteria #3), plus:

- Existing conditions hydrologic analysis, which includes:
    - Existing conditions map
    - Information about the existing conditions of each of the drainage areas found on the development site (e.g., size, soil types, land cover characteristics)
    - Information about the existing conditions of any off-site drainage areas that contribute stormwater runoff to the development site (e.g., size, soil types, land cover characteristics)
    - Information about the stormwater runoff rates and volumes generated, under existing conditions, in each of the drainage areas found on the development site
    - Information about the stormwater runoff rates and volumes generated, under existing conditions, in each of the off-site drainage areas that contribute stormwater runoff to the development site
    - Documentation (e.g., model diagram) and calculations showing how the existing conditions hydrologic analysis was completed

- Proposed conditions hydrologic analysis, which includes:
  - Proposed conditions map
  - Information about the proposed conditions of each of the drainage areas found on the development site (e.g., size, soil types, land cover characteristics)
  - Information about the proposed conditions of any off-site drainage areas that contribute stormwater runoff to the development site (e.g., size, soil types, land cover characteristics)
  - Information about the stormwater runoff rates and volumes generated, under proposed conditions, in each of the drainage areas found on the development site
  - Information about the stormwater runoff rates and volumes generated, under proposed conditions, in each of the off-site drainage areas that contribute stormwater runoff to the development site
  - Documentation (e.g., model diagram) and calculations showing how the proposed conditions hydrologic analysis was completed
- Post-construction stormwater management system plan, which includes:
  - Proposed topography
  - Proposed drainage divides and patterns
  - Existing and proposed roads, buildings, parking areas and other impervious surfaces
  - Existing and proposed primary and secondary conservation areas
  - Plan view of existing and proposed low impact development and stormwater management practices
  - Cross-section and profile views of existing and proposed low impact development and stormwater management practices, including information about water surface elevations, storage volumes and inlet and outlet structures (e.g., orifice sizes)
  - Plan view of existing and proposed storm drain infrastructure (e.g., inlets, manholes, storm drains)
  - Cross-section and profile views of existing and proposed storm drain infrastructure (e.g., inlets, manholes, storm drains), including information about invert and water surface elevations
  - Existing and proposed channel modifications (e.g., bridge or culvert installations)
- Post-construction stormwater management system narrative, which includes:
  - Information about how post-construction stormwater runoff will be managed on the development site, including a list of the low impact development and stormwater management practices that will be used
  - Documentation and calculations that demonstrate how the selected low impact development and stormwater management practices satisfy the post-construction stormwater management criteria that apply to the development site, including information about the existing and proposed conditions of each of the drainage areas found on the development site (e.g., size, soil types, land cover characteristics)
  - Hydrologic and hydraulic analysis of the post-construction stormwater management system for all applicable design storms, which should include stage-storage or outlet rating curves and inflow and outflow hydrographs.

The stormwater management design plan should be submitted to the local development review authority for review and approval.

A copy of the stormwater management concept plan (SP&D Criteria #3) should be included with the submittal of the stormwater management design plan. The stormwater management

design plan should be consistent with the stormwater management concept plan. If any significant changes were made to the development plan, the local development review authority may ask for a written statement providing rationale for any of the changes that were made.

4.3.5 SP&D Criteria #5: Downstream Analysis

Although the overbank flood protection criteria (SWM Criteria #4) and extreme flood protection criteria (SWM Criteria #5) have been designed to help prevent an increase the frequency, duration and severity of damaging flooding events, occasionally, due to the timing and duration of discharges from development sites, they do not always accomplish this goal. Consequently, it is *recommended* that a downstream analysis be performed to identify any additional overbank or extreme flooding that may result from an increase in stormwater runoff rates and volumes on a development site. The analysis should be performed at the discharge point(s) of the development site and at each junction in the downstream conveyance system where the portion of the development site draining to that point is greater than or equal to ten percent of the total area contributing drainage to that same point. If the results of the downstream analysis show that there will be increased overbank or extreme flooding due to the proposed development project, additional control of post-construction stormwater runoff may need to be provided on the development site. Additional guidance on performing a downstream analysis is provided in Section 2.9.1 of Volume 2 of the *Georgia Stormwater Management Manual* (ARC, 2001).

The results of the downstream analysis should be included with the submittal of the stormwater management design plan (SP&D Criteria #4).

