Chapter 2 Design Review & Permitting Process

2.1 Satisfying the Stormwater Management and Site Planning and Design Criteria

2.1.1 Overview

This chapter presents a comprehensive set of site planning and design and post-construction criteria that must be applied to new development and redevelopment activities occurring within the Southern Lowcountry region. Satisfying these criteria promotes the systematic development of acceptable stormwater management plans, and a successful integration of natural resource protection and stormwater management through the site planning and design process (Figure 2.1).

Through the use of Better Site Design, as described in detail below, the integration of natural resource protection and stormwater management can be achieved by:

- identifying and protecting valuable natural resources;
- limiting land disturbance, new impervious cover, and disturbed pervious cover; and
- reducing and managing post-construction stormwater runoff rates, volumes, and pollutant loads.

This approach involves the use of two distinct but complementary groups of natural resource protection and stormwater management techniques:

- Green Infrastructure Practices: Natural resource protection and stormwater management practices and techniques (i.e., better site planning and design techniques, low impact development practices) that can be used to help prevent increases in post-construction stormwater runoff rates, volumes and pollutant loads.
- Stormwater Management Practices: Stormwater management practices (e.g., wet ponds, swales) that can be used to manage post-construction stormwater runoff rates, volumes and pollutant loads.

Natural resource protection and stormwater management techniques help control and minimize the negative impacts of the land development process while retaining and, perhaps, even enhancing a developer's vision for a development site. When applied during the site planning and design process, they can be used to create more natural and aesthetically pleasing development projects and create more cost-effective post-construction stormwater management systems (ARC, 2001). The use of these techniques, particularly the green infrastructure practices, can even reduce overall development costs while maintaining or increasing the resale value of a development project (MacMullan and Reich, 2007; US EPA, 2007; Winer-Skonovd et al., 2006).

2.1.2 Better Site Design in the Planning Process

Better Site Design (BSD) refers to planning land development using certain principles to minimize stormwater impacts. Integral to low impact development design, proper application of BSD principles can allow for smaller required stormwater BMP storage and retention volumes, and can help provide significant reductions in post-construction peak flows and pollutant loads. These principles include reduction/restoration of impervious cover, conservation of natural cover areas, stream restoration, and

integration of both structural and non-structural stormwater management within site design. The principles of Better Site Design are referenced in the sections below.

Fundamental to the application of Better Site Design is the correlation between impervious surface area in a watershed and negative impacts on receiving water resources. On a national level, the Impervious Cover Model (ICM) estimates stream quality based on percentage of impervious cover (Schueler and Fraley-McNeal, 2009). This model demonstrates that streams follow a continuous gradient of degradation in response to increasing impervious cover in a watershed. Local studies have supported this paradigm, and report that changes in the rate and volume of stormwater runoff were primary causes of ecological impairment in headwater tidal creeks, such as those found in Beaufort and Jasper Counties. These studies have shown that physical and chemical characteristics such as altered hydrography, increased salinity variance, increased chemical contaminants, and increased fecal coliform loadings of tidal creeks were negatively impacted with as little as 10 to 20% impervious cover. When impervious cover exceeded 30% of the watershed, measurable impacts to living resources were observed, indicating the ecological processes in the creek ecosystems were impaired (Holland et al., 2004).

Such findings are of consequence to Beaufort and Jasper Counties. Increasing pressure for development in response to population growth, and land development practices of the Lowcountry result in significant tree removal and loss of vegetative cover from land grading and storm pond construction, and increases in impervious surfaces. According to the NOAA C-CAP Land Cover Analysis (https://coast.noaa.gov/ccapatlas/), from 1996 to 2010, the percent net increase in impervious surface area was 60% for Beaufort County and 59% for Jasper County. Table 2.1 below summarizes the findings of this NOAA report. Although the percentage of total wetlands lost is relatively low for both counties, the actual wetland types have been converted from palustrine forested wetlands to palustrine scrub/shrub and palustrine emergent wetlands, which may alter ecosystem processes and hydrology in these areas.

Table 2.1 Summary of Land Cover Changes in Southern Lowcountry from 1996 to 2010

	Beaufort County[1]			Jasper County[1]		
Land Cover %	**1996**	**2010**	**% change**	**1996**	**2010**	**% change**
Development	3.87	6.16	+59.12	1.62	2.52	+55.15
Forested Area	25.28	21.5	-14.98	62.50	48.37	-22.60
Wetlands	33.85	33.20	-1.93	45.24	44.74	-1.11

[1]Percent of County under each land cover type

Given the rapid growth the Southern Lowcountry experienced in the past 20 years, the goals of Better Site Design should resonate with those charged with managing stormwater and its release into the area watersheds. Succinctly, the goals of Better Site Design include the following:

- Preventing stormwater impacts rather than mitigating them;
- Managing stormwater (quantity and quality) as close to the point of origin as possible and minimizing collection and conveyance;
- Utilizing simple, nonstructural methods for stormwater management that are lower cost and lower maintenance than structural controls;
- Creating a multifunctional landscape; and
- Using hydrology as a framework for site design.

The Center for Watershed Protection's Better Site Design Handbook outlines 22 model development principles for site design that act to reduce impervious cover, conserve open space, prevent stormwater pollution, and reduce the overall cost of development (CWP, 2017). The principles can provide notable reductions in post-construction stormwater runoff rates, volumes and pollutant loads (ARC, 2001). Better Site Design across the country is implemented through review of existing planning and development codes, and streets, parking and stormwater engineering criteria. Within the context of a stormwater management document and this Manual, the Better Site Design techniques of greatest application include protection of existing natural areas, incorporation of open space into new development, effective sediment and erosion control practices, and stormwater management that mimics natural systems. The following sections apply Better Site Design to the Southern Lowcountry Watershed Protection Areas and Special Watershed Protection Areas to help mitigate the effects of development to the watersheds. Therefore, the conservation principles below are part of an overall watershed approach to stormwater management and will complement the Watershed Protection Area approach in this Manual. Their application is subject to <local jurisdiction> requirements and/or standards.

2.1.3 Natural Resources Inventory

The first step to conserve natural resources is properly documenting existing assets. An up-to-date natural resources inventory map can provide geospatial information for water resources, soils, sensitive natural resource areas, critical habitats, and other unique resources (Ellis et al., 2014).

An application for new development requires a natural resources inventory prior to the start of any land disturbing activities. A natural resources inventory prepared by a forester, biologist, ecologist or other qualified professional shall be used to identify and map the most critical natural resources identified on the property that would be best to preserve, such as those listed in Table 2.2, as they exist predevelopment. A thorough assessment of the natural resources (Appendix D), both terrestrial and aquatic, found on a development site shall be submitted in the development application.

Table 2.2: **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 (e.g., 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 as described by South Carolina Department of Natural Resources

2.1.4 Conservation Development

Conservation development, also known as open space development or cluster development, is a site planning and design technique used to concentrate structures and impervious surfaces in a small portion of a development site, leaving room for larger conservation areas and managed open spaces elsewhere on the site (Figure 2.1). Alternative lot designs are typically used to "cluster" structures and other impervious surfaces within these conservation developments.

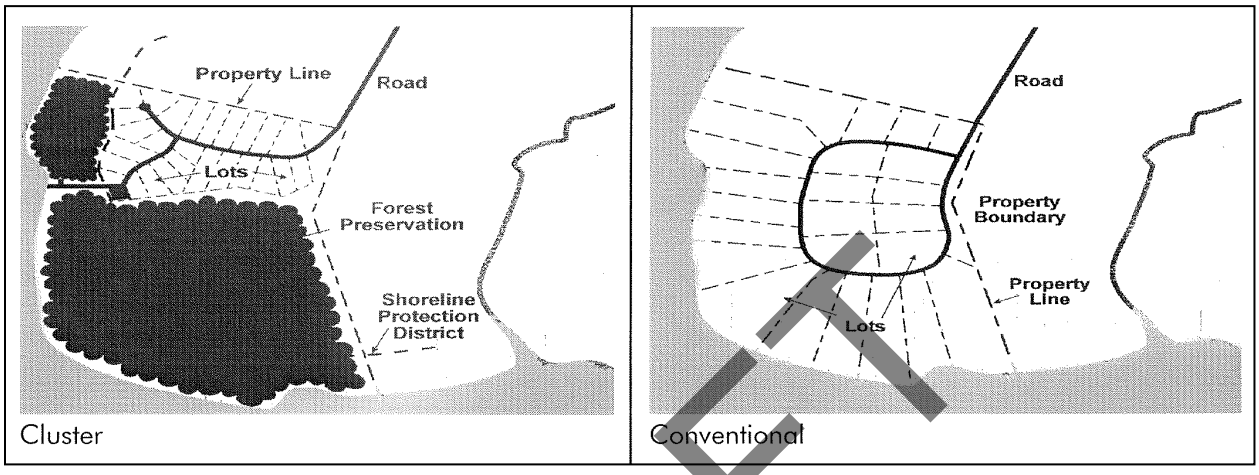

Figure 2.1 Conservation (Cluster) Development Versus Conventional Development

Conservation development projects provide a host of environmental benefits that are typically more difficult to achieve with conventional site design techniques. They provide for better natural resource protection on development sites and inherently limit increases in site imperviousness, sometimes by as much as 40 to 60 percent (CWP, 1998). Reduced site imperviousness results in reduced post-construction stormwater runoff rates, volumes and pollutant loads, which helps better protect both on-site and downstream aquatic resources from the negative impacts of the land development process. Reduced stormwater runoff rates, volumes and pollutant loads also help reduce the size of and need for storm drain systems and stormwater management practices on development sites.

