



**BERKELEY COUNTY
STORMWATER MANAGEMENT PROGRAM**

STORMWATER DESIGN STANDARDS MANUAL

Adopted December 1, 2009

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CHAPTER 1 – GENERAL INFORMATION

1.1 PURPOSE

It is the purpose of this Manual and the Stormwater Management Ordinance to protect, maintain, and enhance water quality and the environment of Berkeley County and the short-term and long-term public health, safety, and general welfare of the citizens of Berkeley County. This Manual is also designed to minimize property damage by establishing requirements and procedures to control the potential adverse effects of increased stormwater runoff and related pollutant loads associated with both future development and existing developed land. Proper management of stormwater runoff will further the purpose of this Manual and the Stormwater Management Ordinance to ensure a functional drainage system, reduce the effects of development on land and stream channel erosion, attain and maintain water quality standards, enhance the local environment associated with the drainage system, reduce local flooding, maintain where necessary pre-developed runoff characteristics of the area in terms of flow rate, volume and pollutant concentration, and facilitate economic development while mitigating associated pollutant, flooding, erosion, and drainage impacts.

This Manual describes the policies and procedures used by the County Engineer to implement the Stormwater Management Ordinance and elements of the County's Stormwater Management Program (SWMP). These standards and procedures will:

1. Clearly describe the stormwater management plan and Construction Activity Application requirements and approval process as it relates to stormwater management;
2. Convey the technical design standards to the engineering community, to include standards which address flow rates, runoff volume, and pollutant load/concentration, as well as specific standards during construction and for long-term performance;
3. Provide general information on approaches to improve water quality, prevent illicit discharges, and minimize stormwater runoff impacts due to development and re- development;
4. Convey other protection provisions related to stormwater discharges such as wetlands and watercourse conservation;

Every effort has been made throughout this Manual to cover the common conditions and information needed by those involved in construction activities, however, these design standards and the County ordinances should be reviewed carefully to ensure that all requirements are being met. Developments may also be impacted by State and Federal requirements to include, but not be limited to, the NPDES Phase II Construction General Permit for Stormwater Discharges from Large and Small Construction Activities (CGP). Those projects not subject to NPDES requirements must still comply with applicable County ordinances and standards.

1.2 SCOPE

The scope of this Manual is limited to the requirements related to stormwater management as reviewed and approved by the Berkeley County Engineer. This Manual is not intended as a textbook or a comprehensive engineering design reference. It was instead developed under the assumption that the user possesses a basic understanding of stormwater control design, construction, or land development depending on the user's particular area of expertise. References to guidance documents from Federal,

State, and local agencies, as well as commercial products are given throughout this Manual to provide additional information to users. Two common examples are the Natural Resources Conservation Service's (NRCS) TR-55 and SCDHEC's Best Management Practices (BMP) Manual.

The design standards are not intended to restrain or inhibit engineering creativity, freedom of design, or the need for engineering judgment. When shown to be applicable, it is encouraged that new methods, techniques, and innovative stormwater BMPs be submitted with supporting documentation. However, the use of such approaches should be substantiated with submitted documentation by design professionals showing that the proposed design is equal to, or exceeds the traditional procedures in terms of performance and economic feasibility.

On projects that require site specific designs pertaining to stormwater management and water quality, site plans, details, calculations, construction specifications, and other technical documents must be signed and sealed by a professional engineer licensed in the state of South Carolina, with sufficient knowledge and experience to accomplish all design elements of the site plan. Users who are not justly qualified by education or experience in the fields of stormwater management design, construction, or land development should consult with a qualified professional in one or more of these areas prior to planning for construction activities.

1.3 MANUAL ORGANIZATION

The design standards are divided into five (5) chapters, organized to present recommended technical and engineering procedures along with criteria obtained from local, State, and Federal regulations. The remainder of this chapter provides information on the County's authority to develop and enforce design requirements along with several legal matters, some background information on stormwater management and its importance, and definitions for terms used throughout this Manual. Chapter 2 describes the process for obtaining stormwater approval. Chapter 3 contains specific design requirements and criteria. Chapter 4 describes the inspection and enforcement process. Chapter 5 contains references for designing components of the stormwater management system.

1.4 AUTHORIZATION

This Manual has been prepared under the direction of the County Engineer, who has been granted the authority to develop engineering design standards and enact programs and policies to ensure compliance with the NPDES Phase II General Permit for Stormwater Discharges from Regulated Small Municipal Separate Storm Sewer Systems (MS4s), SCR030000, and the County's pertinent ordinances.

1.4.1 NPDES MS4 GENERAL PERMIT SCR030000

Berkeley County, like many other counties and municipalities across the United States, is required to have an NPDES MS4 permit to discharge stormwater. Because construction activities contribute to the discharge of pollutants, the NPDES MS4 permit requires that Berkeley County encourage, promote, and implement certain practices, programs, and procedures for the purpose of reducing or limiting discharge of pollutants to waters of the State. The permit requires that Berkeley County develop and implement a Stormwater Management Program to control the discharge of pollutants from its MS4 to the maximum extent practicable (MEP). The SWMP has several components that must be met and this Manual provides partial compliance with several, including construction and post-construction management, illicit discharge detection, and public education. The MS4 permit can be found at:

<http://www.scdhec.net/environment/water/docs/scs000000.pdf>.

1.4.2 BERKELEY COUNTY ORDINANCES, REGULATIONS, AND STANDARDS

Berkeley County has developed and adopted ordinances and standards, largely based on State and Federal regulations, specifically to address concerns associated with uncontrolled stormwater runoff. The principal ordinances and standards for the County that affect the land development selection of stormwater control measures are:

1. **Stormwater Management Ordinance:** Established the engineering design standards and procedures for obtaining a stormwater approval within Berkeley County. The County Engineer was authorized by this Ordinance to develop all necessary regulations, as detailed in this Manual for properly controlling stormwater runoff and mitigating existing and future impacts;
2. **Zoning and Land Development Regulations Ordinances:** Issues that may be impacted by these Ordinances when designing stormwater management systems include but are not limited to: limits on building density, buffer and setback requirements, parking lot islands, required parking spaces, tree protection, planting species selection, and screening requirements for ponds and other BMPs. Applicants should specifically check to make sure a desired development type is allowed in the planned location;
3. **Building & Codes and Floodplain Ordinances:** These Ordinances implement and enforce all applicable provisions of the building codes and floodplain management regulations.

1.5 UPDATES TO THE DESIGN STANDARDS

This Manual is subject to updates. As design technology and criteria evolve or change or it becomes evident that additional measures are needed to ensure the public general welfare, the Manual will be updated as needed. Updates will be approved by the County Engineer. Users of this manual are encouraged to provide comments on the content of this manual at anytime in writing to the County Engineer. The comments shall include proposed changes, reasoning, and justification (including any supporting technical documents supporting the changes). All comments will be considered during manual updates. This Manual can also be found on the Berkeley County website at <http://www.berkeleycountysc.gov/>.

1.6 STORMWATER MANAGEMENT

Development has the potential to alter the natural drainage patterns, flow rates and volumes, and quality of the County's water resources. Traditional solutions have removed stormwater as efficiently as possible, while maintaining runoff quantity controls. The following sections discuss these impacts and the design considerations that are available and encouraged.

1.6.1 EFFECTS OF DEVELOPMENT ON WATERSHED HYDROLOGY

Development and urbanization have the following impacts on receiving waterbodies:

- Changes to Stream Flow;
 - Increased runoff volumes;
 - Increased peak runoff discharges;
 - Greater runoff velocities;

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- Increased flooding frequency;
 - Lower dry weather flows (base flow);
 - Increase in floodplain elevation;
 - Changes to Stream Geometry;
 - Stream channel enlargement;
 - Stream down cutting;
 - Changes in channel bed due to sedimentation;
 - Degradation of Aquatic Habitat;
 - Degradation of habitat structure;
 - Decline in stream biological functions;
 - Water Quality Impacts;
 - Reduced oxygen in streams;
 - Microbial contamination;
 - Hydrocarbons and toxic materials;
 - Sedimentation;
 - Property damage and safety concerns;
 - Unsightly aesthetic stream channel conditions and restricted use of recreational waters.

1.6.2 STEPS TO SUCCESSFUL STORMWATER MANAGEMENT PLANS

Proper planning is necessary to ensure that stormwater management is considered and fully integrated at the various stages of the site-development process. This involves a comprehensive approach to site planning and a thorough understanding of the physical characteristics and resources associated with the project site. This planning includes addressing each of the following categories:

- Stormwater quantity controls;
- Erosion and sediment controls;
- Stormwater quality controls;
- Stormwater conveyance controls;
- Maintenance plans and schedules for construction and post construction activities.

The design of successful stormwater management plans involves adhering to the following principles, where applicable:

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- Pre-submittal site meeting/site visit;
 - Review of site development requirements;
 - Detailed site analysis and supporting calculations;
 - A thorough knowledge of the impacts the stormwater system may have on the watershed;
 - Creation of a Stormwater Master Plan;
 - Design aspects of the stormwater management plans;
 - Approval and completion of the Construction Activity Application.

In Chapter 2, the procedure for including the necessary documentation for a complete stormwater management plan and Construction Activity Application is provided.

1.6.3 INNOVATIVE DESIGN APPROACH

Innovative approaches to site design focus on source control for stormwater runoff that limit the amount of runoff generated for a BMP to control. When designing for land disturbance activities, the design must address the following four categories of control: water quantity (flood control), design storm control (rate and volume), erosion prevention and sediment control, and pollution control (water quality standards). If an innovative stormwater design approach is to be used, the design professional should take the following considerations in mind, in addition to meeting these categories of control:

- Stormwater quantity and quality are best controlled at the source of the problem by reducing the potential maximum amount of runoff and pollutants. Source control will typically be more economical in order to treat the first flush of a storm event since a simple BMP for a large area will only treat the first flush from the closest portions of the site;
- Best management practices (BMPs) address stormwater management by using simple, structural and nonstructural methods along with or in place of traditional stormwater management structures when applicable;
- Equaling or exceeding traditional stormwater management designs in terms of performance (rate/volume attenuation, pollutant removal) and economic feasibility (long-term) are essential to a proposed concept's eventual approval.

1.6.4 BEST MANAGEMENT PRACTICES AND SITE PLANNING PROCESS

The first step in addressing stormwater management begins in the site planning and design stage of the development project. By implementing BMPs during the site planning process, the amount of runoff and pollutants generated from a site can be reduced by minimizing the amount of impervious area and utilizing natural on-site treatments. The minimizing of adverse stormwater runoff impacts by the use of BMPs and site planning should be a major consideration for a design professional.

The reduction of runoff volumes and stormwater pollutants decreases the total number and size of stormwater management controls that must be implemented under the guidelines set forth in this Manual.

BMPs reduce the amount of total post-development impervious areas and maintain natural characteristics of the pre-development site conditions. Therefore, the post-development curve numbers and time of concentrations are maintained more closely to the pre-development conditions. This reduces the overall hydrologic and hydraulic impact of the development.

1.6.4.1 MAINTAINING SITE RESOURCES AND NATURAL UNDISTURBED AREAS

Conservation of site resources and natural undisturbed areas helps to reduce the post development runoff volume and provides areas for natural stormwater management. Some natural site resources that should be maintained include, but are not limited to:

- Natural drainageways;
- Vegetated buffer areas along natural waterways;
- Floodplains;
- Areas of undisturbed vegetation;
- Low areas within the site terrain;
- Natural forested infiltration areas;
- Wetlands.

1.6.4.2 LOWER IMPACT SITE LAYOUT TECHNIQUES

Lower impact site layout techniques involve identifying and analyzing the location and configuration of structures on the site to be developed. Where applicable, the following options that create lower impact layouts should be used:

- Fit the design layout to follow the natural contours of the site to minimize clearing and grading and preserve natural drainage ways and patterns;
- Limit the amount of clearing and grading by identifying the smallest possible area on the site that would require land disturbance;
- Place development areas on the least sensitive areas of the site and avoid steeply sloped areas when possible;
- Utilize nontraditional designs to reduce the overall imperviousness of the site by providing more undisturbed open space and minimizing clear-cutting;
- Consider the utilization of cisterns and rain barrels to collect stormwater for reuse;
- Level spreaders or other energy dissipation devices should be used at all discharge points including discharge points into ponds and other basin-type BMPs. More information on these devices is provided in Chapter 3.

1.6.4.3 MINIMIZATION OF IMPERVIOUS COVER

The minimization of total impervious area directly relates to a reduction in stormwater runoff volume and the associated pollutants from a development site. The amount of impervious cover on a site can be reduced by the following techniques where applicable:

- Reduce building footprints by constructing some buildings as multi-story;
- Reduce parking lot areas and use porous/pervious pavement surfaces for desired overflow parking where feasible;
- Increase the amount of vegetated parking lot “islands” that can also be utilized for stormwater management practices such as bioretention areas;
- Disconnect impervious surfaces by directing runoff to adjacent pervious areas so that runoff can be filtered and infiltrated.

1.6.4.4 UTILIZATION OF NATURAL FEATURES FOR STORMWATER MANAGEMENT

Structural stormwater drainage controls are traditionally designed to quickly remove stormwater runoff from the site without utilizing any of the natural storage areas. These natural drainage areas should be considered as potential stormwater drainage systems. These natural areas can be utilized in the following ways where applicable:

- Vegetated buffers and undisturbed areas on the site are useful to control sheet flow (not concentrated flows) by providing infiltration, runoff velocity reduction, and pollutant removal;
- Various natural drainageways should be maintained and not disturbed to provide a natural stormwater drainage system to carry runoff to an existing outlet. The use of natural drainageways allows for more storage of stormwater runoff, lower peak flow rates, a reduction in erosive runoff velocities, and the capture and treatment of pollutants;
- Use vegetated swales where appropriate;
- Curb and gutter systems may be combined with vegetated swales at outfalls to provide added water quality benefits versus the traditional piped outfall designs;
- When applicable, direct rooftop runoff to pervious natural areas for water quality treatment and infiltration instead of connecting rooftop drains to roadways and other structural stormwater conveyance systems.

1.6.4.5 ENGINEERED/PROPRIETARY DEVICES

Berkeley County is aware of the potential benefit in using a number of stormwater engineered devices currently available on the market, such as baffle boxes, cartridge filters, bioretention, and sock and tube erosion control devices. The County Engineer will evaluate any and all such devices specified for a given product and require appropriate drawings, specifications, and discussions as to the applicability of the product, expected performance, and required maintenance. The County Engineer reserves the right to request that certain devices be installed and maintained.