4.3.6 SP&D Criteria #6: Stormwater Management System Inspection and Maintenance Plan

In order to help ensure that they will continue to function as designed over time, it is *recommended* that comprehensive inspection and maintenance plans be developed for all post-construction stormwater management systems. All stormwater management system inspection and maintenance plans should outline the routine inspection and maintenance tasks that will be completed on all components of the post-construction stormwater management system, including: (1) green infrastructure practices; (2) stormwater management practices; (3) stormwater conveyance features; and (4) storm drain infrastructure. Consequently, it is *recommended* that all stormwater management system inspection and maintenance plans include the following information:

- Timeline indicating, in general, when routine inspection and maintenance activities will occur
- Name of the person or party responsible for completing routine inspection and maintenance activities
- Signed statement confirming that responsibility for the inspection and maintenance of the post-construction stormwater management system, unless assumed by the local development review authority, will remain with the property owner
- Signed statement confirming that, if portions of the property are sold or otherwise transferred, arrangements will be made to pass the inspection and maintenance responsibilities to the successive owners
- Signed statement providing the local development review authority with permission to enter the property, at reasonable times and in a reasonable manner, and inspect the post-construction stormwater management system

The stormwater management system inspection maintenance and plan should be included with the submittal of the stormwater management design plan (SP&D Criteria #4).

4.3.7 SP&D Criteria #7: Erosion and Sediment Control Plan

An erosion and sediment control plan should be prepared for all proposed development projects. All erosion and sediment control plans should be prepared in accordance with requirements of the *Georgia Erosion and Sediment Control Act* (O.C.G.A. §12-7-1 through §12-7-22) and the State's National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges Associated with Construction Activities, and should include erosion and sediment control practices, such as those detailed in the *Manual for Erosion and Sediment Control in Georgia* (GSWCC, 2000), that will help minimize the negative impacts of construction stormwater runoff on coastal Georgia's valuable aquatic and terrestrial resources. Additional guidance on preparing an erosion and sediment control plan and on the use of erosion and sediment control practices is provided in the *Manual for Erosion and Sediment Control in Georgia* (GSWCC, 2000) and *Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites* (US EPA, 2007).

The erosion and sediment control plan should be included with the submittal of the stormwater management design plan (SP&D Criteria #4).

4.3.8 SP&D Criteria #8: Landscaping Plan

A landscaping plan should be prepared for all proposed development projects. All landscaping plans should illustrate the layout of the proposed development project and should identify any landscaping features that will be installed on the development site. Consequently, it is *recommended* that all landscaping plans include the following information:

- Existing trees and other vegetation
- Existing and proposed roads, buildings, parking areas and other impervious surfaces
- Existing and proposed primary and secondary conservation areas (e.g., aquatic buffers, trees and other existing vegetation)
- Proposed limits of clearing and grading
- Existing and proposed low impact development and stormwater management practices
- Other landscaping features and areas
- Proposed plantings
- Information about the landscaping methods and materials that will be used during construction

The landscaping plan should be included with the submittal of the stormwater management design plan (SP&D Criteria #4).

4.3.9 SP&D Criteria #9: Stormwater Pollution Prevention Plan

A stormwater pollution prevention plan should be developed for all proposed development projects involving the creation or modification of a stormwater hotspot. To help minimize the acute negative impacts that these development projects can have on the aquatic and terrestrial resources of coastal Georgia, it is *recommended* that appropriate pollution prevention practices be used to the *maximum extent practical* during the creation of a stormwater pollution prevention plan. Additional guidance on developing a stormwater pollution prevention plan and on the use of pollution prevention practices is provided in the *Municipal Stormwater*

Best Management Practice Handbook (CASQA, 2003) and the *Pollution Source Control Practices Manual* (Schueler et al., 2005).

The stormwater pollution prevention plan should be included with the submittal of the stormwater management design plan (SP&D Criteria #4).

4.4 Post-Construction Stormwater Management Criteria

It is *recommended* that the following post-construction stormwater management criteria (SWM Criteria) be applied to any new development or redevelopment activity that meets one or more of the applicability criteria listed above (Section 4.2). These SWM Criteria help translate the integrated approach to natural resource protection, stormwater management and site design detailed in this CSS into a set of quantitative criteria that can be used to design a post-construction stormwater management system on a development site. These SWM Criteria are briefly summarized in Table 4.5 below.

Table 4.5: Summary of the Post-Construction Stormwater Management Criteria

Criteria	Description
SWM Criteria #1: Stormwater Runoff Reduction	Reduce the stormwater runoff volume generated by the 85th percentile storm event (and the "first flush" of the stormwater runoff volume generated by all larger storm events) on a development site through the use of appropriate green infrastructure practices. In coastal Georgia, this equates to reducing the stormwater runoff volume generated by the 1.2 inch rainfall event (and the stormwater runoff generated by the first 1.2 inches of all larger rainfall events).
SWM Criteria #2: Stormwater Quality Protection	Adequately treat post-construction stormwater runoff before it is discharged from a development site. In coastal Georgia, this criteria can be satisfied simply by satisfying the stormwater runoff reduction criteria (SWM Criteria #1). However, if any of the stormwater runoff generated by the 1.2 inch storm event (and the first 1.2 inches of all larger rainfall events), cannot be r*educed* on a development site, due to site characteristics or constraints, it should be *intercepted and treated* in one or more stormwater management practices that: (1) provide for at least an 80 percent reduction in TSS loads; and (2) reduce nitrogen and bacteria loads to the *maximum extent practical*.
SWM Criteria #3: Aquatic Resource Protection	Protect coastal Georgia's valuable aquatic resources from several other negative impacts of the land development process (e.g., complete loss or destruction, stream channel enlargement, increased salinity fluctuations) by: (1) protecting them from the direct impacts of the land development process through the use of better site planning techniques; (2) establishing a minimum 25-foot wide aquatic buffer around them (although a 75-foot wide aquatic buffer is preferred); (3) providing 24 hours of extended detention for the stormwater runoff volume generated by the 1-year, 24-hour storm event before it is discharged from a development site; and (4) providing velocity control and energy dissipation measures at all new and existing stormwater outfalls.
SWM Criteria #4: Overbank Flood Protection	Prevent an increase in the duration, frequency and magnitude of damaging overbank flooding by controlling (attenuating) the peak discharge generated by the 25-year, 24-hour storm event under post-development conditions.