As a number of recent studies have shown (MacMullan and Reich, 2007; US EPA, 2007; Winer-Skonovd et al., 2006), conservation development projects can also be significantly less expensive to build than more conventional development projects. Most of the cost savings can be attributed to the reduced amount of infrastructure (e.g., roads, sidewalks, post-construction stormwater management practices) needed on these development projects. And while these projects are frequently less expensive to build, developers often find that the lots located within conservation developments command higher prices and sell more quickly than those located within more conventional developments (ARC, 2001).

Table 2.3 provides suggestions for Better Site Design techniques that will help protect valuable resources such as buffers, trees, wetlands, and open space.

Table 2.3 Better Site Design Principles for Conservation

Principle	Description
Vegetated Buffer System	Create a variable width, naturally vegetated buffer system along all streams that also encompasses critical environmental features such as the 100-year floodplain, steep slopes, and freshwater wetlands. *Recommended buffer widths are included in Table 3.2-4 in Ellis et al., 2014*
Buffer Maintenance	The riparian buffer should be preserved or restored with native vegetation that can be maintained through delineation, plan review, construction, and occupancy stages of development.
Clearing and Grading	Clearing and grading of forests and native vegetation should be limited to the minimum amount needed to build lots, allow access, and provide fire protection. A fixed portion of any community open space should be managed as protected green space in a consolidated manner.
Tree Conservation	Conserve trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native plants. Wherever practical, manage community open space, street rights-of-way, parking lot islands, and other landscaped areas to promote natural vegetation.
Land Conservation	Open space development should be encouraged to promote conservation of stream buffers, forests, meadows, and other areas of environmental value. In addition, off-site mitigation consistent with locally-adopted watershed plans should be encouraged.
Stormwater Outfalls	New stormwater outfalls should not discharge unmanaged into jurisdictional wetlands, sole-source aquifers, or sensitive areas.

2.1.5 Integrating Natural Resource Protection and Stormwater Management with the Site Planning and Design Process

In order to successfully *integrate* natural resource protection and stormwater management with the site planning and design process, site planning and design teams are encouraged to consider following questions at the beginning of the process:

- What valuable natural resources, both terrestrial and aquatic, can be found on the development site?
- How can better site planning techniques be used to protect these valuable natural resources from the direct impacts of the land development process?
- How can better site design techniques be used to minimize land disturbance and the creation of new impervious and disturbed pervious cover?
- What low impact development practices can be used to help preserve pre-development site hydrology and *reduce* post-construction stormwater runoff rates, volumes and pollutant loads?
- What stormwater management practices can be used to *manage* post-construction stormwater runoff rates, volumes and pollutant loads?

- Are there any site characteristics or constraints that prevent the use of any particular low impact development or stormwater management practices on the development site?

Although answering these questions is no easy task, they can be readily obtained within the context of the seven-step *stormwater management planning and design process* outlined in Figure 2.2 and the steps describe in more detail below.

2.1.6 Residential Streets and Parking Lots

Up to 65% of the total impervious cover in a watershed can be the attributed to streets, parking lots, and driveways (CWP, 1998). Table 2.4 describes Better Site Design principles related to techniques to reduce the impervious surfaces associated with these hardscapes.

Table 2.4 Better Site Design Principles for Streets and Parking to meet <local jurisdiction> requirements

Principle	Description
Street Width	Design residential streets for the minimum required pavement width needed to support travel lanes; on-street parking; and emergency, maintenance, and service vehicles.
Street Length	Reduce the total length of residential streets by examining alternative street layouts to determine the best option for increasing the number of homes per unit length.
Right-of-Way Width	Wherever possible, residential street right-of-way widths should reflect the minimum required to accommodate the travel-way, the sidewalk, and vegetated open channels. Utilities and storm drains should be located within the pavement section of the right-of-way wherever feasible.
Cul-de-sacs	Minimize the number of residential cul-de-sacs and incorporate landscaped areas to reduce their impervious cover. The radius of cul-de-sacs should be the minimum required to accommodate emergency and maintenance vehicles. Alternative turnarounds should be considered.
Vegetated Open Channels	Where density, topography, soils, and slope permit, vegetated open channels should be used in the street right-of-way to convey and treat stormwater runoff.
Parking Ratios	The required parking ratio governing a particular land use or activity should be enforced as both a maximum and a minimum in order to curb excess parking space construction. Existing parking ratios should be reviewed for conformance, taking into account local and national experience to see if lower ratio is warranted and feasible.
Parking Lots	Reduce the overall imperviousness associated with parking lots by providing compact car spaces, minimizing stall dimensions, incorporating efficient parking lanes, and using pervious materials in spillover parking areas.
Structured Parking	Utilize structured (e.g. parking garage) and shared parking to reduce impervious surface area.
Parking Lot Runoff	Wherever possible, provide stormwater treatment for parking lot runoff using bioretention areas, filter strips, and/or other practices that can be integrated into required landscaping areas and traffic islands.

2.1.7 Lot Development Principles to meet <local jurisdiction> requirements

Development of lots follows similar guidelines for reducing impervious cover and protecting natural areas, such as open space. Table 2.3 summarizes Better Site Design principles for lot development. Preserving open space is critical to maintaining water quality at the regional level. Compared to traditional development, open space development can reduce the annual runoff volume from a site by 40-60%, nitrogen loads by 42-81%, and phosphorus loads by 42-69% (CWP, 1998). Large, continuous areas of open space reduce and slow runoff, absorb sediments, serve as flood control, and help maintain aquatic communities. Open space can be provided by minimizing lot sizes, setbacks, and frontage distances.

Table 2.3 Better Site Design Principles for Lot Development

Principle	**Description**
Open Space Development	Utilize open space development that incorporates smaller lot sizes to minimize total impervious area, reduce total construction costs, conserve natural areas, provide community recreational space, and promote watershed protection.
Setbacks and Frontages	Consider minimum setbacks allowed by <local jurisdiction>. Relax side yard setbacks and allow narrower frontages to reduce total road length in the community and overall site imperviousness. Relax front setback requirements to minimize driveway lengths and reduce overall lot imperviousness.
Sidewalks	Where practical, consider locating sidewalks on only one side of the street and providing common walkways linking pedestrian areas.
Driveways	Reduce overall lot imperviousness by promoting alternative driveway surfaces and shared driveways that connect two or more homes together.
Rooftop Runoff	Direct rooftop runoff to pervious areas such as yards, open channels, or vegetated areas and avoid routing rooftop runoff to the roadway and the stormwater conveyance system.
Open Space Management	Clearly specify how community open space will be managed and designate a sustainable legal entity responsible for managing both natural and recreational open space.

For more detailed descriptions of these techniques, please reference *Better Site Design: A Handbook for Changing Development Rules in Your Community* (CWP, 1998) and Chapter 3 of *Low Impact Development in Coastal South Carolina: A Planning and Design Guide* (Ellis et al., 2014).

2.1.8 Site Planning and Design Process

Figure 2.2 depicts the site planning and design process that is captured in *Low Impact Development in Coastal South Carolina: A Planning and Design Guide* (Ellis et al., 2014) and is applicable to the *<local jurisdiction>*. The site planning and design checklist of the Southern Lowcountry Design Manual does not make each of the phases of the process a submittal requirement. The checklist, however, gives the *<local jurisdiction>* the opportunity to ask whether each of these steps have been considered. The actual document submittal begins with the preliminary plan when considered in context of the planning process below:

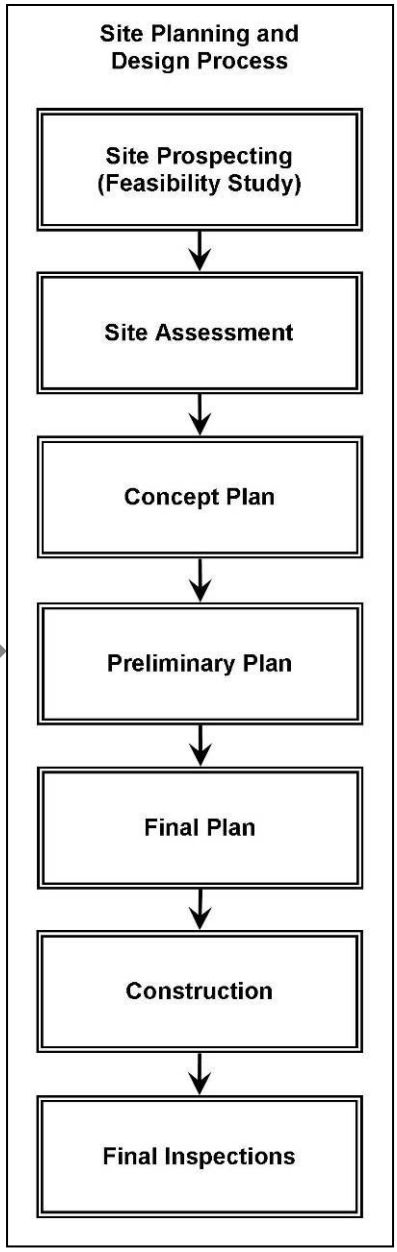

Figure 2.2: Site Planning and Design Process

(Source: Center for Watershed Protection)