1.7 ENGINEERING DESIGN ACCOUNTABILITY

This Manual will assist engineers, plan reviewers, inspectors, and contractors in the design and layout of most land disturbance projects. However, this Manual does not replace or otherwise excuse the need for professional engineering judgment and knowledge. The user of this Manual is hereby cautioned that many aspects of engineering design must be considered, including but not limited to:

- Public health and safety;
- Site-specific conditions or unusual features of a project site that warrant special designs;
- Current versions of design texts, manuals, technical documents, and research.

The design engineer (with assistance from other design professionals as needed) is expected to thoroughly investigate field conditions and coordinate all design efforts with Berkeley County.

For applicable projects, construction plans must be stamped and signed by a professional engineer licensed in the state of South Carolina, unless otherwise stated in this Manual. The design professional must have sufficient education and experience to perform a complete and thorough design of each element shown on the construction plans, and must also have complete control to change or alter plans during the design phase. The professional's stamp is a public guarantee that his design has the highest regard for health and safety, protects the environment (air, soil, water) to the maximum degree possible, and serves the interests of the general public within Berkeley County. A Certificate of Authorization (COA) is required on the construction plans in addition to the design professional's certification.

Berkeley County requires a certain level of design expertise for stormwater calculations and flooding analyses. Stormwater design criteria are based upon current scientific knowledge and engineering judgment. It should be realized by engineering designers that floods and flooding may occur at any time due to any number of factors beyond the reasonable control of Berkeley County, such as: greater amounts of precipitation or different rainfall patterns than used in design storms, wet soil conditions, debris or blockage of key stormwater channels, high groundwater tables, etc.

1.8 LEGAL ASPECTS

If any portion of this Manual is ruled to be invalid or unconstitutional by any court with adequate jurisdiction over Berkeley County, then such portion shall be considered to have been selectively removed from the design standards without affecting this Manual's overall applicability and legal standing to the land disturbance process. This Manual will be revised on a periodic basis to reflect known changes to laws and regulations. All local, State, and Federal laws and regulations shall be considered in regards to this Manual. In each instance, the more restrictive requirement shall govern unless sound engineering judgment can determine and prove that the more restrictive requirement would be otherwise unnecessary. In most instances, laws and regulations that are phrased more explicitly shall apply over those items that are described in general terms.

1.9 CONTACT INFORMATION

The following Berkeley County personnel should be contacted for any questions, clarifications, or other information related to stormwater management and this Manual.

Primary contact for stormwater issues:

Mr. Frank Carson
Berkeley County Engineer
PO Box 6122
Moncks Corner, S.C. 29461-6120
(843) 719-4179
fcarson@berkeleycountysc.gov

1.10 DEFINITIONS

Words used in this Manual shall have their customary meanings as determined by the standard dictionary definition except for the following specific words and terms which are herein defined or are otherwise defined in the Berkeley County Stormwater Management Ordinance. In any case, the County Engineer shall have the right to define or interpret any other word or term contained within this Manual. The rules of verbal construction found in the Stormwater Management Ordinance apply to this Manual.

1. **Applicant:** "Applicant" is a person, firm, governmental agency, partnership, or any other entity who seeks to obtain approval under the requirements of this Ordinance and who will be responsible for the land disturbing activity and related maintenance thereof.
2. **Building:** (1) a relatively permanent enclosed structure over a plot of land, having a roof and usually windows and often more than one level, used for any of a wide variety of activities, as living, entertaining, or manufacturing; (2) anything built or constructed; (3) the act, business, or practice of constructing houses, office buildings, etc.
3. **Construction Activity:** activity involving clearing, grading, transporting, filling, or any other activity which results in a change in the natural cover or topography that may cause erosion and contribute to sediment and alter the quality and quantity of stormwater runoff.
4. **Construction Activity Application:** means the set of drawings, specifications, design calculations, and other documents necessary to demonstrate compliance with the Stormwater Management Ordinance.
5. **Contour:** an imaginary line, or its representation on a contour (topographic) map, joining points of equal elevation.
6. **Control/Outlet structure:** stormwater management facility designed to regulate the elevation, rate, and volume of stormwater discharge from detention facilities.
7. **Culvert:** any structure not classified as a bridge which provides an opening under any roadway, including pipe culverts, and any structure so named in the plans.
8. **Detention:** the collection and storage of stormwater runoff in a surface or sub-surface facility for subsequent controlled discharge to a watercourse or water body.

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9. Developer: any person, or others who act in his own behalf, that is required to submit an application for approval to disturb land or encroachment and is thereafter responsible for maintaining compliance with this Ordinance and conditions of the approved application.
 10. Ditch: a drainage channel in earth created by natural or artificial means to convey surface and/or subsurface water, flowing continuously or intermittently.
 11. Drainage: a general term applied to the removal of surface or subsurface water from a given area either by gravity via natural means or by systems constructed so to remove water, and is commonly applied herein to surface water.
 12. Elevation: height in feet above a given known datum, such as mean sea level.
 13. Embankment or Fill: a deposit of soil, rock or other material placed by man.
 14. Grading: any displacement of soil by stripping, excavating, filling, stockpiling, or any combination thereof, including the land in its excavated or filled state.
 15. Impervious surface: a surface which has been compacted or covered with a layer of material so that it is highly resistant to infiltration by water. The term includes most conventionally surfaced streets, roofs, sidewalks, parking lots, and other similar structures.
 16. Mean sea level (MSL): the average (mean) height of the sea or ocean, in reference to NAVD88.
 17. New-Development: any of the following actions undertaken by any person, including, without limitation, any public or private individual or entity:
 - (a) division of a lot, tract, or parcels or other divisions by plat or deed;
 - (b) the construction, installation, or alteration of land, a structure, impervious surface or drainage facility;
 - (c) clearing, scraping, grubbing or otherwise significantly disturbing the soil, vegetation, mud, sand or rock of a site; or
 - (d) adding, removing, exposing, excavating, leveling, grading, digging, burrowing, dumping, piling, dredging, or otherwise disturbing the soil, vegetation, mud, sand or rock of a site.
 18. Operator: means the person who is operating the property, including an operator or person who is in charge of any activity related to land disturbance, construction or post construction stormwater quality or quantity.
 19. Owner: means the property owner, or any person who acts in his own behalf, that submits an application for approval to disturb land or vegetation or for encroachment, and the person, if so designated by default or on legal documents, as the responsible party for maintenance of a stormwater management system(s) and/or facility(s).
 20. Post-Development Conditions: those conditions which are expected to exist, or do exist, after alteration, of the natural topography, vegetation, and rate, volume or direction of stormwater runoff, (resulting from development activity).
 21. Pre-Development Conditions: those conditions, in terms of the existing topography, vegetation and rate, volume or direction of stormwater runoff, which exist at the time the applicant submits an application form for a construction activity or variance.

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22. Project: improvements and structures proposed by the applicant to be constructed on a defined site as part of a common plan of development.
 23. Rate: volume of water passing a point per unit of times, generally expressed in cubic feet per second (cfs).
 24. Re-Development: see New-Development.
 25. Retention: the collection and storage of stormwater runoff without subsequent discharge to surface waters.
 26. Retrofit: the process of altering an existing drainage system to function properly or more efficiently than currently exists. Retrofitting will be a common method used by the County to address Total Maximum Daily Loads (TMDLs) to include installation of water quality/runoff treatment devices.
 27. Runoff: that part of rainfall that is not absorbed into the sites but flows over the site as surface waters.
 28. Sediment: fine, particulate material, whether mineral or organic, that is in suspension and is being transported, or has been transported, from its site of origin by water or air.
 29. Sedimentation: the process which operates at or near the surface of the ground, or deposits soils, debris and other materials either on other ground surfaces or in the waterbody.
 30. Sedimentation Facility: any structure or area which is designed to retain suspended sediments from collected stormwater runoff, to include sediment basins.
 31. Site: any tract, lot, or parcel of land or combination of tracts, lots, or parcels of land which are in common ownership, or are contiguous and in diverse ownership where development is to be performed as part of a unit, subdivision, or project.
 32. Site Construction: the act or process of altering the natural cover or topography and alters the quality or quantity of stormwater runoff.
 33. Special Protection Areas: designated areas within the County within which more stringent design standards have been established to address an existing problem, such as flooding or water quality. Construction activities occurring within these areas will be required to comply with the additional or more stringent design criteria.
 34. Storm Frequency: rate of likely recurrence of a rainstorm over a period of specified time.
 35. Stormwater Management Plan: the plan to manage stormwater in terms of collection, conveyance, storage, treatment and disposal of stormwater runoff in a manner to meet the objectives of the County Stormwater Management Ordinance, the Manual and their terms, including, but not limited to, measures that control the increased volume and rate of stormwater runoff and water quality impacts caused by man-made changes to the land. This plan is approved as detailed in this document and includes the engineering calculations and construction drawings.
 36. Structures: anything constructed or erected, the use of which requires a location on the ground, or attached to something having a location on the ground, including, but not limited to, tennis courts, swimming pools, fences, and buildings.

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37. Subdivision: all divisions of a tract or parcel of land into two or more lots, building sites, or other divisions for the purpose, whether immediate or future, of sale, lease, or building development, and includes all division of land involving a new street or change in existing streets, and includes re-subdivision which would involve the further division or relocation of lot lines of any lot or lots within a subdivision previously made and approved or recorded according to law; or, the alteration of any streets or the establishment of any new streets within any subdivision previously made and approved or recorded according to law, and includes combination of lots of record
38. Vegetation: all plant growth, especially trees, shrubs, mosses, and grasses.
39. Wetlands: those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions and delineated as freshwater wetlands by the U.S. Army Corps of Engineers.

CHAPTER 2 – STORMWATER APPROVAL PROCEDURES

This chapter provides developers, owners, engineers, contractors, and others with the information needed to obtain approval from the County Engineer as required for certain construction activities within the Berkeley County Regulated Area and encompassed municipalities as authorized under intergovernmental agreements. This section describes conditions when stormwater management plan approval is required, when Construction Activity Application (CAA) approval is required, and the procedures that apply to different situations, application package requirements, and when and if waivers of such requirements are applicable for certain activities.

2.1 DUTY TO COMPLY

Stormwater management plan approval is required for all construction activities within the Regulated Area, other than Single Family Residential (SFR) disturbing less than one-half (1/2) acre. In addition, CAA approval is required for all construction activities within the Regulated Area disturbing one-half (1/2) acre or more. Unless otherwise allowed by the Stormwater Management Ordinance or this Manual, the surface of land in Berkeley County shall not be disturbed or altered for any purpose whatsoever, nor any major drainage channel or component of the stormwater system impeded or encroached upon without approval from the County Engineer.

2.2 STORMWATER APPROVAL AND CONSTRUCTION ACTIVITY CLOSEOUT PROCEDURES

Stormwater management plans and Construction Activity Applications (CAAs) must be submitted to the Berkeley County Engineering Department (see the contact information in Chapter 1, Section 1.9) for approval. Stormwater management plans and applications that require other permit/certification coverage (such as but not limited to Coastal Zone Consistency Determination, 401 Water Quality certification and Navigable waters permit) from any State or Federal agency, can be processed simultaneously during County stormwater management plan review. The remainder of this Manual describes the procedures and application requirements of the County Engineer.

The County Engineer has established three (3) categories of Construction Activity:

1. Construction Activity for sites disturbing one-half (1/2) acre or more (Section 2.2.1).
2. Construction Activity for sites disturbing less than one-half (1/2) acre (Section 2.2.2).
3. Single Family Residential (SFR) disturbing less than one-half (1/2) acre (Section 2.2.3).

Stormwater management plans and applications required in this Manual shall be considered complete only if they are submitted in the required format, include all applicable information, and are accompanied by the established fee(s). Any stormwater management plan or application that is determined to be incomplete shall be returned to the applicant along with an explanation of the application's deficiencies. Fees shall not be refunded. No further processing of the stormwater management plan or application shall occur until the deficiencies are corrected. Once the deficiencies are corrected, the stormwater management plan or application may be resubmitted without the payment of additional fees, provided that it is resubmitted within six (6) months of the date that the stormwater management plan or application was returned to the applicant. A stormwater management plan and application resubmitted more than six (6) months after the date that the plan and application was returned as incomplete shall require repayment of applicable fees.

Whenever the procedures of the County expressly state that applications are to be submitted after a "pre-application conference," applicants shall be responsible for scheduling and attending such meetings. When pre-application conferences are required, an application shall not be accepted until the pre-application conference has been conducted, and any errors or omissions noted in review of the application for completeness have been addressed by the applicant.

2.2.1 CONSTRUCTION ACTIVITY FOR SITES DISTURBING ONE-HALF (1/2) ACRE OR MORE

All construction activity disturbing one-half (1/2) acre or more must submit a stormwater management plan and Construction Activity Application (CAA) to the Berkeley County Engineering Department. Construction shall not commence until the County approves the CAA. The approval process for CAA is shown in Appendix D. Submittal requirements are detailed below.

2.2.1.1 SUBMITTAL REQUIREMENTS

The following submittal requirements must be provided as part of a complete CAA to receive Berkeley County stormwater approval.