Table 4.5: Summary of the Post-Construction Stormwater Management Criteria	
Criteria	**Description**
SWM Criteria #5: Extreme Flood Protection	Prevent an increase in the duration, frequency and magnitude of dangerous extreme flooding by controlling (attenuating) the peak discharge generated by the 100-year, 24-hour storm event under post-development conditions.

4.4.1 SWM Criteria #1: Stormwater Runoff Reduction

An analysis of historical rainfall data shows that small, frequent storm events account for a majority of the storm events that occur in the Coastal Nonpoint Source Management Area and Area of Special Interest (Appendix B). Consequently, these small, but frequent storm events also account for a majority of the stormwater runoff volumes (and pollutant loads) that are generated on development sites. By reducing the stormwater runoff generated by these small, but frequent, storm events, it is possible to help maintain pre-development site hydrology and help protect coastal Georgia's aquatic resources from several indirect impacts of the land development process (i.e., decreased groundwater recharge, decreased baseflow, degraded water quality). Therefore, it is *recommended* that the stormwater runoff volume generated by the 85th percentile storm event (and the "first flush" of the stormwater runoff generated by all larger storm events) be *reduced* on a development site through the use of appropriate green infrastructure practices.

In coastal Georgia, reducing the stormwater runoff volume generated by the 85th percentile storm event equates to reducing the stormwater runoff volume generated by the 1.2 inch rainfall event (and the stormwater runoff generated by the first 1.2 inches of all larger rainfall events). The correlation between the 85th percentile storm event and the 1.2 inch storm event was derived from an analysis of historical rainfall data from the communities of Brooklet, Brunswick, Douglas, Folkston, Jesup and Savannah (Appendix B) and is considered to be an average value for the entire Coastal Nonpoint Source Management Area and Area of Special Interest.

Based on some simple hydrologic modeling, and the results of several other studies investigating the hydrology of the Atlantic coastal plain, the volume of stormwater runoff generated by the 1.2 inch storm event was deemed to be a reasonable initial target for stormwater runoff reduction in coastal Georgia. Hydrologic modeling conducted using the Simple Method (Schueler, 1987) shows that only about five percent of the annual rainfall that falls on an undeveloped site can be expected to be converted to stormwater runoff (Box 4.2). The remaining 95 percent can be expected to be "lost", primarily through the hydrologic processes of infiltration and evapotranspiration.

Although these results are based on some simple hydrologic modeling, other researchers (DeBusk 2008, Holland and Sanger, 2008,) have drawn similar conclusions about the hydrology of undeveloped sites located within the Atlantic coastal plain. Their studies have concluded that, depending on site characteristics (e.g., land cover, soils, hydrologic condition), somewhere between two and twenty percent of the annual rainfall that falls on an undeveloped site can be expected to be converted to stormwater runoff. The remainder of the annual rainfall can be expected to be "lost" to hydrologic processes of infiltration and evapotranspiration.

Box 4.2: Hydrologic Modeling of Pre-Development Conditions Using the Simple Method

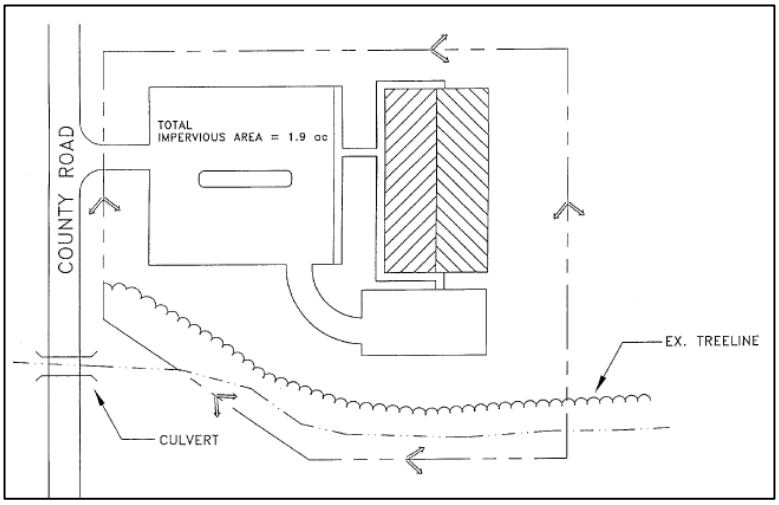

Figure 4.2: Bay Street Community Center, Savannah, GA
(Source: Atlanta Regional Commission, 2001)