- Site Prospecting: During the site prospecting phase, some basic information is used to evaluate the feasibility of completing a development or redevelopment project. A *feasibility study* is typically used to evaluate the many factors that influence a developer's decision about whether or not to move forward with a potential development project. Factors that are typically evaluated during a *feasibility study* include information about site characteristics and constraints, applicable local, state and federal stormwater management and site planning and design requirements, adjacent land uses and access to local infrastructure (e.g., water, sanitary sewer).
- Site Assessment: Once a potential development or redevelopment project has been deemed feasible, a more thorough assessment of the development site is completed. The site assessment, which is typically completed using acceptable site reconnaissance and surveying techniques, provides additional information about a development site's characteristics, its natural resource inventory and constraints. Once the assessment is complete, a developer can identify and analyze the natural, man-made, economic and social aspects of a potential development project, define the actual buildable area available on the development site and begin making some preliminary decisions about the layout of the proposed development project.
- Concept Plan: The results of the site assessment are typically used to create a concept plan (also known as a *sketch plan*) for the proposed development project. A concept plan is used to illustrate the basic layout of the proposed development project, including lots and roadways, and is usually reviewed with the local development review authority before additional resources are used to create a more detailed plan of development. During this phase, several alternative concept plans can be created and compared with one another to craft a plan of development that best "fits" the character of the development site (Figure 2.3 - Figure 2.5). It is at this point in the planning and design process that a Maximum Extent Practical demonstration described in

Section 3.9 is required for development projects that will seek a waiver from requirements of this Manual.

- Preliminary Plan: A preliminary plan presents a more detailed layout of a proposed development project. It typically includes information about lots, buildings, roadways, parking areas, sidewalks, conservation areas, utilities and other infrastructure, including the post-construction stormwater management system. After the preliminary plan has been reviewed and approved by the local development review authority, a final plan may be prepared. There may be several iterations of the preliminary plan between the time that it is submitted and the time that it is approved by the local development review authority.
- Final Plan: The final plan adds further detail to the preliminary plan and reflects any changes to the plan of development that were requested or required by the local development review authority. The final plan typically includes all of the information that was included in the preliminary plan, as well as information about landscaping, pollution prevention, erosion and sediment control and long-term operation and maintenance of the site's post-construction stormwater management system. There may be several iterations of the final plan between the time that it is submitted and the time that it is approved by the local development review authority.
- Construction: Once the final plan has been reviewed and approved, performance bonds are set and placed, contractors are retained, and construction begins. During the construction phase, a development project may be inspected on a regular basis by the local development review authority to ensure that all roadways, parking areas, buildings, utilities and other infrastructure, including the post-construction stormwater management system, are being built in accordance with the approved final plan and that all primary and secondary conservation areas have been protected from any land disturbing activities.
- Final Inspections: Once construction is complete, final inspections take place to ensure that all roadways, parking areas, buildings, utilities and other infrastructure, including the post-construction stormwater management system, were built according to the approved final plan. As-built plans are also typically prepared and executed during this phase. If a development project passes all final inspections, an occupancy permit may be issued for the project.