1. Application Form: The CAA is provided in Appendix A.
2. Technical Report: One (1) copy of the technical report should be prepared and submitted as part of the application package, prepared by a registered professional engineer. This report shall consist of maps, and supporting design calculations for the proposed stormwater system and erosion measures used during construction, to include, but not limited to, the following, when applicable:
 - a. Map: A map of the project area containing the following:
 - i. Site location drawing of the proposed project showing project location in relation to roadways, jurisdictional boundaries, streams, rivers, and lakes, and the boundary lines of the site to be developed,
 - ii. Identification of all areas within the site that will be included in the construction activities,
 - iii. Location of temporary and permanent stormwater management controls.
 - b. Site Narrative: A narrative should be submitted with the application which includes, but is not limited to, the following:
 - i. General description of the site,
 - ii. Purpose of the construction activity,
 - iii. Summary table(s) of existing and proposed runoff flows, volumes, and pollutant loads,
 - iv. Topographic and soil information,
 - v. Adjacent properties and owners,
 - vi. Waterbodies receiving stormwater runoff (existing and proposed),
 - vii. Water quality and flooding issues, and anticipated potential impacts (quality, downstream structures, etc.) and benefits (open space, treatment, maintenance, etc.),
 - viii. Anticipated starting and completion dates of the various stages of the construction activities and the expected date of final stabilization,
 - ix. If applicable, the narrative should also contain justification for variances, waivers, or other special conditions of the site,

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- x. Also, if applicable, wetland and water body disturbance issues should be discussed along with details on the status of necessary permit application to the USACOE,
 - xi. If a TMDL(S) is in place for the receiving waterbody, the narrative must describe how the project will comply with the TMDL(s).
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- c. Pre-development and post-development hydrologic analysis that determines the existing stormwater peak flow rates, flow velocities, and pollutant loads for all delineated sub basins/discharge points. The natural or historic condition will be the standard by which the stormwater plan for a construction project is evaluated. The stormwater plan must demonstrate control of runoff quantity and quality in accordance with design criteria provided in Chapter 3;
 - d. Hydraulic design calculations for all conveyances showing the ability to handle anticipated flows and volumes. Provide calculations showing that the project does not cause or increase any negative impact on downstream structures, and the upstream and downstream stormwater drainage system. The following computations should be included as necessary: hydrographs, routing of hydrographs through system components, pipe and open channel capacity, velocity calculations, and water surface elevations. Calculations and discussion shall be provided for energy dissipation and inlet/outlet protection devices. All system components should have standard details and specifications;
 - e. If the project is located in a Special Protection Area, a comprehensive evaluation of engineering calculations and analysis should be included that demonstrate that the project will not negatively impact current drainage conditions and/or comply with State and Federal regulations on stormwater discharges. More information is provided in Chapter 3;
 - f. Erosion and sediment control plan to include:
 - i. A description of the erosion and sediment control facilities selected,
 - ii. Plan showing the location of all erosion and sediment control facilities,
 - iii. Design calculations of each measure, including trapping efficiencies. Each measure should also have a standard detail and specification,
 - iv. Explanation/discussion of models used in the design.
 - g. Downstream analysis calculations showing the effect of post-development design flows on downstream storm water conveyance systems and channels. More details on this analysis and where it is applicable covered in Chapter 3;
 - h. Watershed delineation maps with consistent sequential notations;
 - i. Location map showing topography and waters of the state in relation to proposed project;
 - j. Discussion and calculation of any wetlands issues;
 - k. Map showing type and classification of all soils expected to be encountered or used at the development site;
 - l. Presentation of existing and proposed contours at the development site;

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- m. General description of the adjacent property and description of existing structures, buildings, and other fixed improvements located on surrounding properties;
 - n. Discussion of site access issues and easements to be obtained and provided to the County.

3. Construction Plans:

One complete set of certified and signed construction plans are to be included as part of the CAA. The information required on the construction plans shall include, but are not limited to the following list. Other items may be requested by the County Engineer on a case-by-case basis. Some items may be included in other components of the CAA application package, but should be adequately noted. Size D (24" X 36") Plan sheets/drawings are preferred.

- a. North arrow and scale,
- b. Property lines, bearings and distances, adjacent landowners' names, and land use conditions,
- c. Legend,
- d. Registered engineer's seal and signature,
- e. Certificate of Authorization seal, as appropriate,
- f. Existing and proposed contours (one foot contours) and land uses,
- g. Limits of disturbed area,
- h. Delineation of wetlands and/or waters of the state,
- i. Location of any and all FEMA floodplains,
- j. Easements,
- k. Stormwater system profiles with existing and proposed ground elevations,
- l. Construction sequence (include implementation of all stormwater and sediment controls in the first phase of construction),
- m. Locations of all temporary and permanent control measures,
- n. Details for all temporary and permanent control measures,
- o. Grassing and stabilization specifications and schedule,
- p. Maintenance requirements (for temporary and permanent controls, grassing, etc.),
- q. Construction entrance/exit,
- r. Tree protection, preservation, and overall landscaping plan with appropriate species selection and screening for ponds and other components required by the Zoning Ordinance,

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- s. Details and specifications of all necessary construction components,
 - t. Location map,
 - u. The cover sheet shall contain, at a minimum, the following items:
 - i. Project name,
 - ii. Engineers contact information (name, mailing address, telephone, fax),
 - iii. Contact information (name, mailing, address, telephone, fax) of the owner, operator or designated party,
 - iv. Vicinity map, and
 - v. Table of contents.
 - v. All drawing elevations shall be based on the NAVD 88 and projected in the state plane coordinate system.
 - w. The following standard notes shall be shown on the plans. This list is not meant to be exhaustive and other notes should be included as necessary:
 - i. If necessary, slopes which exceed eight (8) vertical feet should be stabilized with synthetic or vegetative mats, in addition to hydroseeding. It may be necessary to install temporary slope drains during construction. Temporary berms may be needed until the slope is brought to grade;
 - ii. Stabilization measures shall be initiated as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than fourteen days (14) after work has ceased, unless activity in that portion of the site will resume within twenty-one (21) days;
 - iii. All sediment and erosion control devices shall be routinely inspected every seven (7) days or every fourteen (14) days and after each rainfall occurrence that exceeds one-half inch. Damaged or ineffective devices shall be repaired or replaced, as necessary;
 - iv. Provide silt fence and/or other control devices, as may be required, to control soil erosion during utility construction. All disturbed areas shall be cleaned, graded, and stabilized with grassing as soon as practicable after the utility installation;
 - v. All erosion control devices shall be properly maintained during all phases of construction until the completion of all construction activities and all disturbed areas have been stabilized. Additional control devices may be required during construction in order to control erosion and/or offsite sedimentation. All temporary control devices shall be removed once construction is complete and the site is stabilized;
 - vi. The contractor must take necessary action to minimize the tracking of mud onto the paved roadway construction areas. The contractor shall daily remove mud/soil from pavement, as may be required;

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- vii. Residential subdivisions require erosion control features for infrastructure as well as for individual lot construction. Individual property owners shall follow these plans during construction.
 - viii. Temporary diversion berms and/or ditches will be provided as needed during construction to protect work areas from upslope runoff and/or to divert sediment laden water to appropriate traps or stable outlets.
 - ix. Litter, construction debris, oils, fuels and building products with significant potential for impact (such as stockpiles of freshly treated lumber) and construction chemicals (concrete washdown areas, paint brush cleaners, etc.) that could be exposed to stormwater must be prevented from becoming a pollutant source in stormwater discharges.
 - x. Provide written proof that all off-site easements have been obtained.
4. Subdivision projects disturbing one-half (1/2) acre or more must have a complete set of plans and specifications to include, but not be limited to, the following items, as appropriate: lot layout/site plan and staking, acreage, limits of disturbance, road plan/profiles, storm drainage plan/profile, pre and post development drainage areas (both on and off-site), sediment and erosion control plans and details, construction waste management, utilities (water and sanitary sewer), post-construction stormwater management facilities, and traffic patterns with temporary (construction) and permanent traffic signage. Plans shall provide existing and proposed contours with intervals of not more than one (1) foot. Where possible and as needed, contour lines should be extended beyond the site boundary lines. While some of these items lend themselves to combining information on a single sheet/drawing, care should be taken to ensure that plans are not overcrowded/cluttered. The lot layout sheet should show a tie distance from the primary entrance of the proposed project to the nearest existing intersection.
 5. All available or used bench marks shall be shown on this or other applicable sheet. At least one bench mark shall be available or established on/near (within survey instrument sight distance) the site. The bench mark shall be referenced to North American Datum (NAVD) 1988.
 6. The applicant will provide a tentative construction time schedule for the development. Sediment and erosion control measures will be some of the first work at a site and such implementation will be demonstrated. The schedule will also provide for coordination with the responsibilities of all parties, including those installing utilities.
 7. Specifications for all components of construction activities related to grading, utilities, sediment and erosion control, temporary and permanent vegetation, water quality BMPs, etc.
 8. Fees: No plan review or inspection fees are required at this time but it is anticipated that review/inspection fees will be adopted by the County.
 9. Covenants for Permanent Maintenance of Stormwater Systems and Maintenance Plans and Schedules: When stormwater management facilities and system components are to be maintained by an owner, operator, or other designated party, Berkeley County must be given assurance that such activities will be conducted. This is to be established using Berkeley County Covenants for Permanent Maintenance of Stormwater Systems (Covenants) to ensure that the stormwater management facilities are constructed, operated, and maintained by the owner, its successors and assigns, in accordance with the approved stormwater management plan and specifications identified

in the stormwater management plan. The Covenants must be recorded prior to the approval of the CAA in the Office of the Berkeley County Register of Deeds. If someone other than the owner is the responsible party for maintenance activities of stormwater management systems, a maintenance agreement between the operator and owner shall be included with the Covenants. The maintenance plan and schedules must be included in the stormwater management plan for all the activities to be conducted during and after construction for all stormwater system components.

2.2.1.2 PRE-SUBMITTAL MEETING

A pre-submittal meeting may be required for projects located in Special Protection Areas. Special Protection Areas are areas within the County that require some additional stormwater management controls due to existing problems. Such problems can include but are not limited to flooding and State recognized water quality impairments. The County Engineer may waive the pre-submittal meeting requirement on a case by case basis.

2.2.1.3 STORMWATER MASTER PLAN

For sites located in Special Protection Areas, a Stormwater Master Plan is required to be submitted prior to the submittal of the complete package as detailed below. This Master Plan is to be created to give the design professional the opportunity to propose a site layout and proposed stormwater controls to the County Engineer. The Master Plan should be submitted by hand or mail, and can be incorporated for discussion at the pre-submittal meeting. The County Engineer may waive the requirement for a master plan on a case by case basis.

The Master Plan can be a preliminary sketch of the site and shall contain the following items, when applicable:

1. Site layout showing buildings, roads, parking areas, utilities, and grassed or landscaped areas;
2. Vicinity map;
3. Pre- and post-development primary runoff patterns and discharge points;
4. Location/distances to Waters of the State and all other existing natural features such as wetlands, ponds, lakes, floodplains, and stream buffers;

In addition, the applicant should be prepared to discuss the following items, when applicable:

5. All modeling methodologies to be used;
6. Methods to show compliance with any adopted Total Maximum Daily Loads (TMDLs) or other waterbody impairments that may limit the allowable pollutant load that can be discharged;
7. Preliminary waiver or variance requests;
8. Others as requested by the County Engineer.

Upon submittal and discussion of the Master Plan and related concerns, the applicant can submit the complete CAA (items 1-11 in Section 2.2.2.1).

2.2.2 CONSTRUCTION ACTIVITY FOR SITES DISTURBING LESS THAN ONE-HALF (1/2) ACRE

All construction activities, other than SFR, disturbing less than one-half (1/2) acre must submit a stormwater management plan to the Berkeley County Engineering Department. A Construction Activity Application (CAA) is not required for this category of construction activity. Construction shall not commence until the County approves the stormwater management plan. Following is the submittal requirements for a stormwater management plan:

As a minimum the plan must include: location of property lines; existing and proposed structures; parking areas; buffer areas; wetlands; limits of disturbed areas; existing and proposed stormwater runoff patterns; location of 100-year flood plain; sediment and erosion control measures (silt fence, riprap, inlet protection, etc.); measures for construction waste management; location of existing and proposed stormwater management facilities. In addition, the construction activity shall implement and comply with the Minimum Stormwater Management BMPs (See Appendix E). Further guidance on selecting necessary erosion and sediment control measure controls is provided in

http://www.scdhec.gov/environment/ocrm/pubs/tech_docs_water.htm#bmp. The County Engineer may require additional stormwater BMPs and/or a stormwater management plan prepared by a registered engineer.

When stormwater management facilities and system components are to be maintained by an owner, operator, or other designated party, Berkeley County must be given assurance that such activities will be conducted. This is to be established using Berkeley County Covenants for Permanent Maintenance of Stormwater Systems (Covenants) to ensure that the stormwater management facilities are constructed, operated, and maintained by the owner, its successors and assigns, in accordance with the approved stormwater management plan and specifications identified in the stormwater management plan. The Covenants must be recorded prior to the approval of the stormwater management plan in the Office of the Berkeley County Register of Deeds. If someone other than the owner is the responsible party for maintenance activities of stormwater management systems, a maintenance agreement between the operator and owner shall be included with the Covenants. The maintenance plan and schedules must be included in the stormwater management plan for all the activities to be conducted during and after construction for all stormwater system components.

No plan review or inspection fees are required at this time but it is anticipated that review/inspection fees will be adopted by the County.

2.2.3 SINGLE FAMILY RESIDENTIAL CONSTRUCTION ACTIVITY FOR SITES DISTURBING LESS THAN ONE-HALF (1/2) ACRE.

Submittal of a stormwater management plan or a CAA is not required for single family residential (SFR) construction activities that disturb less than one-half (1/2) acre. However, stormwater BMPs must be implemented on all SFR sites. SFR construction activity shall implement and comply with the Minimum Stormwater Management BMPs (See Appendix E). In addition, if the site is part of a larger common plan of development, stormwater management requirements and BMPs specified in the approved CAA for the larger common plan of development must be implemented. Any deviations and/or modifications to the BMPs must be approved by the County Engineer.

2.2.4 FINAL APPROVAL

Stormwater management plans and CAAs shall be submitted to the Berkeley County Engineering Department either via mail or hand delivery (see contact information in Section 1.9) along with required components and fees. Failure to provide all of the required information shall be considered an incomplete submittal. The applicant will be notified that further information is needed to complete the submittal. In some cases, a new stormwater management plan or CAA package will have to be resubmitted.

Once the stormwater management plan and CAA are deemed complete, the County's review shall be accomplished and an approval, denial, review comments, or request for further information shall be transmitted to the applicant. A stormwater plan review checklist for sites disturbing one-half (1/2) acre or more is provided in Appendix C.

SCDHEC may request additional information from the applicant for NPDES permit compliance, which may result in changes to the stormwater management plan or CAA. Any such changes shall be provided to the County Engineer as well. The County Engineer reserves the right to deny approval if a submittal fails to conform to the provisions of the Stormwater Management Ordinance and this Manual.