Site Data
Site Area, A = 3.0 acres
Pre-Development Impervious Area = 0.0 acres
Post-Development Impervious Area = 1.9 acres
Soils = Hydrologic Soil Group "B" Soils

Hydrologic Data
Annual Rainfall, P = 49.58 inches (NOAA, 2008)
Pre-Development Site Imperviousness, I_{pre} = 0.0 ÷ 3.0 = 0.0%
Post-Development Site Imperviousness, I_{post} = 1.9 ÷ 3.0 = 63.3%

(1) Compute Potential Annual Stormwater Runoff Volume
Potential Runoff Volume = (P)(A) ÷ 12
Potential Runoff Volume = (49.58 in)(3.0 ac) ÷ 12 in/ft
Potential Runoff Volume = 12.40 ac-ft

(2) Compute Pre-Development Volumetric Runoff Coefficient, $R_{v\text{-}pre}$
$R_{v\text{-}pre}$ = 0.05 + 0.009(I_{pre})
$R_{v\text{-}pre}$ = 0.05 + 0.009(0.0) = 0.05

(3) Compute Actual Annual Stormwater Runoff Volume
Actual Runoff Volume = (P)($R_{v\text{-}pre}$)(A) ÷ 12
Actual Runoff Volume = (49.58 in)(0.05)(3.0 ac) ÷ 12 in/ft
Actual Runoff Volume = 0.62 ac-ft

(4) Confirm Ratio of Actual Runoff Volume to Potential Runoff Volume
(0.62 ac-ft) ÷ (12.40 ac-ft) = 0.05 OR 5%

Since the 1.2 inch storm event (and the first 1.2 inches of all larger storm events) is responsible for generating nearly 83 percent of the total rainfall that occurs in coastal Georgia (Appendix B),

reducing the stormwater runoff generated by the 85th percentile storm event (and the "first flush" of the stormwater runoff generated by all larger storm events) can be expected to reduce annual post-construction stormwater runoff volumes (and pollutant loads) by nearly 83 percent as well. In the end, only about 17 percent of the total rainfall that falls on a development site will be converted to stormwater runoff; the remaining 83 percent will be "lost" through green infrastructure practices that provide for the interception, evapotranspiration, infiltration or capture and reuse of stormwater runoff.

Although targeting a larger rainfall event (e.g., 1.5 inch, 2 inch) for stormwater runoff reduction would provide further reductions in post-construction stormwater runoff volumes (and pollutant loads), it would also increase the size, cost and complexity of the green infrastructure practices that would need to be used on development sites. On the other hand, targeting a smaller rainfall event (e.g., 0.5 inch) would not provide enough stormwater runoff reduction to meaningfully preserve pre-development hydrologic conditions or adequately protect stormwater quality throughout Georgia's 24-county coastal region.

The amount of stormwater runoff reduction needed to satisfy this criteria, which is known as the runoff reduction volume (RR_v) (Section 5.2), may be reduced on development sites that are considered to be stormwater hotspots or that have site characteristics or constraints (e.g., high groundwater, impermeable soils, contaminated soils, confined groundwater aquifer recharge areas) that prevent the use of green infrastructure practices that provide for the interception, evapotranspiration, infiltration or capture and reuse of stormwater runoff. When seeking reduction in the amount of stormwater runoff reduction that needs to be provided in order to satisfy this criteria, it is *recommended* that:

(1) Appropriate green infrastructure practices be used to reduce, *at a minimum*, the stormwater runoff volume generated by the 0.6 inch rainfall event (and the first 0.6 inches of all larger rainfall events) on the development site.

(2) Adequate documentation be provided to the local development review authority to show that no additional runoff reducing green infrastructure practices can be used on the development site.

Any of the stormwater runoff generated by the 1.2 inch storm event (and the first 1.2 inches of all larger rainfall events) that is not *reduced* on the development site should be *intercepted and treated* in one or more stormwater management practices that provide at least an 80 percent reduction in total suspended solids loads and that reduce nitrogen and bacteria loads to the *maximum extent practical* (SWM Criteria #2).

4.4.2 SWM Criteria #2: Stormwater Quality Protection

In order to protect coastal Georgia's aquatic resources from water quality degradation, it is *recommended* that stormwater runoff be adequately treated before it is discharged from a development site. In accordance with the Guidance Specifying Management Measures for Sources of Nonpoint Source Pollution in Coastal Waters (US EPA, 1993), this means reducing the total suspended solids (TSS) loads contained in post-construction stormwater runoff by at least 80 percent, as measured on an average annual basis.