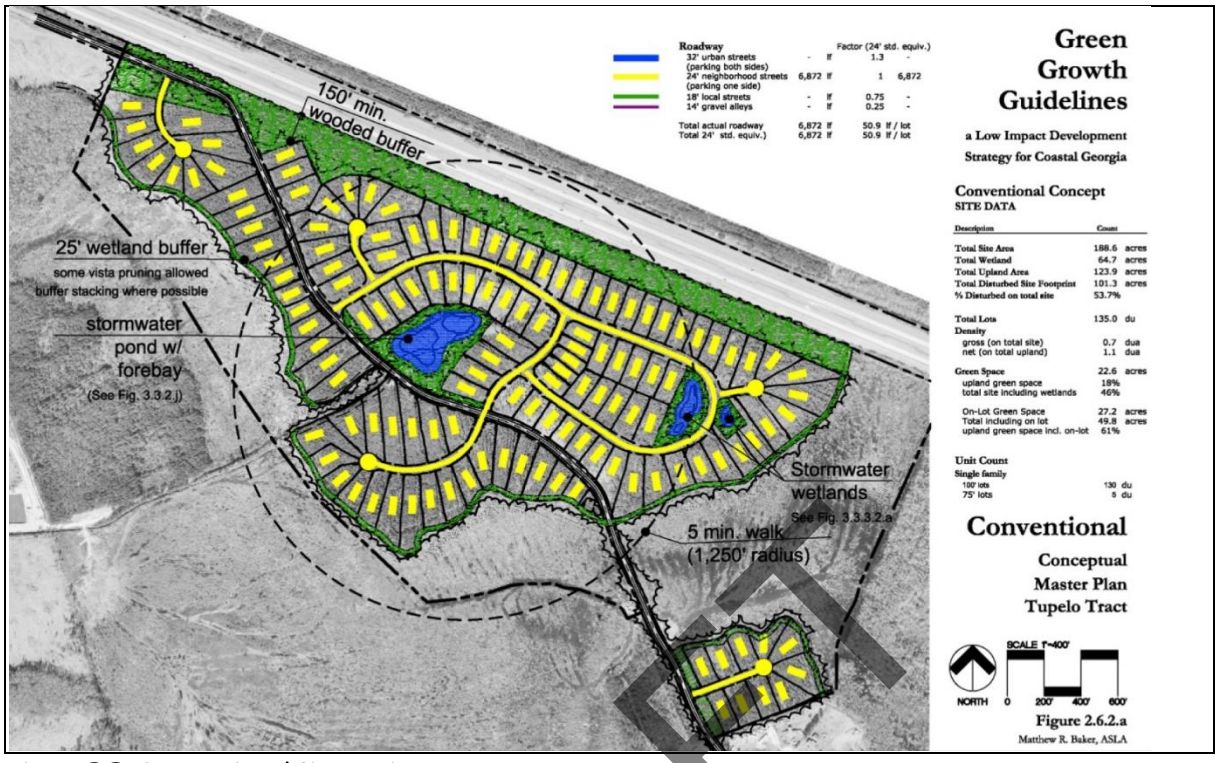

Figure 2.3 Conventional Site Design

Source: Merrill et al., 2006

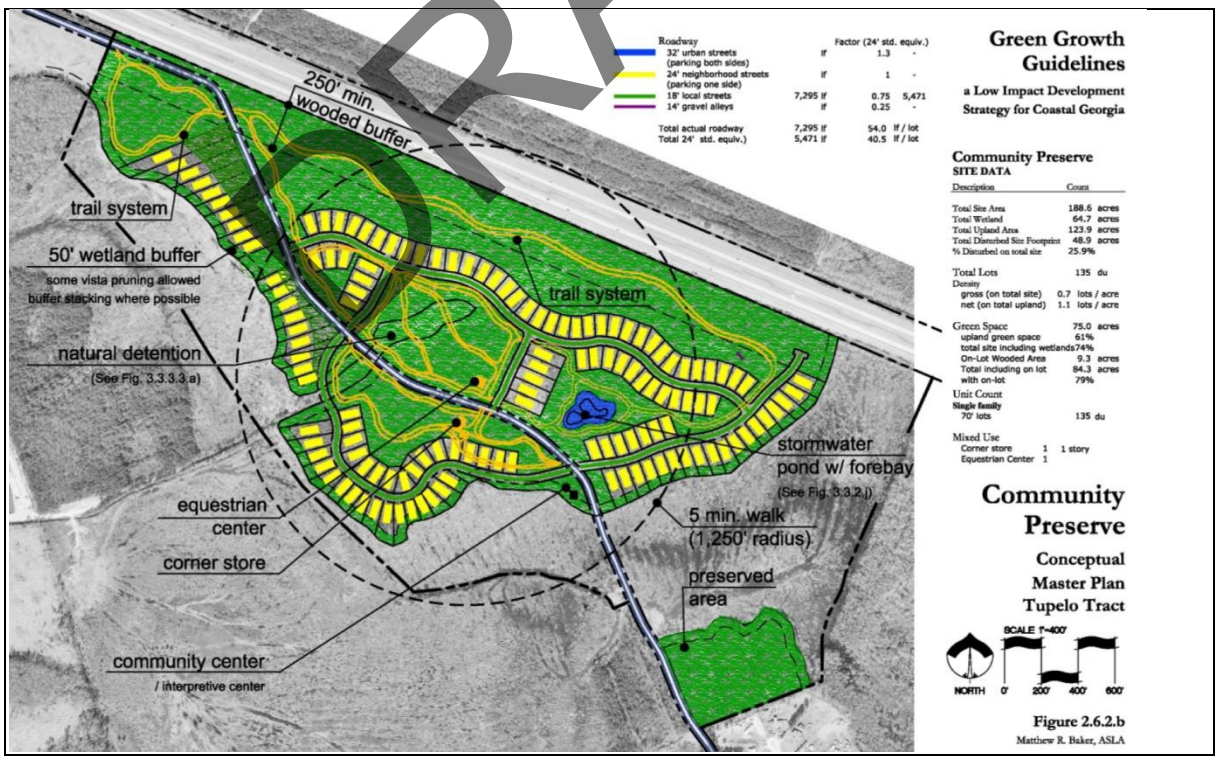

Figure 2.4 Conservation Site Design

Source: Merrill et al., 2006

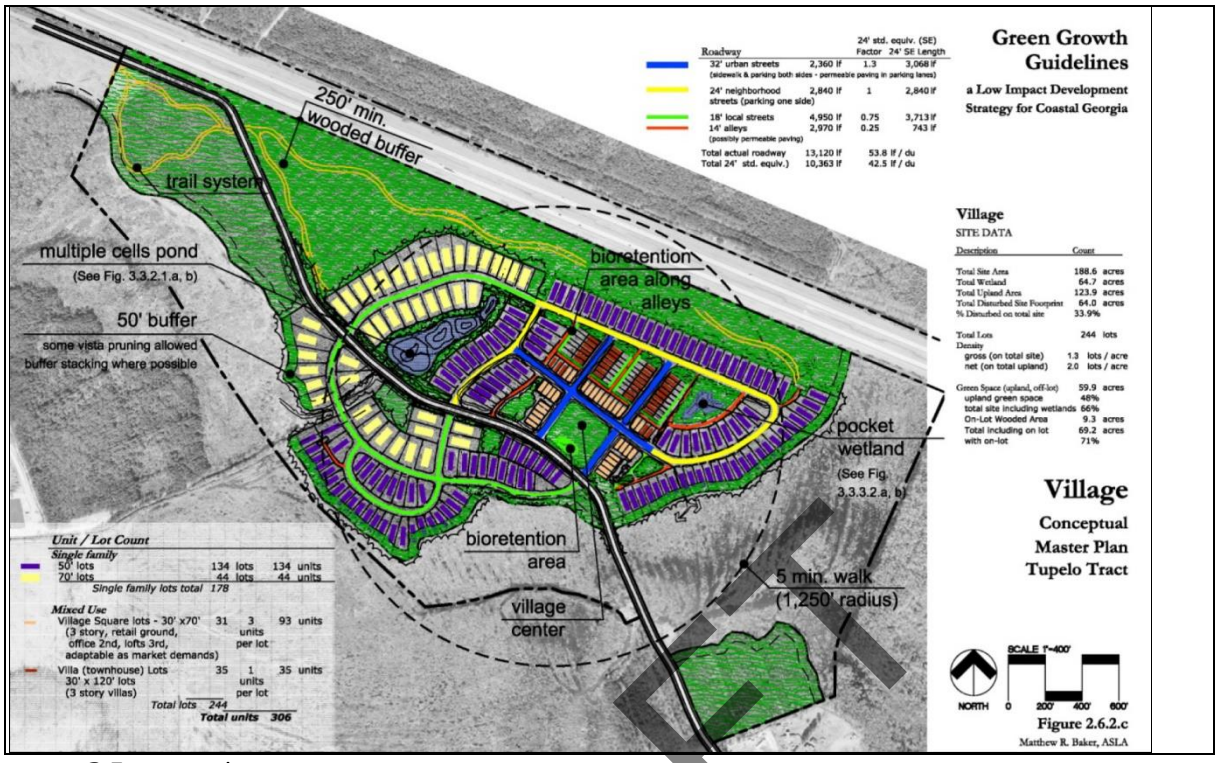

Figure 2.5 New Urbanist Site Design
Source: Merrill et al, 2006

2.1.9 Integrating Natural Resource Protection and Stormwater Management with the Site Planning and Design Process

In order to successfully *integrate* natural resource protection and stormwater management with the site planning and design process, site planning and design teams are encouraged to consider following questions at the beginning of the process:

- What valuable natural resources, both terrestrial and aquatic, can be found on the development site?
- How can better site planning techniques be used to protect these valuable natural resources from the direct impacts of the land development process?
- How can better site design techniques be used to minimize land disturbance and the creation of new impervious and disturbed pervious cover?
- What low impact development practices can be used to help preserve pre-development site hydrology and *reduce* post-construction stormwater runoff rates, volumes and pollutant loads?
- What stormwater management practices can be used to *manage* post-construction stormwater runoff rates, volumes and pollutant loads?
- Are there any site characteristics or constraints that prevent the use of any particular low impact development or stormwater management practices on the development site?

Although answering these questions is no easy task, they can be readily obtained within the context of the six-step *stormwater management planning and design process* outlined in Figure 2.6 and the steps describe in more detail below.

Step 1: Pre-Application Meeting

It is recommended that a pre-application meeting between the applicant's site planning and design team and the *<local jurisdiction>* development review authority occur at the very beginning of the stormwater management planning and design process. This meeting, which should occur during the site prospecting phase of the overall site planning and design process (Figure 2.6), helps establish a relationship between the site planning and design team and the *<local jurisdiction>* development review authority. The pre-application meeting also provides an opportunity to discuss the local site planning and stormwater management design criteria that will apply to the proposed development project, which increases the likelihood that the remainder of the site planning and design process will proceed both quickly and smoothly.

Step 2: Review of Local, State and Federal Stormwater Management and Site Planning and Design Requirements

Once a pre-application meeting has been completed, it is recommended that the site planning and design team review the local, state and federal requirements that will apply to the proposed development project. This review should occur during the site prospecting phase of the overall site planning and design process (Figure 2.6), while the feasibility study is still being completed.

During their review of stormwater management and site planning and design requirements, the applicant's site planning and design teams should also investigate opportunities and incentives for land conservation, and opportunities and incentives for conservation development as illustrated earlier in Figure 2.1.

Step 3: Natural Resources Inventory

Once the potential development or redevelopment project has been deemed feasible, acceptable site reconnaissance and surveying techniques must be used to complete a thorough assessment of the natural resources, both terrestrial and aquatic, found on the development site. The identification and subsequent preservation and/or restoration of these natural resources helps reduce the negative impacts of the land development process "by design." The natural resources inventory should be completed during the site assessment phase of the overall site planning and design process (Figure 2.6). A 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 for the proposed development project.

Once the natural resources inventory has been completed and a site fingerprint has been created, the site planning and design team should have a better understanding of a development site's characteristics and constraints. This information can be used to identify primary and secondary conservation areas (Figure 2.7) and define the actual buildable area available on the development site (Figure 2.7). Along with information about adjacent land uses and available infrastructure (e.g., roads, utilities), the site fingerprint can also be used to make some preliminary decisions about the layout of the proposed development project and to guide the creation of the stormwater management concept plan.