2.2.5 CONSTRUCTION ACTIVITY AND CLOSEOUT PROCEDURE

Site construction shall not commence until the stormwater management plan and CAA is approved by the County Engineer. Construction activities must adhere to the provisions and requirement of the stormwater management plan and CAA. Any substantial revisions to the approved stormwater management plan or CAA should be submitted in writing to the County Engineer along with any subsequent fees for review. Such changes shall not be implemented until approval is given. Substantial revisions for stormwater management issues may include, but are not limited to pipe size and grade alterations that affect hydraulic capacity, changes to easement boundary due to changes in the stormwater system components, or changes to the general grading plan of the site that affect the flow direction, rate, volume, or quality of stormwater runoff.

The owner is required to maintain at least one copy of the approved stormwater management plan on site. The County Engineer, or his designee, will conduct inspections during the construction phase. Frequency and specific times and dates of these inspections will be done at the discretion of the County Engineer or his designee. More information on inspections is given in Chapter 4. During construction, the owner or his designated representative must conduct inspections of all temporary erosion and sediment controls, construction waste control, and permanent stabilization on site in accordance with the submitted and approved plans and maintenance schedule.

2.2.5.1 TRANSFER OF OWNERSHIP

In certain cases and as requested by an applicant, the CAA may be transferred from one applicant to another. The most obvious example of this is when a developer prepares a piece of property for a new neighborhood by performing grading activities, utility installation, the building of roads, and then turns the property over to a homebuilder(s). In such cases, the applicant must make Berkeley County aware of plans to transfer ownership of the CAA and associated stormwater management issues through completion of the CAA transfer form in Appendix F. A transfer of ownership is also allowed for phases within a project. If a CAA transfer is not requested using the appropriate form, the current owner will continue to be held responsible for stormwater management issues at the site.

2.2.5.2 CONSTRUCTION ACTIVITY CLOSEOUT

At the conclusion of construction, the owner is responsible for making sure a site is permanently stabilized with vegetation established, paved areas and stormwater conveyances clean of debris and sediment/stormwater controls working properly. Proof of these will be determined by a County inspector and any problems found must be corrected by the owner prior to closing out a construction activity. As-built/record drawings must be submitted prior to the inspection. Upon confirming any such corrections are completed and the site is ready, the County Engineer will release any remaining bonds. The County Engineer may require additional items on a case by case basis in order to closeout a construction activity.

2.2.6 EXEMPTIONS

Per the Stormwater Management Ordinance, the provisions of this Manual shall not apply to:

- Land disturbing activities undertaken on forestland for the production and harvesting of timber and timber products and conducted in accordance with best management practices and minimum erosion protection measures established by the South Carolina Forestry Commission pursuant to Section 48-18-70 of the 1976 Code of Laws of South Carolina, as amended.
- Land disturbing activities on agricultural land for production of plants and animals, including but not limited to: forages and sod crops, grains and feed crops, tobacco, cotton, and peanuts; dairy animals and dairy products; poultry and poultry products; livestock, including beef cattle, sheep, swine, horses, ponies, mules, or goats, including the breeding and grazing of these animals; bees, fur animals, and aquaculture. The construction of an agricultural structure that requires the disturbance of one or more acres, such as, but not limited to, broiler houses, machine sheds, repair shops, coops, barns, and other major buildings shall require the submittal and approval.
- Linear utility installation activities that are covered under their own DHEC approved utility general permit requiring associated assurance of proper stormwater management.

2.2.7 EXPIRATION OF STORMWATER APPROVAL

Stormwater management plan approval and CAA approval will remain valid for up to five (5) years from the date of approval, provided that the project is in compliance with the Stormwater Management Ordinance and this Manual and is not inactive for a period of twelve (12) consecutive months. For sites disturbing less than one-half (1/2) acre, construction activity must be initiated within twelve (12) months of stormwater management plan approval and for sites disturbing one-half (1/2) acre or more, construction activity must be initiated within twelve (12) months of CAA approval. Failure to initiate construction will render all approvals invalid at the end of the twelfth month.

2.2.8 RESPONSIBILITY OF OWNER/OPERATOR

During any construction operation, the owner/operator shall be responsible for carrying out the proposed work in accordance with the approved plan, specifications, time schedule, and all requirements of the Stormwater Management Ordinance and this Manual.

2.2.9 VARIANCES

The County Engineer may grant variances from the requirements of this Manual for construction activities if there are exceptional circumstances applicable to the site such that strict adherence to these provisions will result in unnecessary hardship and not fulfill the purpose of this Manual and the Berkeley County Stormwater Management Ordinance.

A written request for variance must be provided to the County Engineer stating the specific variance(s) sought and the reason(s) with supporting data including descriptions, drawings, and any other information that is necessary to evaluate the proposed variance.

A separate written variance request shall be required if there are subsequent additions, extensions, or modifications which would alter a previously approved variance. A project may be eligible for a variance if the applicant can demonstrate the following:

1. The variance will not conflict with the purpose of this Manual, all pertinent Berkeley County ordinances or local, State or Federal requirements.
2. The proposed project will have no significant adverse impact on the receiving water or upstream, downstream or adjacent properties; or
3. The imposition of peak or volume control requirements of stormwater runoff would aggravate downstream flooding.

2.2.10 ENCROACHMENT PERMITS

All applicable encroachment permit(s) must be obtained from the SCDOT and/or the Berkeley County Roads & Bridges Department before construction begins. Applicants should be aware of Berkeley County requirements which may differ from SCDOT's.

It is the applicant's responsibility to comply with all SCDOT and Berkeley County Encroachment Permit application requirements. Approved encroachment permits are required prior to stormwater approval from the County Engineer.

2.2.11 EASEMENTS

The following section provides the required easement widths for various components of the stormwater management system(s). In all cases, there will be an allowance for offset easements, in which the pipe, channel, or other stormwater system component does not necessarily have to be in the middle of the easement width, but may be offset to allow for certain construction needs. Proposed offset easements will be identified and additional width may be required as prescribed by the County Engineer.

2.2.11.1 STORM DRAIN PIPE

Drainage easements shall provide adequate room for maintenance equipment to operate. Table 2.1 provides required minimum drainage easement widths for some of the more typical situations:

Table 2.1-Storm Drain Pipe Easements

Pipe size (in)	Maximum depth to invert (ft)	Minimum Width of drainage easement (ft)
18	3.5	20
24	5.0	20
42	7.0	25
54	7.0	30

Notes: (1) For depths greater than shown, pipe easement width shall be as determined by the County Engineer.
(2) For pipe sizes not specifically listed above, the easement width and depth to invert shall be that of the next size up, i.e. the easement width for a 36 inch pipe is the same as those for a 42 inch pipe.
(3) For larger pipe sizes and/or multiple lines of pipe easement width shall be as determined by the County Engineer.

2.2.11.2 DITCHES AND SWALES

The minimum drainage easement width for ditches shall be top of bank width of the ditch plus twenty (20) feet. The ditch shall be located in the easement maintaining five feet (5) shoulder area on one side of the ditch and fifteen feet (15) maintenance shelf on the other side of the ditch. The drainage easement for swales shall not be less than twenty feet (20).

2.2.11.3 DETENTION PONDS

A minimum access easement of twenty feet (20) shall be provided to all detention ponds. The drainage easement for the detention pond shall incorporate and include the pond area plus a minimum fifteen feet (15) around the perimeter of the pond for maintenance access beyond the top of the pond bank. While the County shall not accept responsibility for pond maintenance, unless agreed to in writing, the County may utilize the easement for necessary emergency repairs.

2.2.11.4 OTHER STORMWATER FACILITIES & BMPs

All other structures used for the control of stormwater runoff (quantity or quality) not otherwise covered above, shall have an easement for access and maintenance that is a minimum of twenty (20) feet beyond the boundary of any such structure. The County Engineer may request or allow other easement widths on a case-by-case basis given site constraints or special conditions. While the County shall not accept responsibility for stormwater facility maintenance, unless agreed to in writing, the County may utilize the easement for necessary emergency repairs.

2.2.11.5 OFFSITE EASEMENTS

Any required off-site easements should be obtained prior to stormwater approval which would impact upon that area. Any work done without a proper and adequate easement(s) shall be at the owner's own risk. Non-subdivision projects shall provide validation of necessary easements before a stormwater management plan and CAA is approved.

2.2.12 STORMWATER FACILITY OWNERSHIP AND MAINTENANCE

2.2.12.1 OWNERSHIP

The owner of a portion or the entire stormwater system, as the case may be, shall be clearly designated before a stormwater approval will be issued. Ownership shall also be recorded on the final plat. Ownership shall imply responsibility for maintaining the stormwater system, including all ponds and other BMPs used for controlling runoff quantity and quality. Ownership does not imply that the owner(s) may in any way alter the size, or function of any component of the stormwater system without consent from the County Engineer. Owners found altering such components will be required to remove any alterations.

2.2.12.2 MAINTENANCE

Each component of the stormwater management system (pipes, inlets, BMPs) shall have a maintenance plan (activities and associated schedule) as part of stormwater management plan and CAA package. The plan shall also cover temporary measures used during construction in addition to the long term maintenance of the system. Suggested maintenance activities and recurrence intervals for water quality BMPs are discussed and referenced in Chapter 3.

In addition, Covenants for Permanent Maintenance of Stormwater Systems must be recorded in the permanent land records with the Berkeley County Register of Deeds. The Covenants is provided in Appendix B. The Covenants must be signed and executed prior to the issuance of a stormwater approval.

CHAPTER 3 - DESIGN REQUIREMENTS

This chapter provides engineers, designers, developers, and others with the necessary information needed to design adequate systems that will control the rate, volume, and pollutant loads released from a new or re-development project where the County Engineer has been authorized by law or agreement to enforce engineering standards. These design requirements have been developed based on common engineering practice and reference State and Federal requirements, engineering publications, and other municipal and academic guidance.

It is the goal of this Chapter to provide a minimum set of design standards that will result in effective stormwater management to mitigate the impact of land development on existing/natural hydrologic and hydraulic processes, as well as attempt to prevent further degradation of the water resources in Berkeley County through proper planning, design, installation, and maintenance. The design professional shall use all means necessary to develop land in a manner consistent with all County ordinances and this Manual. Specific methods and applications not covered in this section can and should be discussed with the County Engineer for applicability prior to the submission of site plans and drainage calculations. The following section details the criteria that shall be followed in the absence of designated specific watershed master plan criteria.

3.1 GENERAL DESIGN STANDARDS

General requirements for all stormwater systems and facilities will include, but not be limited to, the following:

1. Site designers shall minimize the generation of stormwater and maximize pervious areas by:
 - a. Selecting portions of the site where the drainage pattern, topography, and soils are favorable for the intended use.
 - b. Exposing the smallest practical area of land for the least possible time during development. This includes maintaining or creating buffers and preserving natural areas.
 - c. Limiting the drainage area to all BMPs. Specific maximum contributing areas to BMPs are provided in this chapter.
 - d. When feasible, retaining and protecting natural vegetation and saving topsoil, for replacing on graded areas.
 - e. Using plant cover, mulching, hydroseeding, or other stabilization methods to control runoff and protect areas subject to erosion during and after construction.
2. Annual groundwater recharge rates should be maintained to the maximum extent practical by promoting infiltration through the use of structural and non-structural methods.
3. Stormwater runoff generated from development shall be controlled to predevelopment and/or natural rates. The method for computing adequate control shall be based on several design storms. Greater detail is provided in this chapter.
4. Stormwater runoff generated from development shall be treated through the use of structural and/or non-structural practices. It is presumed that sufficient treatment is provided by the

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- proposed BMPs if they are:
- a. Designed according to the specific performance criteria outlined in this Manual,
 - b. Constructed properly, and
 - c. Maintained regularly.
5. Stormwater discharges to special protection areas with sensitive resources or that have existing flooding or water quality problems [e.g., cold water fisheries, recharge areas, water supply reservoirs, Total Maximum Daily Loads (TMDLs), and 303(d) listings] are subject to additional performance criteria. Section 3.9 contains more specific information and design requirements on the areas that will receive this additional set of protection criteria.
 6. All BMPs shall have an enforceable operation and maintenance plan and schedule to ensure the system functions as designed.
 7. Sediment basins and other BMPs shall be used during construction to remove heavy sediment loads from runoff waters leaving the disturbed area. Design criteria are provided in this chapter.
 8. Permanent vegetative cover and the long-term erosion protection structures shall be installed as soon as practical in the development process.
 9. If wetlands are suspected to exist on the property, they should be investigated and delineated by a qualified professional. The US Army Corps of Engineers (USACOE) must make a determination as to whether or not the wetlands fall under their jurisdiction. All efforts should be made to reduce or eliminate impacts such as using a buffer and/or installing a silt fence around wetlands. If the wetlands fall under the jurisdiction of the USACOE, a Section 404 permit is needed before any disturbance of the wetlands is allowed. In addition, the DHEC-OCRM Coastal Zone Consistency Determination will address any proposed wetland impacts. Berkeley County will accept certified delineations from qualified consultants if the USACOE is unable to issue a verification on the jurisdictional determination.
 10. Where existing wetlands are intended as a component of an overall stormwater management system, the approved plan for stormwater management shall not be implemented until all necessary State and Federal permits have been obtained.
 11. All stormwater management and sediment control practices shall be designed, constructed, and maintained with consideration for the proper control of mosquitoes and other vectors. Specific design criteria are provided in this chapter.
 12. For the purposes of hydraulic design, capacity of a system to transport stormwater runoff, shall be based on the size of the contributing drainage basin or subwatershed, as outlined below:
 - a. Major Drainage Channels:

All channels which drain an accumulation of primary and/or secondary drainage channels. These channels shall be the natural drainage channels of the watershed or man-made channels draining an area of one (1) square mile or more.

b. Primary Drainage Channels

All drainage channels which drain an area of two hundred (200) acres or more.

c. Secondary Drainage Channels

All drainage channels which drain an area of less than two hundred 200 acres and the primary benefit is to the development.

14. All development sites disturbing one-half (1/2) acre or more shall have an analysis performed of the drainage system to ascertain the function of the system during the 100-year storm event (precipitation only) or more specifically, determine that the project will not:

- a. Increase the likelihood of dwelling flooding and property damage.
- b. Increase water surface elevations or reduce system capacity in stormwater system and facilities upstream or downstream of the project.
- c. Impose any new or additional increase in stormwater runoff velocity on adjacent properties, discharge points, or downstream areas.
- d. Impose any new or additional increase in erosion and pollutant loads that would adversely impact waters of the state.