Although providing an 80 percent reduction in TSS loads can be assumed to provide adequate removal of a number of common stormwater pollutants (e.g., phosphorus, metals) (US EPA, 1993), it can not be assumed to provide sufficient removal of either nitrogen or bacteria, which, along with TSS, should be considered to be the primary pollutants of concern in coastal Georgia

(Novotney, 2007). In order to help minimize the negative impacts that these two other pollutants of concern can have on coastal Georgia's valuable estuarine and marine resources (e.g., shellfish bed contamination and closure, beach contamination, increased primary productivity, reduced dissolved oxygen levels), it is *recommended* that the nitrogen and bacteria loads contained in post-construction stormwater runoff be reduced to the *maximum extent practical* on development sites.

Since reducing the stormwater runoff volume generated by the 85th percentile storm event (and the "first flush" of the stormwater runoff generated by all larger storm events) can be expected to reduce annual post-construction stormwater runoff volumes (and pollutant loads) by more than 80 percent on development sites, this stormwater quality protection criteria can be satisfied simply by satisfying the stormwater runoff reduction criteria (SWM Criteria #1). However, if any of the stormwater runoff volume generated by the 1.2 inch storm event, cannot be r*educed* on a development site, due to site characteristics or constraints, it should be *intercepted and treated* in one or more stormwater management practices that: (1) provide for at least an 80 percent reduction in TSS loads; and (2) reduce nitrogen and bacteria loads to the *maximum extent practical*. Adequate documentation should be provided to the local development review authority to show that total TSS, nitrogen and bacteria removal were considered during the selection of the stormwater management practices that will be used to *intercept and treat* stormwater runoff on the development site.

4.4.3 SWM Criteria #3: Aquatic Resource Protection

In order to protect coastal Georgia's valuable aquatic resources from several other negative impacts of the land development process (i.e., complete loss or destruction, stream channel enlargement, increased salinity fluctuations), it is *recommended* that:

(1) The following aquatic resources be identified as primary conservation areas and protected from the direct impacts of the land development process through the use of better site planning techniques:

- Rivers
- Perennial and Intermittent Streams
- Freshwater Wetlands
- Tidal Rivers and Streams
- Tidal Creeks
- Coastal Marshlands
- Tidal Flats
- Scrub-Shrub Wetlands
- Near Coastal Waters
- Beaches

(2) Although a 75-foot wide aquatic buffer is preferred (Rowe et al., 2007, Franzen et al., 2006), a minimum 25-foot wide aquatic buffer, as measured horizontally from the point where vegetation has been wrested by normal stream flow or wave action, be established (Box 4.3) around all of the aquatic resources listed above. Aquatic buffers not only provide streams, wetlands and other aquatic resources with protection against the direct impacts of the land development process, but also help protect adjacent properties from flooding during storm events. All aquatic buffers should be identified as primary conservation areas and protected from the direct impacts of the land development process through the use of better site planning techniques.

(3) 24 hours of extended detention be provided for the stormwater runoff volume generated by the 1-year, 24-hour storm event before it is discharged from a development site. Providing the storage needed to provide 24 hours of extended detention for the stormwater runoff volume generated by the 1-year, 24-hour storm event, which is known as the aquatic resource protection volume (ARP_v) (Section 5.3), will not only help control streambank erosion in coastal Georgia's freshwater rivers and streams (by reducing the frequency and duration of channel forming bankfull and near bankfull events), but will also help control the harmful salinity fluctuations that occur in the region's tidal creeks, coastal marshlands and other vital estuarine resources.

(4) Velocity control and energy dissipation measures be installed at all new and existing stormwater outfalls. Implementing these erosion control practices will help prevent localized erosion in coastal Georgia's freshwater, estuarine and marine resources. Additional information on the use of velocity control and energy dissipation measures is provided in Section 4.5 of Volume 2 of the *Georgia Stormwater Management Manual* (ARC, 2001).

Box 4.3: Establishing an Aquatic Buffer

An aquatic buffer is an undisturbed natural area located immediately adjacent to a river, stream, tidal creek, coastal marshland or other aquatic resource where land disturbing activities are significantly restricted or prohibited. While they function primarily to preserve the integrity of streams, wetlands and other aquatic resources, and protect them from the direct impacts of the land development process, they also provide a number of other important ecological services, including pollutant removal, erosion control and flood attenuation.

Although a 75-foot wide aquatic buffer is preferred (Rowe et al., 2007, Franzen et al., 2006), a minimum 25-foot wide aquatic buffer, as measured horizontally from the point where vegetation has been wrested by normal stream flow or wave action, should be established around all of coastal Georgia's aquatic resources. Aquatic buffers can be of fixed or variable width, but should be continuous and should not be interrupted by impervious surfaces or bypassed with stormwater outfalls that discharge post-construction stormwater runoff directly into the stream, wetland or other aquatic resource being protected by the buffer. Where aquatic buffers have been significantly altered by clearing, grading and other land disturbing activities, or where they consist exclusively of managed turf, reforestation or revegetation is recommended (Section 7.8.2).