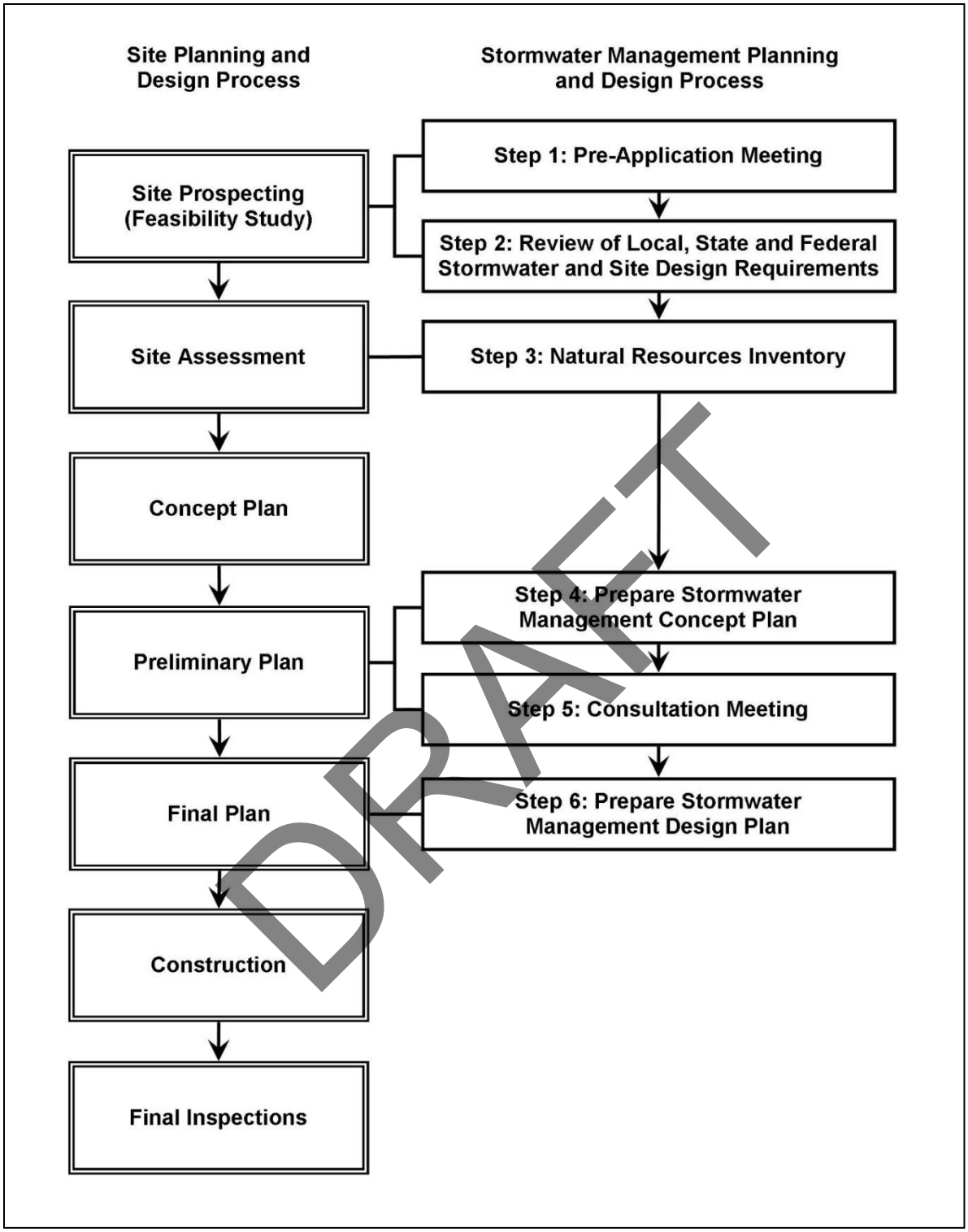

Figure 2.6 Integrating Natural Resource Protection and Stormwater Management with the Site Planning and Design Process

Source: Center for Watershed Protection

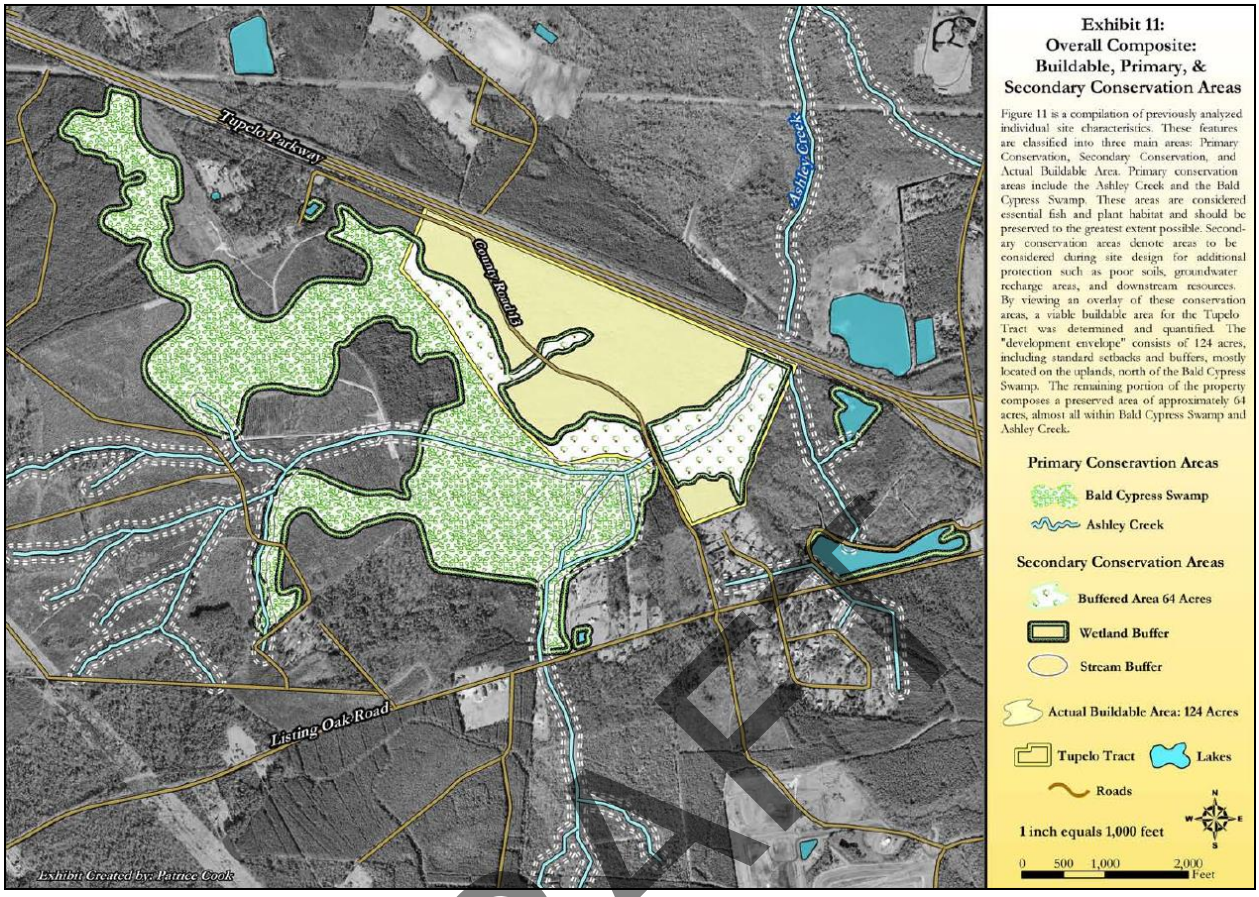

Figure 2.7 Buildable Area and Primary and Secondary Conservation Areas
Source: Merrill et al., 2006

Step 4: Prepare Stormwater Management Concept Plan

After the natural resources inventory has been completed, it is recommended that the site fingerprint be used to develop a stormwater management concept plan for the proposed development project. 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.

The creation of a stormwater management concept plan allows the applicant's site planning and design team to make some preliminary decisions about the layout of the proposed development project. If it is submitted to the local development review authority prior to the preparation and submittal of the stormwater management design plan, it can also be used to solicit early feedback on the project and on the green infrastructure and stormwater management practices that will be used to manage post-construction stormwater runoff on the development site.

During the creation of the stormwater management concept plan, most of the site layout, including the layout of lots, buildings, roadways, parking areas, sidewalks and green infrastructure and stormwater management practices, will be completed. Therefore, it is very important that natural resource

protection and stormwater management be considered throughout this part of the stormwater management planning and design process.

Step 5: Consultation Meeting

Once a stormwater management concept plan has been created, it is recommended that the applicant's site planning and design team hold a consultation meeting with the *<local jurisdiction>* development review authority. This meeting, which should occur right after completion of the stormwater management concept plan, provides an opportunity to discuss the proposed development project and the approach that was used to satisfy the stormwater management and site planning and design criteria that apply to the development site. It may be advantageous for the consultation meeting to take place on the development site after the concept plan submittal, but prior to approval. This meeting can be used to verify site conditions and feasibility of the proposed stormwater management concept plan.

Step 6: Prepare Stormwater Management Design Plan

Subsequent to review and approval of the stormwater management concept plan, the site planning and design team should prepare a stormwater management design plan. 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. The stormwater management design plan should be submitted to the local development review authority for review and approval.

2.2 Submittal and Review Process of Stormwater Management Plans

The Stormwater Management Plan (SWMP) consists of the entire submittal package and includes the following components:

- project description and narrative;
- description of selected stormwater management systems;
- erosion and sediment control plans;
- sufficient information to evaluate the environmental characteristics of the affected areas, the potential impacts of the proposed development on water resources, the effectiveness and acceptability of stormwater best management practices (BMPs), and land covers for managing stormwater runoff;
- supporting computations and drawings; and
- construction, inspection, and maintenance schedules.

All SWMPs must include the Stormwater submittal checklist (Appendix D) and calculations summary. The plans must include the calculated Stormwater Retention Volume (SWRv) for each BMP and for the overall project, the pre and post development peak flow comparison, extreme flood requirements, and any off-site retention or detention volume obligation.

The SWMP and accompanying documentation may be submitted electronically according to the *<local jurisdiction>* process, but the applicant must also submit one paper copy of the SWMP carrying the stamp of a registered professional engineer licensed in the State of South Carolina with all supporting documentation to *<local jurisdiction>*.