If a master plan exists for the area/watershed which encompasses the project, criteria set by that plan shall be used for determining the extent of this analysis. Without a master plan, analysis shall extend up to the top of the watershed and down to a Water of the State or to a point in which the project comprises 10% of the total contributing area, whichever occurs first. In these cases, the analysis criteria may include, but is not limited to:

- a. Utilization of existing land use curve numbers for all areas,
- b. Routing the flows using an accepted hydrologic and hydraulic method, and
- c. Providing hydraulic step-backwater calculations using USACE's HEC-2 or HEC-RAS models or equivalent. Other calculations may be required by the County Engineer based on severity of potential impact and location of the project.

If the downstream analysis determines that the development of a particular site does contribute to flooding, pollution, or erosion problems, then the system design shall be changed or additional controls shall be included.

15. Watersheds that have documented water quantity problems may have more stringent or modified design criteria as determined from Berkeley County master plan studies or as dictated by State and Federal regulations. The County Engineer reserves the right to impose additional design requirements, such as the examples listed below:

- a. Post-development discharge rates from the entire development area not exceeding pre-development discharge rates for storm frequencies greater than the 25-year frequency 24-hour duration storm event,

- b. Post-development discharge volumes from the entire development area not exceeding pre-development discharge volumes for storm frequencies smaller than the 1-year frequency 24-hour duration storm event,
- c. Reduction of peak flow rates below pre-development levels,
- d. Downstream channel, culvert, or property improvements.

3.2 HYDROLOGIC COMPUTATION METHODS

All hydrologic computations shall be completed using volume-based hydrograph methods acceptable to the County Engineer. The design storm duration for these computations shall be the 24-hour storm event utilizing a SCS Type III distribution with a 0.1-hour duration time increment. Typical hydrologic inputs include, but are not limited to the following:

- Rainfall depth or intensity,
- NRCS soil classification and hydrologic soil group,
- Land use,
- Time of concentration, and
- Initial abstraction/surface storage.

The remainder of this section will provide basic information for the hydrologic calculations. As discussed, the intent of the Manual is not to provide detail on every aspect of hydrologic computations, their limitations, assumptions, appropriateness of use, but rather general guidance on generally accepted standards. This Manual does, however, reference suggested materials as necessary for detailed discussion of related topics.

3.2.1 INPUTS

The precipitation depths corresponding to various return periods to be used for projects in Berkeley County are shown in Table 3.1.

Table 3.1: Design Storm Precipitation Data (in Inches) for Berkeley County

Area	1-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Berkeley (North)	3.5	3.8	5.0	5.9	7.2	8.2	9.4
Berkeley (South)	3.6	4.0	5.2	6.2	7.5	8.6	9.8

Source: SCDHEC 2003

Soil types in Berkeley County range from sands to sandy clays. Existing land use and corresponding runoff potential factors should be obtained from the site visit and other appropriate sources. Appropriate runoff potential factors can be found in several of the references listed in Chapter 5.

3.2.2 STORMWATER MANAGEMENT DESIGN METHODOLOGIES

Berkeley County recommended methods and corresponding design circumstances are listed in Table 3.2 and 3.3 below. If other methods are used, approval must first be given by the County Engineer. Complete source documentation must be submitted for approval.

Table 3.2: Recommended Methodologies Based on Land Disturbance Area

Method	Size Limitations*	Comments
(Modified) Rational Method	0 – < 1 Acres	Acceptable for sizing individual culverts or storm drains that are not part of a pipe network or system. <u>Not to be used for storage design.</u>
“SCS Method” (TR-55)	0 – 2000 Acres	Used for estimating peak flows from urban areas.

*Size limitations refer to the subwatershed size to the point where a stormwater system component (i.e., culvert, inlet, BMP) is located.

Details of Rational Method and Modified Rational Method can be found in Chow (1988), ASCE (1996), USDA (1996), and Mays (2001). Documentation on the commonly used SCS (or NRCS) Method can be found on the US Department of Agriculture website (<http://www.wcc.nrcs.usda.gov>). The USGS regression equations for South Carolina can be obtained from the US Geological Survey website (<http://water.usgs.gov/osw/>). Haan, C. T., Barfield, B. J., and Hayes, J. C. (1995) and USDT (1996, 2001) can also be referenced for greater detail on hydrology calculations and assumptions.

Table 3.3: Recommended Hydrologic Methods for Designing Various Stormwater Management Systems and Controls

Method	Rational Method	SCS Method
Extreme Flood Protection		+
Storage/Sedimentation Facilities		+
Outlet Structures		+
Gutter Flow and Inlets	+	
Storm Drain Pipes	+	+
Culverts	+	+
Small Ditches		+
Open Channels		+
Energy Dissipation		+

Methods for calculating the time of concentration and abstraction are numerous. However, a minimum time of concentration of six (6) minutes shall be used for all hydrologic calculations. See references given above for the suggested methodologies for information on these calculations.

3.2.3 HYDROGRAPHS

Hydrographs should be used to evaluate entire systems by routing storm events through pipe or storage systems. The use of a hydrograph will provide better insight into system performance than simply using the peak discharge. The County Engineer will accept computer models commonly used in the industry as well as newer models with appropriate documentation.

3.3 WATER QUANTITY CONTROL STANDARDS

Water quantity control is an integral component of overall stormwater management. Quantity control is effectively flood control, reducing potential damages and health risks, but because uncontrolled runoff can cause erosion, it can also be a form of water quality control. The following design criteria are established for water quantity control. All designs of storage facilities utilized for stormwater quantity control and required downstream analyses shall be submitted as part of the engineering calculations for obtaining a Berkeley County stormwater approval.

3.3.1 GENERAL WATER QUANTITY CRITERIA

1. Controls shall be designed by a traditional reservoir routing procedure.
2. All ponds shall have an emergency spillway designed to pass the 100-year storm event if the storage capacity is exceeded.
3. All quantity controls that are also used for quality control shall have a forebay or screening vault for removal of debris and coarse sediments.
 - a. Forebays shall be placed upstream of the main pond storage area.
 - b. Unless a separate vault is to be used for the forebay, the forebay shall be separated from the larger detention area by barriers or baffles that may be constructed of earth, stones, riprap, gabions, or geo-textiles. The barrier and/or baffles act as a trap for coarse sediments and minimize their movement into the main pond.
 - c. Maintenance of forebays will be needed more frequently than the main storage area and all designs should consider this need.

3.3.2 DETENTION PONDS/RESERVOIRS

1. Ponds with vegetated embankments shall be less than 15-feet in height and shall have side slopes no steeper than 3H:1V. Embankments protected with Turf Reinforcement Matting or other methods (if approved by County Engineer) shall be no steeper than 2H:1V.
2. Access inside a pond shall be provided with at least one side slope at 3H:1V or flatter. Geotechnical slope stability analysis is required for embankments greater than 10-feet in height and have steeper slope than those indicated above.
2. A minimum freeboard of 1-foot above the design storm high water elevation shall be provided for all impoundments.

3.3.2.1 WET DETENTION PONDS

1. The maximum depth of permanent storage facilities with a permanent pool shall be determined by site conditions, design constraints, and environmental needs. The facility should provide a permanent pool of water with a depth sufficient to discourage weed and mosquito growth without creating undue potential for anaerobic bottom conditions. A minimum depth of four (4) feet is reasonable unless the Berkeley County Mosquito Abatement Department requirements dictate otherwise. In addition, the pond bottom shall be a minimum of two (2') below the invert to allow for sediment build-up.
2. Aeration or other means shall be used as necessary to prevent anaerobic conditions.

3.3.2.2 DRY DETENTION PONDS

1. The bottom of dry detention structures shall be graded towards the outlet structure(s) to prevent standing water conditions with a minimum 0.5% bottom slope. Provide a low flow channel to allow the pond to drain dry and prevent standing water.
2. Pond slopes and bottom to be grassed according to the seeding schedule in Section 3.5.1.5
3. Do not use dry detention ponds in areas with high water tables.

3.3.3 UNDERGROUND DETENTION DEVICES

1. Underground detention facilities shall be designed using the following criteria:
 - a. Underground detention systems shall be located downstream of other stormwater controls providing treatment of the water quality volume.
 - b. The maximum contributing drainage area to be served by a single underground detention vault or tank is five (5) acres.
 - c. All systems shall be designed and located to facilitate maintenance. Systems should be cleaned out (sediment removal) as directed by the approved maintenance plan, but more frequently if necessary.
 - d. The minimum pipe diameter for underground detention tanks is thirty-six (36) inches or equivalent.
 - e. Underground detention systems must meet structural requirements for overburden support and traffic loading if appropriate.
 - f. Access must be provided over the inlet pipe and outflow structure. Access openings can consist of a standard frame, grate and solid cover, or preferably a removable panel.
 - g. All underground detention systems should accommodate at least six (6) inches of sediment storage in the volume calculations.
 - h. The feasibility of these devices for a given situation shall be evaluated by a soil scientist, geotechnical engineer, or other individual certified by the State of South Carolina in water table estimation.

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- i. Water table estimation shall be based on first occurrence of two chroma features.
 1. Any development that uses a parking area or other feature for detention storage capacity shall clearly identify the limits and depths of the proposed detention pool.
 2. Basin configurations which create stagnant water conditions shall be avoided.
 3. Post-development discharge rates shall not exceed pre-development discharge rates for the 2-year, 10-year, (and in some cases 25-year) frequency 24-hour duration storm events. The same hydrologic procedures shall be used in determining both the pre-development and post-development peak flow rates.
 4. Post-development discharge velocities shall be reduced to provide non-erosive flow velocities from structures, channels or other control measures, or equal the pre-development 10-year 24-hour storm event flow velocities, whichever is less.
 5. The volume within any structure used for water quantity control shall be drained from the structure within 72 hours.

3.3.4 INFILTRATION DEVICES

1. Infiltration devices shall be required on those sites which do not currently discharge stormwater runoff or have no existing outlet. In such cases, in the post-development condition, devices shall be designed to infiltrate the runoff volume equivalent to the 5-year storm event. For evaluating the 10-year and 25-year storm events, the discharge rate from the site shall be limited to (not exceed) that of a site of equivalent size and slope with a SCS Curve Number equal to 39. As with detention ponds, an emergency spillway shall be designed to pass the 100-year storm event if the storage capacity is exceeded. The system must be analyzed, but only to the extent that no structure flooding or damage results. The following other criteria, based primarily on SC Code of Regulation Section 72-307.C requirements, shall be followed in the design of infiltration systems:
 - a. Infiltration device design shall be based on soils characteristics of the first twelve (12) inches below the proposed bottom of the device (not necessarily the first twelve (12) inches below ground surface).
 - b. Areas draining to these practices must be stabilized and vegetative filters established prior to runoff entering the system. Infiltration practices shall not be used if a suspended solids filter system does not accompany the practice. If vegetation is the intended filter, there shall be, at least a twenty (20) foot length of vegetative filter prior to stormwater runoff entering the infiltration practice. Forebays or other engineered devices for sediment removal may be prudent.
 - c. Each system shall be designed to prevent clogging by fine material and for ease of maintenance.

The bottom of the infiltration practice shall be at least 0.25 feet above the “zone of seasonal saturation” and infiltration interface.
 - d. The infiltration practice shall be designed to completely drain of water within 72 hours.

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- e. Soils must have adequate permeability to allow water to infiltrate. Infiltration practices are limited to soils having an infiltration rate of at least 0.30 inches per hour. If the infiltration rate is greater than 0.3 but less than 2.0 inches/hour, then an underdrain system must be installed. Initial consideration will be based on a review of the appropriate soil survey, and proposed depths of excavation. The survey may serve as a basis for rejection. On-site soil borings and textural classifications must be accomplished to verify the actual site and seasonal high water table conditions when infiltration is to be utilized.
 - f. Infiltration practices greater than three (3) feet deep shall be located at least twenty-five (25) feet from basement walls.
 - g. Infiltration practices designed to handle runoff from areas with a high runoff potential shall be a minimum of one hundred fifty (150) feet from any public or private water supply well.
 - h. The design of an infiltration practice shall have a properly sized overflow or bypass for larger storm events. Measures to provide a non-erosive velocity of flow along its length and at the outfall shall also be included as necessary. Additional control devices will typically be necessary prior to a release to a watercourse to meet water quality requirements.
 - i. The slope of the bottom of the infiltration practice shall not exceed five (5) percent. Also, the practice shall not be installed in fill material as piping along the fill/natural ground interface may cause slope failure.
 - j. An infiltration practice shall not be installed on or atop a slope whose natural or existing angle of incline exceeds twenty (20) percent.
 - k. If an underdrain system is required, clean outs will be provided at a minimum, every one hundred (100) feet along the infiltration practice to allow for access and maintenance.
2. In cases where such criteria or limitations make the use of infiltration devices inappropriate, but no discharge currently leaves a given site, runoff control must be provided by some other measure. The County Engineer shall be contacted for guidance on the appropriate controls to employ or other mutually accepted best management practices.

3.3.5 WATER QUANTITY VARIANCE AND DESIGN/CONSTRUCTION REFERENCES

The County Engineer may grant a variance from the requirements of the Stormwater Management Ordinance and this Manual for individual construction activities if there are exceptional circumstances applicable to the site such that strict adherence to these provisions will result in unnecessary hardship and not fulfill their intent. A written request from the applicant shall contain descriptions, drawings, and any other information that is necessary to evaluate the proposed variance. A separate written variance request shall be required if there are subsequent additions, extensions, or modifications which would alter a previously approved variance. A project may be eligible for a variance of stormwater management for water quantity if the applicant can demonstrate that:

1. The proposed project will have no significant adverse impact on the receiving natural waterway or upstream, downstream or adjacent properties; or

2. Attenuation of the runoff within the subject basin will alter the release rate such that downstream systems will be adversely impacted by storing the regulated storm event (i.e. it can be shown that the time of concentration of the basins will coincide, leading to an increase of the peak at an already vulnerable point downstream).

The imposition of peak or volume control requirements of stormwater runoff would aggravate downstream flooding. An example of this situation would be when an overall analysis has indicated that imposing restrictions in the upstream watershed of the proposed project would cause the timing of the peak of the routed hydrograph to coincide with the peak flow from another contributing watershed at a certain point downstream.

3.3.6 ACCEPTED WATER QUANTITY CONTROLS

Detention structural controls are used for providing water quantity control and are typically used downstream of other minor structural controls. These structures are designed to provide channel protection, overbank flood protection, and protection against adverse downstream impacts that are related to the increase in peak flow rates and flow volumes from a land disturbing activity development. Structural detention stormwater controls accepted by Berkeley County are shown in Table 3.4.