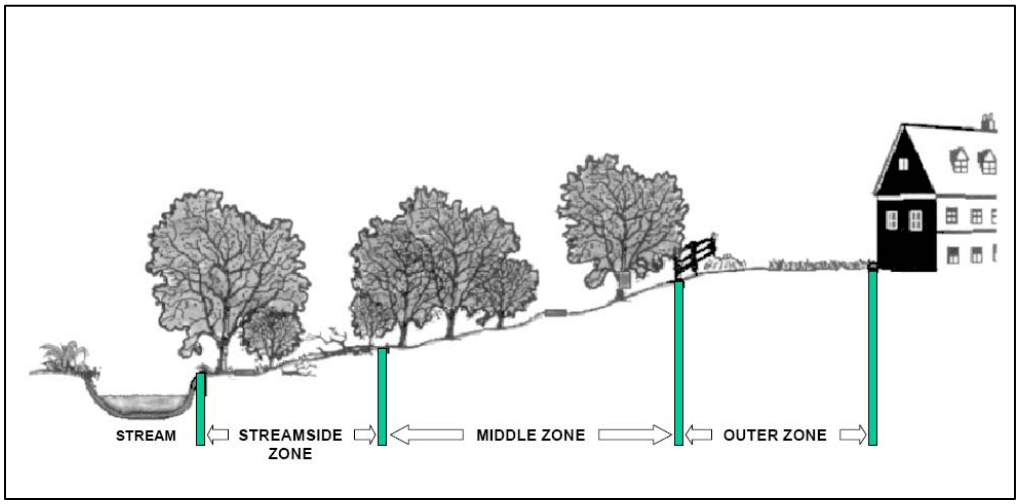

Figure 4.3: Multi-Zone Aquatic Buffer System
(Source: Center for Watershed Protection, 1998)

Box 4.3: Establishing an Aquatic Buffer

Even if site characteristics or constraints only permit the use of a 25-foot wide *undisturbed* aquatic buffer on a development site, additional "disturbed buffer zones" (Figure 4.3) can be added to extend the total width of the buffer to 75 feet. Although they do not provide the same environmental benefits as *undisturbed* aquatic buffers, these "disturbed buffer zones" provide site planning and design teams with additional flexibility during the site planning and design process. Each of these "disturbed buffer zones" are described in more detail in Table 4.6.

Table 4.6: Allowable Uses Associated with the Multi-Zone Aquatic Buffer System (Source: CWP, 1998)

Characteristic	Undisturbed Streamside Zone	Middle Zone	Outer Zone
Width	Minimum 25 feet	Variable, depending on stream order, slope and extent of 100-year floodplain (Minimum 25 feet)	25 feet or less
Vegetation	Undisturbed native vegetation; reforest or revegetate if necessary	Managed native vegetation, some clearing allowed	Native vegetation encouraged; turf grass acceptable
Allowable Uses	**Significantly Restricted** (e.g., flood control, utility easements)	**Restricted** (e.g., some recreational use, bike paths)	**Unrestricted** (e.g., residential use, gardening)

4.4.4 SWM Criteria #4: Overbank Flood Protection

In order to prevent an increase in the duration, frequency and magnitude of downstream overbank flooding, it is *recommended* that enough stormwater detention be provided on a development site to ensure that the peak discharge generated by the 25-year, 24-hour storm event under post-development conditions, which is known as the overbank peak discharge (Q_{p25}) (Section 5.4), does not exceed the peak discharge generated by the same storm event under pre-development conditions. Satisfying this overbank flood protection criteria will help protect downstream properties from damaging overbank flooding events.

This criteria may be modified or waived on development sites where both the on-site and downstream stormwater conveyance systems are designed to safely convey the peak discharge generated by the 25-year, 24-hour storm event under post-development conditions to a receiving water without causing additional downstream flooding or other environmental impacts (e.g., stream channel enlargement, degradation of habitat).

It is important to note that satisfying this overbank flood protection criteria and the aquatic resource protection criteria (SWM Criteria #3) typically provides effective control of the peak discharges generated by all of the storm events that are smaller than the 25-year, 24-hour storm event and larger than the 1-year, 24-hour storm event (e.g., 2-year, 24-hour storm event, 10-year, 24-hour storm event). It is also important to note that satisfying this overbank flood protection criteria and the extreme flood protection criteria (SWM Criteria #5) will also help control the peak discharges generated by storm events that are larger than the 25-year, 24-hour storm event (e.g., 50-year, 24-hour storm event).