Upon acceptance of a complete application (which includes payment of filing fees), the <local jurisdiction> will review the SWMP and make a determination to approve, approve with conditions, or disapprove the SWMP. Relatively large and/or complicated projects tend to require a longer review time than smaller and less complicated projects. A written response of approval or disapproval will be provided to the applicant. If it is determined that more information is needed or that a significant number of changes must be made before the SWMP can be approved, the applicant must resubmit the applications with the revisions required and certified by the registered professional engineer according to the plan resubmittal process of the <local jurisdiction>.

When a SWMP approval is granted, a final submission package is required, including the following:

- One PDF copy of the SWMP, certified by a registered professional engineer licensed in the State of South Carolina,
- A declaration of covenants that has been approved for legal sufficiency by the *<local jurisdiction>*, and
- All supporting documents specified within this Manual or as requested during the review process according to the *<local jurisdiction>* requirements.

2.2.1 SWMP Components

As itemized in the SWMP checklist in Appendix D Design Checklists and Supporting Forms, a SWMP includes the following:

Site Plan

The following information must be formatted to print as a standard drawing size of 24 by 36 inches. The site drawing will provide details of existing and proposed conditions:

- A cover page that contains a blank space measuring 7 inches wide by 9.5 inches high. The blank space must be located 1 inch below the top edge and 1 inch from the left edge of the page;
- A plan showing property boundaries and the complete address of the property;
- Lot number or property identification number designation (if applicable);
- North arrow, scale, and date;
- Property lines (include longitude and latitude);
- Location of easements (if applicable);
- Existing and proposed structures, utilities, roads, and other paved areas;
- Existing and proposed topographic contours;
- Soil information for design purposes;
- Area(s) of soil disturbance;
- Volume(s) of excavation;
- Volume(s) of fill;
- Volume(s) of backfill;
- Drainage area(s) within the limits of disturbance (LOD) and contributing to the LOD;
- Contributing drainage area (CDA) to each BMP;
- Location(s) of BMPs, marked with the BMP ID Numbers to agree with the BMP design summary list;
- Delineation of existing and proposed land covers including natural cover, compacted cover, and impervious surfaces. Consult Appendix G Compliance Calculator Instructions for details;
- Natural resources inventory with site fingerprint map;

- All plans and profiles must be drawn at a scale of 1 in. = 10 ft, 1 in. = 20 ft, 1 in. = 30 ft, 1 in. = 40 ft, 1 in. = 50 ft, or 1 in. = 80 ft. Although, 1 in. = 10 ft, 1 in = 20 ft, and 1 in. = 30 ft, are the most commonly used scales. Vertical scale for profiles must be 1 in. = 2 ft, 1 in. = 4 ft, 1 in. = 5 ft, or 1 in. = 10 ft;
- Drafting media that yield first- or second-generation, reproducible drawings with a minimum letter size of No. 4 (1/8 inch);
- Location and size of existing utility lines including gas lines, sanitary lines, telephone lines or poles, electric utilities and water mains;
- A legend identifying all symbols used on the plan;
- Applicable flood boundaries and FEMA map identification number for sites lying wholly or partially within the 100-year floodplain;
- Site development plan and stormwater management narrative;
- Assess potential application of green infrastructure practices in the form of better site planning and design techniques. Low impact development practice should be used to the maximum extent practicable during the creation of a stormwater management concept plan. A demonstration of better site planning is required. The following site information and practices shall be considered:
    - Soil type (from Soil Study);
    - Depth of ground water on site;
    - Whether the type of development proposed is a hotspot as defined by the Ordinance and Design Manual and address how this influences the concept proposal;
    - Protection of primary and secondary conservation areas;
    - Reduced clearing and grading limits;
    - Reduced roadway lengths and widths;
    - Reduced parking lot and building footprints to minimize impervious surface;
    - Soil restoration;
    - Site reforestation/revegetation;
    - Impervious area disconnection;
    - Green roof (for redevelopment, infill and major substantial improvement projects); and
    - Permeable pavements.
- Stormwater Pollution Prevention Plan (SWPPP) or Erosion and Sediment Control narrative (for projects disturbing over an acre);
- Information regarding the mitigation of any off-site impacts anticipated as a result of the proposed development;
- Construction specifications;
- Design and As-Built Certification, including the following:
    - i Certification by a registered professional engineer licensed in the State of South Carolina that the site design, land covers, and design of the BMPs conforms to engineering principles applicable to the treatment and disposal of stormwater pollutants; and
    - ii Certification and submission of the As-Built Certification by Professional Engineer form (provided in Appendix O) and one set of the as-built plans within 21 days after completion of construction of the site, all BMPs, land covers, and stormwater conveyances. For a project consisting entirely of work in the public right-of-way (PROW), the submission of a Record Drawing certified by an officer of the project contracting company is acceptable if it details the as-built construction of the BMP and related stormwater infrastructure;
- Maintenance sheet for stormwater BMPs, including the following:
    - i A maintenance plan that identifies routine and long-term maintenance needs and a maintenance schedule;

ii A declaration of covenants stating the owner's specific maintenance responsibilities identified in the maintenance plan and maintenance schedule. These must be exhibits recorded with the property deed at the Recorder of Deeds. An example of a declaration of covenants is provided at the end of this chapter. Though government-owned properties are exempt from the declaration of covenants requirement, long-term maintenance obligations are the same as for any other regulated site; and

iii For applicants using Rainwater Harvesting, submission of third-party testing of end-use water quality may be required at equipment commissioning as determined by the requirements in Appendix J Rainwater Harvesting Treatment and Management Requirements. Additional regular water quality reports certifying compliance for the life of the BMP may also be required in Appendix J Rainwater Harvesting Treatment and Management Requirements.

Stormwater Retention Volume Computations

The following summary calculations must be included on the plan set. Supporting documentation and the South Carolina DHEC C-SWPPP are not in the plan set but provided separately.

- Calculation(s) of the required SWRv for the entire site within the LOD and each SDA within the LOD;
- Calculation(s) for each proposed BMP demonstrating retention value towards SWRv in accordance with Chapters 2 and 4 Stormwater Best Management Practices (BMPs);
- For Rainwater Harvesting BMP, calculations demonstrating the annual water balance between collection, storage, and demand, as determined using the Rainwater Harvesting Retention Calculator;
- For proprietary and non-proprietary BMPs outside Chapter 4, complete documentation defined in Appendix K Proprietary Practices Approval Process to identify/receive approval or denial to use these practice(s); and
- Off-site stormwater volume requirement.

Pre-/Post-Development Hydrologic Computations

Include in the plan set a summary of the pre-/post-runoff analysis with the following information at a minimum:

- A summary of soil conditions and field data;
- Pre- and post-project curve number summary table;
- Pre and post construction peak flow summary table for the 2, 10, 25 and the 50-year 24-hour storm events for each SDA within the project's LOD; and
- Flow control structure elevations;

Hydraulic Computations

Hydraulic computations for the final design of water quality and quantity control structures may be accomplished by hand or through the use of software using equations/formulae as noted in Chapters 3 and 4. The summary of collection or management systems will include the following:

- Existing and proposed SDA must be delineated on separate plans with the flow paths used for calculation of the times of concentration;

- Hydraulic capacity and flow velocity for drainage conveyances, including ditches, swales, pipes, inlets, and gutters. Plan profiles for all open conveyances and pipelines, with energy and hydraulic gradients for the 25-year and 50-year, 24-hour storms;
- The proposed development layout including the following:
    - Location and design of BMP(s) on site, marked with the BMP ID Numbers;
    - Stormwater lines and inlets;
    - A list of design assumptions (e.g., design basis, 2 through 50-year return periods);
    - The boundary of the CDA to the BMP;
    - Schedule of structures (a listing of the structures, details, or elevations including inverts); and
    - Manhole to manhole profile, listing of pipe size, pipe type, slope, computed velocity, and computed flow rate (i.e., a storm drain pipe schedule).

Supporting Documentation

Provide a written report with the following supporting documentation:

- Pre- and post-project curve number selection
- Time of concentration calculation;
- Travel time calculation;
- Hydrologic computations supporting peak discharges assumed for each SDA within the project's LOD for the 2-, 10-, 25-, and 100-year, 24-hour storm events;
- SCDHEC's Construction Stormwater Pollution Prevention Plan (C-SWPPP).