Table 3.4: Accepted Water Quantity Controls

General Structural Control	Description
Dry Detention/Dry Extended Basins	Dry detention basins and dry extended detention basins are surface storage facilities intended to provide temporary storage of stormwater runoff and releasing it at a designed flow rate to reduce downstream water quantity impacts. These structures are designed to completely drain to a dry condition within 72 hours.
Wet Storm Water Detention Basins <ul style="list-style-type: none"> • Wet Pond • Wet Extended Detention Pond • Micropool Extended Detention Pond • Multiple Pond System 	Wet detention basins are constructed stormwater basins that have a permanent pool or micropool of water. Runoff from each rain event is detained above the permanent pool and released at a designed flow rate to reduce downstream water quantity impacts. Permanent pool depths must be ≥ 4 feet to prevent mosquito breeding.
Multi-purpose Detention Areas	Multi-purpose detention areas are used for one or more specific activities such as parking areas and rooftops. These areas are used to provide temporary storage of runoff. Some of the multi-purpose areas such as infiltration trenches or bio-retention cells may also be used for water quality purposes.
Underground Detention	Underground detention is used as an alternative to surface dry-detention basins. They are used in areas that are space-limited where there is not enough adequate land to provide the required detention volume. Underground storage utilizes tanks, vaults, and buried pipes to supply the required storage volume.
Infiltration Basins	Infiltration basins are used to remove runoff from the flow path into the ground. They are used in areas that currently do not discharge stormwater or create runoff only during large storm events.

3.3.7 STANDARD WATER QUANTITY DESIGN PROCEDURES

This section provides the general procedures for the design of stormwater quantity structures. The following items shall be required for the design of these structures and routing flows through them:

1. Compute the inflow hydrograph for the structure for the 2-year, 10-year, 25-year, 50-year, and 100-year 24-hour storm events for both the existing and proposed conditions. From this, determine peak flow rates for each storm.
2. Compute a stage-storage relationship for the proposed structure. A stage storage-curve defines the relationship between the depth of water and storage volume within the detention facility.
3. Compute stage-discharge relationship of the outlet control structure(s). A stage-discharge curve defines the flow capacity of a structure at a given stage or elevation.
4. Perform routing calculations for the 2-year, 10-year, and in some cases 25-year 24-hour storm events. Calculations may be done by hand, or may be done by using a storage routing computer model.
5. Determine the cumulative volume at the 24-hour point released from the facility.
6. Compare the two volumes and two peak discharges. The volume released from the pond after 24 hours should be at or below that for pre-development conditions. The peak discharge rate from the pond should be at or below the peak discharge rate for the pre-development condition for the 2-year, 10-year and in some cases 25-year storm events. Check to make sure the discharge hydrograph from the 100-year storm event does not overtop the banks of the facility.
7. Evaluate the control structure outlet flow velocity and provide velocity control and channel stabilization if needed. Drawings and details should be provided for outlet structures and basins.
8. Repeat Steps 1-7 for post-development condition until peak, volume, and velocity criteria are met.
9. Provide all calculations in submittal package in a cohesive, organized, and easy to follow format.

Stage-storage and stage-discharge calculations should be included in the engineering calculations. Common methodologies for stage-storage curves include the double end area method and the pyramid frustum method. Other methods will be accepted upon justification.

Hand calculations are available for routing hydrographs through detention structures, however they are time consuming and inefficient when multiple designs are required to be evaluated. For this Manual, it is assumed that the design professional will be using one of the many computer software packages available to perform storage routing calculations. All models/methodologies used must be approved by Berkeley County. A list of accepted models to date includes, but is not necessarily limited to:

- ICPR
- Drain:Edge
- PondPack/Civil Storm
- HEC-HMS
- HYDRAFLOW
- HydroCad
- SWMM

3.4 WATER QUALITY CONTROL STANDARDS

Water quality control is an integral and required component of overall stormwater management systems. New development and redevelopment projects must now include controls that treat or otherwise limit the discharge of pollutants. These requirements have been added due to new State and Federal requirements, but also due to the need to improve and preserve the water resources in Berkeley County. Because this is a requirement of stormwater design, some background information and references are provided in the sections below, followed by the design standards for addressing water quality.

3.4.1 CHARACTERIZATION OF URBAN STORM WATER RUNOFF QUALITY

This section provides some background information on the major sources of pollutants commonly found in stormwater flows and those that impact County waterbodies. In Table 3.5, these sources and the pollutants most commonly associated with them are presented. This is followed by a detailed discussion of the most common pollutants found in stormwater discharges.

Table 3.5: Typical Stormwater Pollutants and Sources

Pollutant Source	Pollutants of Concern
Erosion	Sediments and attached soil nutrients (numerous nitrogen and phosphorus forms), organic matter, and other adsorbed pollutants.
Atmospheric Deposition	Hydrocarbons emitted from automobiles, dust, metals, nutrients, and other chemicals released from industrial and commercial activities.
Roadways/Transportation related areas	Hydrocarbons emitted from automobiles, dust, metals,
Construction Sites	Sediment, metals, paint, and wood preservatives.
Manufactured Products (Industrial land uses)	Heavy metals, phenols, and oils from automobiles, Zinc and Cadmium from tire wear.
Lawn and Landscape Maintenance	Fertilizer and pesticides.
Plants and Animals	Plant debris, animal excrement.
Septic Tanks	Coliform bacteria, nitrogen, NO ₃ .
Non-Storm Water Connections	Sanitary sewage, industrial wastewater, commercial discharge, and construction activities.
Accidental Spills	Pollutants of concern depend on the nature of the spill.
Animal Waste Management	Coliform bacteria, nitrates, and phosphorus.

Pollutant Source	Pollutants of Concern
Pesticide Applications	Pollutants of concern depend on the pesticide being used and the type of crop or pest being treated.
Land Disturbance Agriculture	Sediment and attached soil nutrients, organic matter, and other adsorbed pollutants.
Fertilizer Applications	Nitrogen and phosphorus.

Source: U.S. Environmental Protection Agency, June 1992.

3.4.1.1 SUSPENDED SOLIDS

The most prevalent form of stormwater pollution is the presence of suspended matter that is either eroded by stormwater or washed off paved surfaces by stormwater. Suspended solids increase the turbidity of the receiving water, thereby reducing the penetration of light, resulting in decreased activity and growth of photosynthetic organisms. The increased turbidity also detracts from the aesthetics of natural waters. In addition, the clogging of fish gills has been attributed to the presence of suspended solids. Combined sewer overflows typically contain high suspended solids concentrations. The solids that settle in the receiving water pose long-term threats resulting from their oxygen demand and gradual accumulation of toxic substances (Moffa, 1990), as well as reducing primary production. Sedimentation and other forms of physical separation are often an effective means of removing suspended solids from stormwater.

Sediment is derived from a variety of sources, including erosion from disturbed areas, washoff of sediment deposited on impervious areas, and detachment of sediment due to the increased stream power that comes from increased flow rates and flow durations with urbanization. A significant number of models are available to predict total suspended solids (TSS) contributions from “clean” sediment, but few of the models have parameters specific to urbanized areas. Most of the models were developed to deal with agricultural soils, and their application to urban areas is limited.

Models that do have capabilities that have been used for predicting urban sediment include SWMM, SWAT, SEDPRO, and IDEAL models. For the models to be effectively utilized in sizing BMPs, predictions must be made of time varying quantities as well as the size distribution. Those distributions must be of the aggregated particles, not just the primary particles.

3.4.1.2 OXYGEN DEMANDING MATTER AND BACTERIA

Sufficient levels of dissolved oxygen (DO) in the water column are necessary to maintain aquatic life, growth, and reproductive activity, as well as to maintain aerobic conditions. The introduction of stormwater containing oxygen-demanding organic matter can impair the receiving water quality by reducing the DO levels such that it is unable to sustain certain forms of aquatic life and can further cause the water to become foul. Bacteria enter the stormwater drainage systems typically from the runoff of animal feces and organic matter from the catchment surface, possibly even disturbed soil. Bacteria also may enter the stormwater system and ultimately natural waters through leaking sewer systems (lateral connections, manholes, and industrial or commercial drains, etc.) and malfunctioning septic systems, all of which are termed illicit discharges and illegal by Berkeley County Stormwater Management Ordinance. Organic matter, usually in the form of vegetation and detritus, is carried through the conveyance system by the stormwater. Pathogenic bacteria and viruses in stormwater discharges pose

human health threats. The removal of pathogenic bacteria is achieved primarily through the process of biological decay and physical-chemical disinfection where practiced. Presence of such bacteria is assumed based on the detection of indicator bacteria such as fecal coliforms or E-coli. The reduction of bacteria in waters of the State has been the focus of TMDL efforts by SCHDEC to date.

3.4.1.3 NUTRIENTS

Nitrogen and phosphorus are plant nutrients that promote the growth of plants such as algae, and are the second leading stressor of impaired rivers and streams and the leading source of pollution in impaired lakes (US EPA, 1997). Such nutrients contribute to the eutrophication of water bodies which can result in decreased oxygen supply, alteration of aquatic life and decreased recreational value (Novotny, 1985).

Nutrients are typically derived from agricultural runoff as well as runoff from chemicals applied to lawns in urbanized areas, runoff from industrial sites, municipal wastewaters (of more concern for combined sewer overflows), or atmospheric deposition onto impervious surfaces that is later washed into stormwater. Model studies indicate that the increase in nutrient loading due to increased imperviousness will be dramatic. For example, the increase in the Maryland Chesapeake Bay watershed due to increased urbanization is expected to range from 2 to 20 times the current load, depending on whether residential development is highly restricted or unrestricted (Houlahan, 1992). Nutrients can be removed from stormwater prior to discharge through biological uptake such as by plantings in stormwater quality control ponds.

Most models of nutrient loadings that have an extensive data base included have been based on agricultural and forest operations. These have applicability to washoff from fertilized lawns and forested areas but not to the impervious areas. Models of nutrient loading in urban runoff are typically based on washoff type calculations or user-defined loadings and concentrations, all of which require user-defined constants and are relatively simplistic. A relatively new model called IDEAL, has additional treatment procedures for nutrient loads and removal using isothermic relationships that define adsorbed to dissolved nutrient ratios.

3.4.2 ACCEPTED WATER QUALITY BMPS

In selecting a BMP(s), it is most important to know what pollutants need to be removed, how to remove them, and what degree of removal is needed to meet water quality goals. There are many other project-specific considerations, however, with the proper planning, installation, and maintenance, BMPs are expected to reduce pollutant loads to receiving waters, reduce erosion, provide health and safety benefits, and be cost effective.

The varieties of water quality BMPs are numerous and are typically considered either structural or non-structural. Berkeley County's current approved list of stormwater quality BMPs, listed in Table 3.7, are based on literature reviews and experience. Some references to BMP selection, effectiveness, and design can be found in SCDHEC (2005), Agricultural Resource Council (2001), Schueler (1987), and Water Environment Foundation (WEF) & American Society of Civil Engineers (ASCE) (1998). Guidance on applying BMPs into Low Impact Development (LID) approaches can be found in Prince George County (1999 a and b).

Table 3.6. Average Pollutant Concentrations for Various Land Uses (mg/l)

Land Use	Pollutant Concentration (mg/l)											
	BOD	COD	TSS	TDS	TP	DP	TKN	NO ₂ /NO ₃	Pb	Cu	Zn	Cd
Forest/ Rural Open	3	27	51	415	0.11	0.03	0.94	0.80	0.000	0.000	0.000	0.000
Urban	3	27	51	415	0.11	0.03	0.94	0.80	0.014	0.000	0.040	0.001
Agricultural/ Pasture	3	53	145	415	0.37	0.09	1.92	4.06	0.000	0.000	0.000	0.000
Low Density Residential	38	124	70	144	0.52	0.27	3.32	1.83	0.057	0.026	0.161	0.004
Medium Density Residential	38	124	70	144	0.52	0.27	3.32	1.83	0.180	0.047	0.176	0.004
High Density Residential	14	79	97	189	0.24	0.08	1.17	2.12	0.041	0.033	0.218	0.003
Commercial	21	80	77	294	0.33	0.17	1.74	1.23	0.049	0.037	0.156	0.003
Industrial	24	85	149	202	0.32	0.11	2.08	1.89	0.072	0.058	0.671	0.005
Highways	24	103	141	294	0.43	0.22	1.82	0.83	0.049	0.037	0.156	0.003
Water/ Wetlands	4	6	6	12	0.08	0.04	0.79	0.59	0.011	0.007	0.003	0.001

Adapted from NURP (1983), Horner et. al (1994), and Cave et. Al. (1994)

- BOD = Biochemical Oxygen Demand
- COD = Chemical Oxygen Demand
- TSS = Total Suspended Solids
- TDS = Total Dissolved Solids
- TP = Total Phosphorus
- DP = Dissolved Phosphorus
- TKN = Total Kjeldahl Nitrogen
- NO₂/NO₃ = Nitrates / Nitrites
- Pb = Lead
- Cu = Copper
- Zn = Zinc
- Cd = Cadmium

Fecal coliform (FC) concentrations were not provided in the table above due to the large variability. Guidance from SCHDEC and NURP (1983) should be sought when estimating existing and post-development bacteria loads and the reduction requirements.

Table 3.7: Accepted Water Quality Controls

General Structural Control	Description
Wet Ponds	Wet stormwater ponds are constructed stormwater basins that have a permanent pool or micropool of water. Runoff from each rain event is detained and treated in the pool, and released at a designed rate.
Storm Water Wetlands	Stormwater wetlands are natural or constructed systems used for stormwater management. Stormwater wetlands consist of a combination of shallow marsh areas, open water and semi-wet areas above the permanent water surface.
Bioretention Areas	Bioretention areas are shallow stormwater basins or landscaped areas that utilize engineered soils and vegetation to capture and treat stormwater runoff. Runoff may be returned to the conveyance system or partially exfiltrate into the soil.
Sand Filters	Sand filters are multi-chamber structures designed to treat stormwater runoff through filtration, using a sand bed as its primary filter media. Filtered runoff may be returned to the conveyance system or partially exfiltrated into the soil.
Infiltration Trenches	An infiltration trench is an excavated trench filled with stone aggregate used to capture and allow infiltration of stormwater runoff into the surrounding soils from the bottom and sides of the trench.
Enhanced Grassed Swales	Enhanced swales are vegetated open channels that are explicitly designed and constructed to capture and treat stormwater runoff within dry or wet cells formed by check dams or other structures.
Engineered Devices <ul style="list-style-type: none"> • Vortex Separator • Baffles • Cartridges • Skimmers • Bioretention • Gravity Oil-Grit Separator • Filter Material • Inlet inserts 	Pre-fabricated controls use the movement of stormwater runoff through a specially designed structure to remove target pollutants. They are typically used on smaller commercial sites and urban hotspots. There are numerous commercial vendors of these structures, but there is limited data on the performance of these structures. Until further research is done and substantial removal efficiencies are published, these structures may require monitoring. Some of the popular vendors/products include, but are not limited to, Crystal Stream, Vortech, Aquashield, Filterra, Stormceptor, Stormfilter, CDS, BaySaver, and Downstream Defender ¹ . This is by no means a complete list and the County Engineer will evaluate any such device if included in designs, provided evidence is submitted as to their effectiveness. Such evidence must include applicability and proof of third-party testing on trapping efficiencies.