4.4.5 SWM Criteria #5: Extreme Flood Protection

In order to prevent an increase in the duration, frequency and magnitude of downstream extreme flooding, it is *recommended* that enough stormwater detention be provided on a development site to ensure that the peak discharge generated by the 100-year, 24-hour storm event under post-development conditions, which is known as the extreme peak discharge (Q_{p100}) (Section 5.5), does not exceed the peak discharge generated by the same storm event under pre-development conditions. Satisfying this extreme flood protection criteria will protect downstream properties from dangerous extreme flooding events and will help maintain the boundaries of the existing 100-year floodplain. It will also help protect public health and safety and the physical integrity of downstream stormwater conveyance features and management practices.

This criteria may be modified or waived on development sites where both the on-site and downstream stormwater conveyance systems are designed to safely convey the peak discharge generated by the 100-year, 24-hour storm event under post-development conditions to a receiving water without causing additional downstream flooding or other environmental impacts (e.g., stream channel enlargement, degradation of habitat). Other appropriate flood protection measures (e.g., levees, floodwalls, channel enlargements) may also be used to protect downstream properties from extreme flood events, as long as the measures do not have other negative environmental impacts (e.g., degradation of habitat).

4.5 Special Stormwater Management and Site Planning and Design Criteria

Because of the importance of shellfish harvesting areas to the economy of coastal Georgia and that of the entire state, and their enhanced sensitivity to the impacts of the land development process, it is *recommended* that several special stormwater management and site planning and design criteria (Special Criteria) be applied to new development and redevelopment activities taking place near these critical areas. Additional information about these Special Criteria is provided below.

4.5.1 Special Criteria for Shellfish Harvesting Areas

It is *recommended* that the following Special Criteria be applied to any new development or redevelopment activity located that is located within 1/2-mile of a shellfish harvesting area and that meets one or more of the applicability criteria listed above (Section 4.2).

4.5.1.1 Special Criteria #1: Increased Stormwater Runoff Reduction

In order to better protect shellfish harvesting areas from contamination and closure, it is *recommended* that the amount of stormwater runoff reduction needed to satisfy the stormwater runoff reduction criteria (SWM Criteria #1) be *increased* on development sites that are located within 1/2-mile of a shellfish harvesting area. On these development sites, the stormwater runoff volume generated by the 90th percentile storm event (and the "first flush" of the stormwater runoff generated by all larger storm events) should be *reduced* on site through the use of appropriate green infrastructure practices.

In coastal Georgia, reducing the stormwater runoff volume generated by the 90th percentile storm event equates to reducing the stormwater runoff volume generated by the 1.5 inch rainfall event (and the stormwater runoff generated by the first 1.5 inches of all larger rainfall events). The correlation between the 90th percentile storm event and the 1.5 inch storm event was derived from an analysis of historical rainfall data from the communities of Brooklet, Brunswick,

Douglas, Folkston, Jesup and Savannah (Appendix B) and is considered to be an average value for the entire Coastal Nonpoint Source Management Area and Area of Special Interest.

The amount of stormwater runoff reduction needed to satisfy this criteria may be reduced on development sites that have site characteristics or constraints (e.g., high groundwater, impermeable soils, contaminated soils, confined groundwater aquifer recharge areas) that prevent the use of green infrastructure practices that provide for the interception, evapotranspiration, infiltration or capture and reuse of stormwater runoff. When seeking reduction in the amount of stormwater runoff reduction that needs to be provided in order to satisfy this criteria, it is *recommended* that:

(1) Appropriate green infrastructure practices be used to reduce, *at a minimum*, the stormwater runoff volume generated by the 0.75 inch rainfall event (and the first 0.75 inches of all larger rainfall events) on the development site.

(2) Adequate documentation be provided to the local development review authority to show that no additional runoff reducing green infrastructure practices can be used on the development site.

Any of the stormwater runoff generated by the 1.5 inch storm event (and the first 1.5 inches of all larger rainfall events) that is not *reduced* on the development site should be *intercepted and treated* in one or more stormwater management practices that provide at least an 80 percent reduction in total suspended solids loads and that reduce nitrogen and bacteria loads to the *maximum extent practical* (SWM Criteria #2). Adequate documentation should be provided to the local development review authority to show that nitrogen and bacteria removal were considered during the selection of the stormwater management practices used to *intercept and treat* stormwater runoff on the development site.

4.5.1.2 Special Criteria #2: Enhanced Aquatic Resource Protection

In order to better protect them from contamination and closure, it is also *recommended* that the minimum buffer width needed to satisfy the aquatic resource protection criteria (SWM Criteria #3) be *increased* on development sites that are located within 1/2-mile of shellfish harvesting areas. On these development sites, although a 75-foot wide aquatic buffer is preferred (Rowe et al., 2007, Franzen et al., 2006), a minimum 50-foot wide aquatic buffer, as measured horizontally from the point where vegetation has been wrested by normal stream flow or wave action, should be established around all aquatic resources considered to be primary conservation areas (Section 4.4.3). All aquatic buffers should themselves be identified as primary conservation areas and protected from the direct impacts of the land development process through the use of better site planning techniques.