A professional engineer registered in the State of South Carolina must also submit the following:

1. Elevation and topographic data illustrating changes in topography and drainage;
2. Impacts upon local flood flows (25, 50 and 100-yr storm events;
3. Identify areas where stormwater flows are discharged off-site or off-property;
4. For proposed off-site/property discharge points, perform analysis of receiving off-site conveyance systems to confirm safe conveyance from the proposed developed property, no negative impact to adjacent properties, and adequacy of the receiving, existing conveyance system for 25-yr storm flows. Such analysis shall be taken to point where the 25-yr storm conveyance is determined to be adequate in the public stormwater conveyance/infrastructure system; and
5. Documentation supporting safe passage of the 100-yr post development flow according to the 10% Rule (see Section 3.8);

2.2.2 Resubmission of Stormwater Management Plans

If changes occur in the design or construction of an accepted SWMP, the applicant may be required to resubmit the SWMP for approval. Examples of changes during design and construction that will require SWMP resubmission for review include the following:

1. Revision to the property boundary, property size, or LOD boundaries that may require redesigning BMPs;
2. Any change to SWRv through land cover designation change;
3. Change in compaction or infiltration rates due to construction activities;
4. Encountering contaminated soil or other underground source of contamination;
5. Changes to floodplain designation or requirements;

6. Changes in any component of the BMP that may adversely affect the intended capacity of the approved BMP, such as the following:
    a. Modification to approved BMP selection, dimensions, or location
    b. Modification to approved material specification
    c. Changes to the size, invert, elevation, and slopes of pipes and conveyances
    d. Installation of new drains and conveyance structures
    e. Need for a new storm sewer outlet connection to the sanitary/storm sewer main
    f. Changes to the amount of off-site requirements
    g. Changes to the CDA to a BMP
7. Revision to the approved grading and drainage divides and that may require redesigning BMPs;
8. Relocation of an on-site storm sewer or conveyance; or
9. Abandonment, removal, or demolition of a BMP.

If the applicant resubmits an SWMP after making changes, the resubmission must contain a list of the changes made and may be in the form of a response to comments. The resubmittal plans and calculations must include the stamp of the registered professional engineer in South Carolina.

However, if any of the following minor changes are made to the SWMP, resubmission is not required. These minor changes may be made anytime during inspection or at the as-built submittal by the *<local jurisdiction>*.

1. Changes to SWM components that do not adversely affect BMP capacity while in consultation with the *<local jurisdiction>*. The inspector should review the appropriate manufacturer's documentation to his/her satisfaction before approving such a change and should ensure that such changes are recorded as red line changes or deviations in the as-built plans. These changes include the following:
    a. Changes to parts type of similar function (e.g. dewatering valve)
    b. Change in hole pattern or size of underdrain pipe perforations
    c. Change in project address, ownership, permit status, or zoning

2.2.3 Design Certifications

The engineer shall certify that this Plan satisfies all requirements of the Southern Lowcountry Ordinance and Stormwater Design Manual. Appendix O includes the certification form with the South Carolina Registered Professional Engineer's seal which must be on plans submitted for approval and signed by Engineer.

The following Grading and Drainage Certification shall accompany the plan submittal:

> I hereby certify the grading and resulting drainage as presented on the approved plan provides for positive and proper drainage within the site. Where water leaves the site to off-site discharge points, off-site drainage facilities have been evaluated and determined to be of sufficient capacity and condition for 25-year storm flows with no impact to downstream properties and or structures.

The following Extreme Flood Certification shall accompany the plan submittal:

> I hereby certify onsite and off-site 100-year storm overflow paths have been evaluated and determined to not impact proposed or existing structures in accordance with the requirements of the Southern Lowcountry Stormwater Ordinance and Design Manual.

2.2.4 Performance Bonds

Bonding for the cost of stormwater facilities approved for the proposed development shall be provided in accordance with the <*local jurisdiction*> bonding and permit issuance process. It is recommended that the bond be in the amount of 125% of the approved estimated cost (labor, equipment, material and incidentals) for construction/installation of the approved stormwater management facilities. The <*local jurisdiction*> shall require from the developer a surety or cash bond, irrevocable letter of credit, or other means of security acceptable to the <*local jurisdiction*> prior to the issuance of any building and/or grading permit for any land development or redevelopment activity requiring a permanent stormwater management system. The bond required shall include provisions relative to forfeiture for failure to complete work specified in the approved stormwater management design plan, compliance with all of the provisions of this ordinance, other applicable laws and regulations, and any time limitations. The bond shall not be fully released without a final inspection of the completed work by the <*local jurisdiction*>, a recorded inspection and maintenance agreement and plan, and submission of "as-built" plans containing certifications provided by the Applicant and Engineer, including the following:

1. Certification that facilities were constructed in accordance with the submitted and approved design and will function as designed.
2. As-built certification to be on as-built drawing submitted by Engineer after construction and prior to Certificate of Project Completion and confirming line, size, elevation and grade of constructed stormwater BMPs and drainage/conveyance systems.

A procedure may be used to release parts of the bond held by the <*local jurisdiction*> after various stages of construction have been completed and accepted by the <*local jurisdiction*>. Partial Bond release will be determined for the portion of work being accepted and construction work has been approved by <<*local jurisdiction* >. All requirements pertaining to this portion of work have been satisfied to include, but not be limited to, as-builts plans, all certifications and approvals for that portion of work related to the partial bond release have been provided by applicant's Engineer and approved by <*local jurisdiction* >.The procedures used for partially releasing performance bonds must be specified by the <*local jurisdiction*> in writing prior to the approval of a stormwater management design plan.

2.3 Construction Inspection Requirements

2.3.1 Inspection Schedule and Reports

Prior to the approval of a SWMP, the applicant will submit a proposed construction inspection schedule. The <*local jurisdiction*> will review the schedule to determine if changes are required. The construction schedule should reflect the construction sequences defined in each BMP section Stormwater Best Management Practices (BMPs) of this Manual. The construction and inspection schedule must be included in the SWMP. The <*local jurisdiction*> will conduct inspections and file reports of inspections during construction of BMPs and site stormwater conveyance systems to ensure compliance with the approved plans.

Note: No stormwater management work may proceed past the stage of construction that the <*local jurisdiction*> has identified as requiring an inspection unless

- the <*local jurisdiction*> has issued an "approved" or "passed" report;
- the <*local jurisdiction*> has approved a plan modification that eliminates the inspection requirement; or
- the <*local jurisdiction*> has eliminated or modified the inspection requirement in writing.

The <*local jurisdiction*> may require that the professional engineer responsible for sealing the approved SWMP, the professional engineer responsible for certifying the as-built SWMP, or, for a project entirely in the PROW, the officer of the contracting company responsible for certifying the Record Drawing be present during inspections.

If the <*local jurisdiction*> conducts an inspection and finds work that is not in compliance with the SWMP, the <*local jurisdiction*> will issue a written notice, and the applicant must take prompt corrective action. The written notice provides details on the nature of corrections required and the time frame within which corrections must be made.

2.3.2 Inspection Requirements Before and During Construction

The <*local jurisdiction*> construction inspection checklists for each BMP are provided in Appendix E Construction Inspection Checklists.

Preconstruction Meetings. These meetings are required prior to the commencement of any land-disturbing activities and prior to the construction of any BMPs. The applicant is required to contact the <*local jurisdiction*> to schedule preconstruction meetings three (3) days prior to beginning any construction activity subject to the requirements the <*local jurisdiction*>.

Inspections During Construction. The applicant is required to contact the <*local jurisdiction*> to schedule inspection three (3) days prior to any stage of BMP construction, or other construction activity, requiring an inspection. For large, complicated projects, the applicant and the <*local jurisdiction*> may agree during the preconstruction meeting to an alternative approach such as a weekly notification schedule. Any such agreement must be made in writing and signed by all parties. The <*local jurisdiction*> will revert to the 3-day notification procedure if the agreement is not followed.

During construction, the <*local jurisdiction*> **may require the presence of the professional engineer responsible for sealing the approved SWMP; the professional engineer responsible for certifying the as-built SWMP; or for a project entirely in the PROW, the officer of the contracting company responsible for certifying the Record Drawing.**

Final Inspection. The applicant is required to contact the <*local jurisdiction*> to schedule a final inspection one week prior to the completion of a BMP construction to schedule a final inspection of the BMP. Upon completion of the BMP, <*local jurisdiction*> will conduct a final inspection to determine if the completed work was constructed in accordance with approved plans.

Inspection Requirements by BMP Type. Chapter 4 Stormwater Best Management Practices (BMPs) of this Manual provides details about the construction sequences for each BMP. After holding a preconstruction meeting, regular inspections will be made at the following specified stages of construction:

- **Infiltration Systems and Bioretention Areas** shall be inspected at the following stages to ensure proper placement and allow for infiltration into the subgrade:
  (a) During on-site or off-site percolation or infiltration tests;
  (b) Upon completion of stripping, stockpiling, or construction of temporary sediment control and drainage facilities;
  (c) Upon completion of excavation to the subgrade;

(d) Throughout the placement of perforated PVC/HDPE pipes (for underdrains and observation wells) including bypass pipes (where applicable), geotextile materials, gravel, or crushed stone course and backfill; and
(e) Upon completion of final grading and establishment of permanent stabilization;

- **Flow Attenuation Devices**, such as open vegetated swales upon completion of construction;
- **Retention and Detention Structures**, at the following stages:

(a) Upon completion of excavation to the sub-foundation and, where required, installation of structural supports or reinforcement for structures, including but not limited to the following:
  - Core trenches for structural embankments;
  - Inlet-outlet structures and anti-seep structures;
  - Watertight connectors on pipes; and
  - Trenches for enclosed stormwater drainage facilities;

(a) During testing of the structure for watertightness;
(b) During placement of structural fill and concrete and installation of piping and catch basins;
(c) During backfill of foundations and trenches;
(d) During embankment construction; and
(e) Upon completion of final grading and establishment of permanent stabilization.