¹ This list is not intended as preference for these devices nor to exclude others.

Some structural BMPs have limited applications and are recommended to be used in conjunction with other BMPs. Limited application controls may be used within a system of water quality controls and are very effective pre-treatment structures for the controls listed in Table 3.7. Limited application structural controls should be designed and used only in development situations where regular maintenance is guaranteed. Some popular limited stormwater controls are shown in Table 3.8.

Table 3.8: Limited Structural Controls

Limited Structural Control	Description
Vegetated Filters <ul style="list-style-type: none">• Filter Strip• Grassed Channels and Swales	Both filter strips and grassed channels provide filtering of stormwater runoff as it flows across the vegetation. However, by themselves these controls do not consistently obtain adequate sediment and pollutant removal. Both filter strips and vegetated channels shall be used as pretreatment measures or part of a treatment system approach.
Submerged Gravel Wetland Systems	Submerged gravel wetlands use wetland plants in a submerged gravel or crushed rock media to remove stormwater runoff pollutants. These systems should only be used in mid- to high- density environments where other structural controls will be utilized.
Small Sand Filters <ul style="list-style-type: none">• Surface Sand Filter• Perimeter Sand Filter	Sand filters are multi-chamber structures designed to treat stormwater runoff through filtration, using a sand bed as its primary filter media. Filtered runoff may be returned to the conveyance system or partially exfiltrated into the soil.
Porous Paver Systems	Porous paver systems consist of open void paver units laid on gravel subgrade to promote stormwater infiltration. Porous pavers provide water quality and quantity benefits.

Regardless of the type of control, maintenance plan and schedules should be included for each BMP proposed.

Listed below are some non-structural BMPs that should be considered for use in larger construction activities and re-development projects.

1. **Buffers:** an area along a shoreline, wetland, or stream where development is restricted or prohibited. The primary function of the buffer is to physically protect and separate a stream, lake, or wetland from future disturbance or encroachment.
2. **Disconnected roof drains/impervious areas:** directing stormwater runoff from rooftops towards pervious areas where it is allowed to filter through vegetation and other landscaped material and infiltrate into the soil.
3. **Grass/Porous pavements:** allows for the reduction of paved areas by implementing areas that are infrequently used, providing water quality benefits through increased infiltration. Should be avoided in high traffic areas
4. **Cluster development:** concentrate development away from environmentally sensitive areas such as streams, wetlands, mature wooded areas, and steep slopes.
5. **Literature for owners, and Homeowners Associations (HOAs)** to educate and train themselves on the impact they can have on water quality and the activities necessary to maintain structural controls. These efforts are particularly critical in Low Impact Development (LID) designs.

3.4.3 WATER QUALITY DESIGN STANDARDS

3.4.3.1 GENERAL STANDARDS

The following design criteria are established for water quality control and must be incorporated in one or more BMPs for a given subbasin unless a specific quality variance is granted by the County Engineer. Incorporation of these requirements shall constitute adequate control of the discharge of pollutants.

1. All sites which disturb one-half (1/2) acre or greater shall have permanent BMP installed.
2. Permanent water quality addressed (all projects or LCP that disturb 5 or more acres)
 - 2.1 All permanent water quality ponds having a permanent pool shall be designed to catch the water quality volume (WQV) defined as the first ½” of runoff from the entire area draining to the pond and release it over at least a 24-hour period.
 - 2.2 Permanent water quality ponds, not having a permanent pool, shall be designed to catch the first 1” of runoff from the entire area draining to the pond and release it over at least a 24-hour period.
 - 2.3 For areas not draining to a pond, show how permanent water quality requirements were addressed.
3. Projects disturbing less than five (5) acres but within one-half (1/2) mile of a receiving water body in the Coastal Zone must meet Section III.C.3.XIII.A of the Coastal Zone Management Program Refinements. Designs must show that the first ½ inch of runoff from the entire site or the first one (1) inch of runoff from the built upon area, whichever is greater, can be stored onsite.
4. Waters of the U.S./State are not used for permanent water quality control (alternative means of treatment must be used if an existing pond is to be used for water quantity control).
5. A variance of the WQV requirement may be approved if treatment is instead provided by engineered devices. Applicability of such waivers will be based on submitted information showing that the device(s) has a design pollutant removal efficiency equivalent to a “dry” pond with a WQV of 1-inch. If the project is located within one thousand feet (1000’) of shellfish beds, the pollutant removal equivalency must match a WQV of the first one and one-half inches (1 ½”) of runoff.
6. BMPs used strictly for water quality that will be capturing one (1) or more acres shall have a pretreatment device as part of the BMP or treatment system, such as a forebay or vault, to remove debris and coarser sediments.
7. All BMPs must have a maintenance plan and schedule for construction site and post construction. Suggested schedules and routine activities are provided in the SCDHEC BMP Manual (2005).
8. Projects that discharge either directly or indirectly into an impaired waterbody as determined by the existence of an adopted TMDL by SCDHEC or through SCDHEC’s listing of the waterbody on the most current 303(d) list shall be required to reduce pollutant loads so as to meet applicable water quality standards. More background information is covered in Section 3.8 – Special Protection Areas. This will require the installation and implementation of measures (structural or non-structural BMPs) which are expected to adequately reduce pollutant loads to levels required by the TMDL (currently expressed as % reductions) or to prevent further impairment. A list of approved water quality devices was provided in the previous section.

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9. The County Engineer reserves the right to require specific effluent limits for any pollutant from a site if necessary to ensure the water quality standards and other State and federal water quality regulations are met

3.4.3.2 TYPICAL WATER QUALITY DESIGN PROCEDURES

1. Determine an appropriate, accepted BMP(s) needed for the site, considering the land use, pollutants of concern (Table 3.5), soils, maintenance requirements, and location in relation to waters of the State and any impairments that may exist.
2. If the receiving water of the project is impaired or has an adopted TMDL, the applicant must show that water quality standards are being met and designated uses are not impacted. This proof must be quantitative and qualitative for sites which disturb greater than 25 acres (see Section 3.4.3.1.6). The appropriate steps include
 - a. Calculate the estimated load for the pollutant(s) of concern. The IDEAL model may be used for all water quality calculations. Another, less preferred option is the Schuler Simple Method (Schueler 1987). This method is based on an extensive database obtained in Washington, D.C. for the National Urban Runoff Program (NURP). The Simple Method estimates pollutant loads from urban development by the following equation:

$$L = 0.227(Q P_j R_v C A) \quad \text{Equation 1}$$

Where:

- L** = Pollutant load in pounds per desired time interval,
- Q** = Runoff depth,
 ½-inch for wet ponds, some wetlands,
 1-inch for all other BMPs,
- P_j** = Fraction of rainfall events over the time intervals that produce runoff
 P_j = 1 for a single event
 P_j = 0.9 for larger time intervals (months, years),
- R_v** = Volumetric runoff coefficient expressing the fraction of rainfall converted to runoff (See Equation 2),
- C** = Event mean pollutant concentration in mg/l (See Table 3.6),
- A** = Total area of site in acres (areas < 640 acres are recommended for this method).

The most important factor affecting the volumetric runoff coefficient (**R_v**) is the imperviousness of the watershed, **I**, in percent. An empirical relationship was developed that relates **R_v** and **I** as:

$$R_v = 0.05 + 0.09(I) \quad \text{Equation 2}$$

The rainfall depth, **P**, was chosen such that a large percentage of storm events will be captured, with larger events only partially captured or bypassed. Greater than 85% of the average annual rainfall amount in Berkeley County occurs from storm events with a

total depth equal to or greater than 1-inch. The 1-inch of runoff from pervious areas is the result of approximately 4.5-inches of total rainfall, but it only takes a rainfall of 1.2 inches on impervious surfaces.

Other loading modules, such as in SEDPRO and SEDCAD for eroded particles or common buildup and washoff equations may be used.

- b. Select appropriate BMPs from Tables 3.7 and the BMP Uses tables in Appendix G. The use of an engineered device would require documentation to demonstrate its equivalency in meeting water quality criteria.
 - c. Compute BMP effectiveness for removing pollutants of concern, showing at a minimum that the concentration of the pollutants of concern from the last BMP meets applicable water quality standards.
3. If the BMP is to capture runoff from 5 or more acres, design a forebay or vault. Guidance on this aspect can be found in SCDHEC (2005) and ARC (2001).
 4. Calculate the water quality volume using the following equation.

$$WQV = \frac{Q * DA}{12} \quad \text{Equation 3}$$

Where:

- WQV** = water quality volume (acre-feet)
Q = runoff depth inches (one-half inch for permanent pool (“wet”) structures, one inch for dry structures, one and one-half inches if project is within 1,000 feet of a shellfish bed)
DA = drainage area to water quality BMP (acres). Runoff from the entire site must be captured in a water quality BMP, unless otherwise allowed by the County Engineer.

5. Compute the inflow hydrograph for the structure for one inch (1”) or one-half inch (1/2”), 24-hour storm event, as necessary, for the proposed condition. Note – this is the one inch (1”) **runoff** event.
6. Unless already known from the quantity calculations detailed in section 3.3.2, compute stage-storage and stage-discharge relationships of the outlet control structure(s).
7. Perform routing calculations for the one inch (1”) or one-half inch (1/2”), 24-hour storm event through the BMP. These may be done by hand, or may be done by using a storage routing computer model.
8. Determine if the entire volume from the one inch (1”) or one-half inch (1/2”), 24-hour storm event was released before the 24-hour point. If it does, the outlet is too large. Resize outlet structure.
9. Repeat steps 4-8 until entire volume is not released prior to 24-hours. This procedure is commonly accomplished using a low-flow orifice and the two-year discharge level is not reached.

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10. For engineered devices, alternative calculations other than detailed here should be provided. SCDHEC has accepted some such devices as providing adequate treatment as compared to capturing and detaining the one inch (1") storm event.
 11. Provide all calculations in the submittal package in a cohesive, organized, and easy to follow format.

3.5 EROSION PREVENTION AND SEDIMENT CONTROL STANDARDS

Berkeley County requires that an erosion prevention and sediment control (EPSC) plan be submitted and approved for construction activities that result in land disturbance of one-half (1/2) acre or more. This plan shall describe the practices and controls that will be used during and after construction to meet the following goals:

1. Minimization of the extent and duration of disturbed soil exposure,
2. Prompt stabilization of disturbed areas,
3. Protection of off-site and downstream locations, drainage systems and natural waterways from the impacts of erosion and sedimentation,
4. Limitation of the exit velocities of the flow leaving the site to non-erosive or pre-development conditions, and
5. Design and implementation of an ongoing inspection and maintenance plan.

3.5.1 ACCEPTED EPSC BMPs

The various types of EPSC BMPs that are acceptable for use in Berkeley County are presented below. These generally fall into three categories: erosion prevention measures, temporary sediment controls, and runoff control and conveyance measures. Runoff from sites should contain controls that fall into at least one of these categories.

3.5.1.1 EROSION PREVENTION MEASURES

Erosion prevention measures shall be used during and after construction site preparation to avert the discharge of runoff highly concentrated with sediment and other associated pollutants. One or more measures are typically needed on a given site. Measures that fall into this category along with their preferred application are provided in Table 3.9. Details on each of these measures are not discussed in this Manual. Guidance documents that should be referenced as necessary include: SCDHEC (2003), Haan, C. T., Barfield, B. J., and Hayes, J. C. (1995) and Shwab, Glenn O. and Richard K. Frevert (1985). Other practices, such as engineered devices, will be allowed as long as sufficient evidence is presented as to their effectiveness. Standard details can be found at:

http://www.scdhec.gov/environment/ocrm/pubs/tech_docs_water.htm.

Table 3.9 Erosion Prevention BMP Suggested Uses

BMP	Slope Protection	Waterway Protection	Surface Protection	Enclosed Drainage	Large Flat Areas	Borrow Areas	Adjacent Properties
Erosion Prevention Measures	X	X	X	X	X	X	X
Surface Roughening	X		X				
Bench Terracing	X		X				
Temporary Seeding	X		X		X	X	X
Mulching	X				X	X	
Erosion Control Blankets (ECB) and Turf Reinforcement Mats (TRM)	X	X	X			X	
Final Stabilization	X		X		X		X
Topsoiling			X		X		
Permanent Seeding and Planting of Grasses	X		X		X		X
Permanent Ground Cover Plants	X		X				X
Sodding	X		X		X		X
Riprap or Aggregate	X	X	X				
Outlet Protection		X		X			X
Dust Control					X	X	X
Polyacrylamide (PAMs)	X		X	X	X	X	X

3.5.1.2 TEMPORARY SEDIMENT CONTROL MEASURES

Berkeley County emphasizes preventative measures as the main control to protect against erosion, both during and following construction. However, there are typically instances where erosion prevention measures alone do not provide sufficient control. For these situations, temporary sediment controls shall be implemented to control the migration of eroded sediment off site. The sediment control measures are typically only applicable as practices for use during construction. One or more of the measures should be utilized as appropriate during the project's construction phase. Table 3.10 contains a list of some of the suggested controls of this type along with their intended use. Details on these and others measures are again not discussed in detail in the Manual, however, an excellent reference is Haan, Barfield, and Hayes (1995) and SCDHEC's BMP Manual. Other practices, such as engineered devices, will be allowed as long as sufficient evidence is presented as to their effectiveness. Standard details can be found at http://www.scdhec.gov/environment/ocrm/pubs/tech_docs_water.htm

Table 3.10 Temporary Sediment Control BMP Suggested Uses

BMP	Slope Protection	Waterway Protection	Surface Protection	Enclosed Drainage	Large Flat Areas	Borrow Areas	Adjacent Properties
Temporary Sediment Control Structures	X	X	X	X	X	X	X
Storage Volumes and Maintenance Schedules		X		X			X
Temporary Sediment Basin		X	X	X			X
Multipurpose Basin		X	X	X			X
Temporary Sediment Trap		X	X				X
Silt Fence	X	X					X
Rock Ditch Check			X				X
Stabilized Construction Entrance					X		X
Storm Drain Inlet Protection		X		X			X
Vegetated Filter Strips		X					X
Rock Sediment Dike		X	X				X

3.5.1.3 RUNOFF CONTROL AND CONVEYANCE MEASURES

This category of EPSC BMPs should be used as necessary during and following construction. Suggested varieties and their corresponding uses are provided in Table 3.11.