4.6 Summary

The post-construction stormwater management and site planning and design criteria presented above provide the foundation for the integrated, green infrastructure-based approach to natural resource protection, stormwater management and site design detailed in this CSS. As shown in Table 4.7, when applied in combination with one another, they can be used to address nearly all of the negative impacts that the land development process can have on coastal Georgia's valuable terrestrial and aquatic resources.

The remainder of this CSS provides information about satisfying these stormwater management and site planning and design criteria, beginning with information about using accepted

hydrologic methods to calculate the stormwater runoff volumes associated with the post-construction stormwater management criteria that apply to a development site. These calculations can be used to plan and design a post-construction stormwater management system that will help protect coastal Georgia's valuable natural resources from the negative impacts of land development and nonpoint source pollution.

Table 4.7: How the Criteria Help Address the Negative Impacts of the Land Development Process	
Criteria	**How It Helps Address the Negative Impacts of the Land Development Process**
Site Planning and Design Criteria	
SP&D Criteria #1: Natural Resources Inventory	Identifying the natural resources found on a development site prior to the start of any land disturbing activities decreases the likelihood of any valuable natural resources being completely lost or destroyed during the land development process.
SP&D Criteria #2: Use of Green Infrastructure Practices	Using green infrastructure practices to protect valuable natural resources, maintain pre-development site hydrology and reduce post-construction stormwater runoff rates, volumes and pollutant loads, helps preserve the ecological function of our watersheds.
SP&D Criteria #3: Stormwater Management Concept Plan	Developing a stormwater management concept plan helps ensure that natural resource protection and stormwater management are integrated with the site planning and design process.
SP&D Criteria #4: Stormwater Management Design Plan	Developing a stormwater management design plan helps ensure that natural resource protection and stormwater management are integrated with the site planning and design process.
SP&D Criteria #5: Downstream Analysis	Conducting a downstream analysis helps protect against an increase in the duration, frequency and magnitude of overbank and extreme flooding events.
SP&D Criteria #6: Stormwater Management System Inspection and Maintenance Plan	Developing a stormwater management system inspection and maintenance plan helps ensure that green infrastructure and stormwater management practices will continue to control and minimize the negative impacts of the land development process over time.
SP&D Criteria #7: Erosion and Sediment Control Plan	Developing an erosion and sediment control plan helps minimize the negative impacts that *construction* stormwater runoff can have on coastal Georgia's valuable aquatic and terrestrial resources.
SP&D Criteria #8: Landscaping Plan	Developing a landscaping plan helps ensure that non-invasive, native species are used to landscape low impact development and stormwater management practices, as well as other landscaping features and areas on a development site.
P&D Criteria #9: Stormwater Pollution Prevention Plan	Developing a stormwater pollution prevention plan helps minimize the negative impacts that stormwater hotspots can have on the aquatic and terrestrial resources of coastal Georgia.
Post-Construction Stormwater Management Criteria	
SWM Criteria #1: Stormwater Runoff Reduction	Reducing stormwater runoff volumes helps maintain pre-development site hydrology and helps protect coastal Georgia's aquatic resources from several indirect impacts of the land development process (i.e., decreased groundwater recharge, decreased baseflow, degraded water quality).
SWM Criteria #2: Stormwater Quality Protection	Adequately treating stormwater runoff before it is discharged from a development site helps protect coastal Georgia's aquatic resources from water quality degradation.
SWM Criteria #3: Aquatic Resource Protection	Protecting them from the direct impacts of the land development process and establishing aquatic buffers around them, along with providing extended detention for the stormwater runoff volume generated by the 1-year, 24-hour storm event and providing velocity control and energy dissipation measures at all stormwater outfalls, helps protect coastal Georgia's aquatic resources from several other negative impacts of the land development process (i.e., complete loss or destruction, stream channel enlargement, increased salinity fluctuations).
SWM Criteria #4: Overbank Flood Protection	Controlling (attenuating) the peak discharge generated by the 25-year, 24-hour storm event helps prevent an increase in the duration, frequency and magnitude of damaging overbank flooding.
SWM Criteria #5: Extreme Flood Protection	Controlling (attenuating) the peak discharge generated by the 100-year, 24-hour storm event helps prevent an increase in the duration, frequency and magnitude of dangerous extreme flooding.
Special Stormwater Management and Site Planning and Design Criteria	
Special Criteria #1: Increased Stormwater Runoff Reduction	Providing increased stormwater runoff reduction on development sites located within 1/2-mile of shellfish harvesting areas helps better protect these sensitive natural resources from contamination and closure.
Special Criteria #2: Enhanced Aquatic Resource Protection	Providing wider aquatic buffers around all aquatic resources located within 1/2-mile of shellfish harvesting areas helps better protect these sensitive natural resources from contamination and closure.

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