- **Stormwater Filtering Systems**, at the following stages:

(a) Upon completion of excavation to the sub-foundation and installation of structural supports or reinforcement for the structure;
(b) During testing of the structure for watertightness;
(c) During placement of concrete and installation of piping and catch basins;
(d) During backfill around the structure;
(e) During prefabrication of the structure at the manufacturing plant;
(f) During pouring of floors, walls, and top slab;
(g) During installation of manholes/trap doors, steps, orifices/weirs, bypass pipes, and sump pit (when applicable);
(h) During placement of the filter bed; and
(i) Upon completion of final grading and establishment of permanent stabilization.

- **Green Roof Systems**, at the following stages:

(a) During placement of the waterproofing layer, to ensure that it is properly installed and watertight;
(b) During placement of the drainage layer and drainage system;
(c) During placement of the growing media, to confirm that it meets the specifications and is applied to the correct depth (certification for vendor or source must be provided);
(d) Upon installation of plants, to ensure they conform to the planting plan (certification from vendor or source must be provided); and
(e) At the end of the first or second growing season, to ensure desired surface cover specified in the Care and Replacement Warranty has been achieved.

2.3.3 Final Construction Inspection Reports

The *<local jurisdiction>* will conduct a final inspection to determine if the completed work is constructed in accordance with approved plans and the intent of this Manual and the Stormwater Ordinance. Within 21 days of the final inspection, the applicant must submit an as-built package, including one PDF copy of the as-built SWMP certified by a registered professional engineer licensed in the State of South Carolina

and one As-Built certification from Appendix O Certification Forms and Templates. For a project consisting entirely of work in the PROW, the submission of a Record Drawing certified by an officer of the project contracting company is acceptable if it details the as-built construction of the BMPs, related stormwater infrastructure, and land covers.

A registered professional engineer licensed in South Carolina is required to certify as-built SWMPs and state that all activities including clearing, grading, site stabilization, the preservation or creation of pervious land cover, the construction of drainage conveyance systems, the construction of BMPs, and all other stormwater-related components of the project were accomplished in strict accordance with the approved SWMP and specifications. As stated in Section 2.2.2 Resubmission of Stormwater Management Plans, all plan changes are subject to the *<local jurisdiction>* approval. The as-built certification must be on the original SWMP.

Upon completion, these plans will be submitted to the *<local jurisdiction>* for processing. The estimated time for processing will be two weeks (10 working days), after which the plans will be returned to the engineer. The *<local jurisdiction>* will provide the applicant with written notification of the final inspection results.

2.3.4 Inspection for Preventive Maintenance

The Stormwater Ordinance requires maintenance inspections for BMPs and landcovers to ensure their ongoing performance is in compliance with their original design. The inspection will occur at least once every three (3) years. Maintenance inspection forms are provided in Appendix F Maintenance Inspection Checklists. The *<local jurisdiction>* will conduct these maintenance inspections, though it may, in certain circumstances, allow a property to self-inspect and provide documentation.

The *<local jurisdiction>* will maintain maintenance inspection reports for all BMPs. The reports will evaluate BMP functionality based on the detailed BMP requirements of Stormwater Best Management Practices (BMPs) and inspection forms found in Appendix F Maintenance Inspection Checklists.

If, after an inspection by the *<local jurisdiction>*, the condition of a BMP presents an immediate danger to the public safety or health because of an unsafe condition or improper maintenance, the *<local jurisdiction>* will take such action as may be necessary to protect the public and make the BMP safe. Any costs incurred by the *<local jurisdiction>* will be assessed against the owner(s).

2.4 Inspections and Maintenance

2.4.1 Inspections and Maintenance Responsibility

A site with an approved SWMP must also have a responsible party inspect and maintain the BMPs and land covers according to the inspections and maintenance schedule in the SWMP and this Manual. Land covers must be maintained in type and extent as approved. Approved BMPs must be kept in good condition, including all the engineered and natural elements of each practice, as well as conveyance features (e.g., grade surfaces, walls, drains, structures, vegetation, soil erosion and sediment control measures, and other protective devices). All repairs or restorations must be in accordance with the approved SWMP.

A declaration of covenants including an exhibit stating the owner's specific maintenance responsibilities must be recorded with the property deed at the Record of Deeds. An inspection and maintenance schedule for any BMP will be developed for the life of the project and shall state the inspection and maintenance to be completed, the time for completion, and who will perform the inspections and maintenance. The schedule will be printed on the SWMP and will appear as an exhibit in the declaration of covenants.

2.4.2 Inspection and Maintenance Agreement

Inspection and maintenance obligations are binding on current and future owners of a property subject to recorded covenants. The *<local jurisdiction>* will not issue final approval of a complete set of the SWMP for private parcels until the applicant has executed a declaration of covenants providing notice of this obligation to current and subsequent owners of the land served by the BMP(s) and land covers. Inspection and maintenance agreements by regulated projects include providing access to the site and the BMP(s) at reasonable times for regular inspection by the *<local jurisdiction>* and for regular or special assessments of property owners, as needed, to ensure that the BMP(s) is maintained in proper working condition and the land covers are retained as approved in the SWMP. An example of the declaration of covenants/maintenance agreement for a site with BMPs and designated land covers is provided at the end of this chapter.

The applicant must record the agreement as a declaration of covenants with the *<local jurisdiction>* Recorder of Deeds. The agreement must also provide that, if after written notice by the *<local jurisdiction>* to correct a violation requiring maintenance work, satisfactory corrections are not made by the owner(s) of the land served by the BMP within a reasonable period of time, not to exceed 45 to 60 days unless an extension is approved in writing by the *<local jurisdiction>*. The *<local jurisdiction>* may perform all necessary work to place the BMP in proper working condition. The owner(s) of property served by the BMP will be assessed the cost of the work and any penalties, and there will be a lien on any property served by the BMP, which may be placed on the tax bill and collected as ordinary taxes by the State.

2.5 As Built Submittals

As-built documentation for stormwater management structures, BMPs and detention shall be submitted to the <local jurisdiction> as required by the procedure for handling close out documents for private development projects. The following items must be completed and provided:

General Information:

- Words As-Built in or near the jo title
- As-Built Signature/Approval block on each sheet
- As-builts shall have a coordinate system based on the South Carolina Coordinate System North American Datum of 1983 (NAD83).
- Elevations shown shall be based on the North American Vertical Datum of 1988 (NAVD88).
- Vicinity map
- Sheets numbered correctly
- Project ID number, Project Name, Permit number and name, address and contact information of project engineer
- All measurements and coordinates shall be shown on all drainage structures, detention and BMP structure outlets, outlet control structures and manholes.
- Any change to BMP capacities, dimensions, specifications or location shall be shown as markthrough of the original design on the drawings
- Elevations to the nearest 0.1 ft.

Basins:

- At least two benchmarks on the plans
- Profile of the top of berm
- Cross-section of emergency spillway at the control section
- Profile along the centerline of the emergency spillway

- Cross-section of berm at the principle spillway
- Elevation of the principle spillway crest or top of structure elevations
- Elevation of the principle spillway inlet and outlet invert
- Riser diameter/dimensions and riser base size
- Diameter, invert elevation and sizes of any stage orifices, weirs or storm drain pipes
- Barrel diameter, length and slope
- Types of material used
- Outfall protection length, width, depth, size of rip rap and filter cloth
- Size, location, and type of anti-vortex and trash rack device (height and diameter, elevations and spacing)
- Pipe cradle information
- On plan view show length, width and depth of pond and contours of the basin area so that design volume is specified
- As-built spot elevations with the disturbed area required for basin construction in sufficient detail to provide accurate as-built contours
- Core trench limits and elevation s of bottom of cut off trench
- Show length width and depth of outfall rip rap
- Certification by a Geotechnical Engineer for compact and unified soil classes
- Vegetation cover certification
- Show location of planted landscaping
- Utility locations and elevations encountered, test pitted and/or relocation during contract work

Storm Drain Piping:

- At least two benchmarks on the plans
- Diameter and class of pipe
- Invert of pipe at outfall, structures and/or field connections
- Slope of pipe
- Pipe lengths (show stationing)
- Types of materials
- Location of all pipes and structures horizontally on the plan
- Length, width and depth of all rip rap and other outfall protection as specified
- Elevation of rip rap at outfall and at changes in grade
- Utility locations and elevations encountered, test pitted and/or relocation during contract work

2.6 Supporting Forms

The following forms found in Appendix O must be included in the plan sheets and a copy submitted to support the <*local jurisdiction*> review and approval of SWMPs.

- As-Built Certification by Professional Engineer Form.
- Statement by Professional Engineer Registered in the State of South Carolina Form.
- Grading and Drainage Certification
- Extreme Flood Certification
- Statement by Person Responsible for Maintenance Form
- Statement by Person Responsible for Achieving Off-Site Retention Form
- Declaration of Covenants/Maintenance Agreement Template.

These forms are subject to change with the latest versions available at the <*local jurisdiction*>.

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