Table 3.11 Runoff Control and Conveyance Measure BMP Suggested Uses

BMP	Slope Protection	Waterway Protection	Surface Protection	Enclosed Drainage	Large Flat Areas	Borrow Areas	Adjacent Properties
Pipe Slope Drains	X		X				
Temporary Stream Crossing		X	X				X
Runoff Conveyance Measures	X					X	X
Construction De-watering		X		X	X	X	
Level Spreader			X		X		X
Subsurface Drains			X		X		

3.5.1.4 TEMPORARY VEGETATION/SEEDING

Description

The purpose of temporary seeding is to reduce erosion and sedimentation by stabilizing disturbed areas that would otherwise lay bare for long periods of time before they are worked or stabilized. Temporary seeding is also used where permanent vegetation growth is not necessary or appropriate.

When and Where to Use

Temporary seeding is used on exposed soil surfaces such as denuded areas, soil stockpiles, dikes, dams, banks of sediment basins, banks of sediment traps and temporary road banks. Temporary seeding prevents and limits costly maintenance operations on sediment control devices. Cleanout requirements for sediment basins, sediment traps and silt fence is reduced if the drainage area is seeded when grading and construction operations are not taking place.

Temporary stabilization is required within fourteen (14) days after construction activity is complete. Cover seeded areas with an appropriate mulch to provide protection from the weather. When the temporary vegetation does not grow quickly or thick enough to prevent erosion, re-seed as soon as possible. Keep seeded areas adequately moist. Irrigate the seeded areas if normal rainfall is not adequate for germination and growth of seedlings. Water seeded areas at controlled rates that are less than the rate at which the soil can absorb water to prevent runoff. Runoff of irrigation water wastes water and can cause erosion.

Plant Selection

Plant seed selection should be based on the type of soil and the season of the year in which the planting is to be done. Tables 3.12 and 3.13 should be used if you plan to use conventional tillage methods (plowing, seedbed preparation, hydroseeding, etc). If you need a fast growing crop to nurse your permanent species, then use the mix rate. Failure to carefully follow agronomic recommendations often results in an inadequate stand of temporary vegetation that provides little or no erosion control.

Tillage

If the area has been recently plowed, no tillage is required other than raking or surface roughening to break any crust that has formed and to leave a textured surface. If the soil is compacted less than 6-inches, it should be disked for optimal germination.

Soil Testing

Information on soil testing is available from the Soil and Water Conservation District Office.

Lime

Lime is not required for temporary seeding unless a soil test shows that the soil pH is below 5.0. It may be desirable to apply lime during the temporary seeding operation to benefit the long-term permanent seeding. Apply a minimum of 1.5 tons of Lime/acre (70 pounds per 1000 square feet) if it is to be used.

Fertilizer

A minimum of 500 pounds per acre of 10-10-10 fertilizer (11.5 pounds per 1000 square feet) or equivalent should be applied during temporary seeding unless a soil test indicates a different requirement. Fertilizer and lime (if used) should be incorporated into the top 4-6 inches of the soil by disking or other means where conditions allow.

Seeding

The surface of the soil should be loosened just before broadcasting the seed. Seed should be applied evenly by the most convenient method available for the type of seed to be used and the location of the temporary seeding. Typical application methods include but are not limited to cyclone seeders, rotary spreaders, drop spreaders, broadcast spreaders, hand spreaders, cultipacker seeder, and hydro-seeders. Cover applied seed by raking or dragging a chain, and then lightly firming the area with a roller or cultipacker.

Mulching

Mulch should be used in seeded areas to retain soil moisture and reduce erosion during establishment of vegetation. The most commonly accepted mulch used in conjunction with temporary seeding is small grain straw. This straw should be dry and free from mold damage and noxious weeds. The straw may need to be anchored with netting or emulsions to prevent it from being blown or washed away. The straw mulch may be applied by hand or machine at the rate of 1.5 - 2 tons per acre (90 pounds per 1000 square feet). Frequent inspections are necessary to check that conditions for growth are good.

Irrigation

Seeded areas should be kept adequately moist. Irrigate the seeded area if normal rainfall is not adequate for the germination and growth of seedlings. Water seeded areas at controlled rates that are less than the rate at which the soil can absorb water to prevent runoff. Runoff of irrigation water wastes water and can cause erosion.

Re-seeding

Areas where the plants do not grow quickly, thick enough, or adequately to prevent erosion should be re-seeded with temporary grasses as soon as such areas are identified.

Table 3.12 Temporary Vegetation Schedule

Species	Rates (lbs/acre)	Optimum Dates to Plant	Remarks
Browntop Millet (Alone)	40	April 20 - August 15	Quick, Dense Cover
Browntop Millet (Mix)*	10	April 20 - August 15	Quick, Dense Cover
Rye Grain (Alone)	56	February - March, August 15 - November 20	Quick Cover
Rye Grain (Mix)*	10	February - March, August 15 - November 20	Quick Cover
Rye Grass (Alone)	50	August 10 - October 10	Competitive, Dense
Rye Grass (Mix)	8	August 10 - October 10	Competitive, Dense

* For details on mixes consult Clemson University Home and Garden Information Center at (888) 656-9988 or at <http://hgic.clemson.edu>.

Table 3.13 Temporary Vegetation for Steep Slopes/Cut Slopes

Species	Rates (lbs/acre)	Optimum Dates to Plant	Remarks
Weeping Lovegrass (Alone)	4	April - July 20	Quick cover, deep roots, likes dry sites, seldom used alone, clumps
Weeping Lovegrass (Mix)	2	April - July 20	Quick cover, deep roots, likes dry sites, seldom used alone, clumps

* For details on mixes consult Clemson University Home and Garden Information Center at (888) 656-9988

3.5.1.5 PERMANENT VEGETATION/SEEDING

Plant Selection

Plant seed selection should be based on the type of soil, the season of the year in which the planting is to be done, and the needs and desires of the permanent land user. Tables 3.14 and 3.15 should be used to select the desired species to be planted. Failure to carefully follow agronomic recommendations often results in an inadequate stand of permanent vegetation that provides little or no erosion control. The rates in Tables 3.14 and 3.15 are based on purity and germination standards required for certification.

The following notes apply to Tables 3.14 and 3.15.

1. In mixtures with temporary cover, the full seeding rate of permanent cover shall be used.
2. Mix means 2 or more long term species plus short term species. For dates other than optimum, call the Soil and Water Conservation District, (843) 719-4146.
3. A legume, such as a clover, crown vetch, and serecia should be used where it is possible.
4. The appropriate inoculants should be used.

Topsoil

If the surface soil of the seedbed is not adequate for plant growth, topsoil should be applied.

Tillage

If the area has been recently plowed, no tillage is required other than raking or surface roughening to break any crust that has formed and to leave a textured surface. If the soil is compacted less than 6-inches, it should be disked for optimal germination. If the soil is compacted more than 6-inches, it should be sub-soiled and disked.

Soil Testing

Information on soil testing is available from the Soil and Water Conservation District Office.

Lime

Unless a specific soil test indicates otherwise, apply 1½ tons of ground course textured agricultural limestone per acre (70 pounds per 1000 square feet).

Fertilizer

A minimum of 1000 pounds per acre of a complete 10-10-10 fertilizer (23 pounds per 1000 square feet) or equivalent should be applied during permanent seeding of grasses unless a soil test indicates a different requirement. Fertilizer and lime (if used) should be incorporated into the top 4-6 inches of the soil by disking or other means where conditions allow. Do not mix the lime and the fertilizer prior to the field application.

Seeding

The surface of the soil should be loosened just before broadcasting the seed. Seed should be evenly applied by the most convenient method available for the type of seed to be applied and the location of the temporary seeding. Typical application methods include but are not limited to cyclone seeders, rotary spreaders, drop spreaders, broadcast spreaders, hand spreaders, cultipacker seeder, and hydro-seeders. Cover applied seed by raking or dragging a chain or brush mat, and then lightly firming the area with a roller or cultipacker. Do not roll seed that is applied with a hydro-seeder and hydro-mulch.

Mulching

All permanent seeded areas should be covered with mulch immediately upon completion of the seeding application to retain soil moisture and reduce erosion during establishment of vegetation. The mulch should be applied evenly in such a manner that it provides a minimum of 75% coverage. Typical mulch applications include straw, wood chips, bark, wood fiber, and hydro-mulches. The most commonly accepted mulch used in conjunction with permanent seeding is small grain straw. This straw should be dry and free from mold damage and noxious weeds. The straw may need to be anchored with netting or asphalt emulsions to prevent it from being blown or washed away. The straw mulch may be applied by hand or machine at the rate of 2 tons per acre (90 pounds per 1000 square feet). Frequent inspections are necessary to check that conditions for growth are good.

Irrigation

Permanent seeded areas should be kept adequately moist, especially late in the specific growing season. Irrigate the seeded area if normal rainfall is not adequate for the germination and growth of seedlings. Water seeded areas at controlled rates that are less than the rate at which the soil can absorb water to prevent runoff. Runoff of irrigation water wastes water and can cause erosion.

Re-seeding

Inspect permanently seeded areas for failure, make necessary repairs and re-seed or overseed within the same growing season if possible. If the grass cover is sparse or patchy, re-evaluate the choice of grass and quantities of lime and fertilizer applied. If the permanent seeding has less than 40% cover, have the soil tested to determine any acidity or nutrient deficiency problems.

Final stabilization by permanent seeding of the site requires that it be covered by a 70% coverage rate.

Post-Stabilization

Once areas are stabilized they can be converted to native species or for establishing on non-critical, level sites. Table 3.16 lists some native species of Berkeley County that can be used.

Table 3.14 Permanent Vegetation Schedule

Species	Rates (lbs/acre)	Optimum Dates to Plant	Remarks
Bahia Grass (Alone)	40	March 20 - June 15	Slow to become established
Bahia Grass (Mix)*	30	March 20 - June 15	Slow to become established
Bermuda Grass (Hulled) (Alone)	8-12	April - July 15	Quick cover, Sod forming, partial winter kill
Bermuda Grass (Hulled) (Mix)*	4-6	April - July 15	Quick cover, Sod forming, partial winter kill
Fescue, Tall (KY31) Alone	40	August 15 - October	Seldom seeded alone, not for dry or wet sites
Fescue, Tall (KY31) Mix*	20	August 15 - October	Seldom seeded alone, not for dry or wet sites
Sericea Lespedeza (Scarified) Alone or Mix*, (Inoculate with EL Inoculant)	40	April - June	Good for slopes, cuts, and fills that require low maintenance
Ladino Clover (Mix* only), (Inoculate with AB Inoculant)	2	August 20 - October	Naturally adds nitrogen

* For details on mixes consult Clemson University Home and Garden Information Center at (888) 656-9988 or at <http://hgic.clemson.edu>.

Table 3.15 Permanent Vegetation Schedule for Steep Slopes/Cut Slopes

Species	Rates (lbs/acre)	Optimum Dates to Plant	Remarks
Weeping Lovegrass (Alone)	4	April – July 20	Quick cover, deep roots, likes dry sites, seldom used alone, clumps
Weeping Lovegrass (Mix)*	2	April – July 20	Quick cover, deep roots, likes dry sites, seldom used alone, clumps
Crownvetch (Mix*) (Inoculate with Type M Inoculant)	8-10	March - April	2 years to establish, no mowing, green all year, 20” maximum height

* For details on mixes consult Clemson University Home and Garden Information Center at (888) 656-9988 or at <http://hgic.clemson.edu>.

3.5.2 EPSC DESIGN STANDARDS

3.5.2.1 GENERAL STANDARDS

1. BMPs should be properly placed (silt fence, inlet protection, construction entrance, rip-rap at outfalls, check dams etc.).
2. EPSC plans shall be developed to achieve an eighty (80) percent design sediment removal efficiency goal, if more than 10 disturbed acres drain to a common point (stream, lake, etc.). Simply applied, when a site is completely denuded of vegetation, the structural and nonstructural EPSC measures shall be designed to trap 80 percent of the total suspended solids (TSS) that are generated by the site. The design storm event associated with this level of control is the 10-year, 24-hour SCS Type III storm event. Calculations using models, such as SEDPRO or SEDCAD, or SCDHEC design aids shall be provided to show adherence to this criteria.
3. SCS procedures should be used to determine runoff amounts. It is important to note that when a BMP is designed for the 10-year, 24-hour storm event, the BMP will have a greater trapping efficiency for more frequent events such as the 2-year 24-hour storm event.
4. Sediment basins must be provided for storage for the 10-year, 24-hour storm event for disturbed conditions or 3600 ft³/ acre draining to the basin, if more than 10 disturbed acres drain to a common point (stream, lake, property line, etc.).
5. Activities that disturb between one (1) and ten (10) acres of land area that do not drain to a single outlet point may incorporate practices other than a sediment basin to achieve an equivalent removal efficiency.
6. Sediment traps only used for drainage areas of less than 5 acres.
7. Sediment trap storage calculations, showing that 1800 ft³/ total acre draining to each trap is provided below the spillway.
8. If trapping efficiency calculations are required for sediment traps, then provide peak outflow, (q_{po}), calculations; the 10-year, 24-hour storm event for construction conditions cannot overtop the trap's spillway.
9. Sediment basins and traps designed for total area draining to them.
10. Drainage area map outlining the area draining to each sediment basin/ trap.
11. Copies of figures used to determine V_{15} (SV-1) and trapping efficiency (ST-1, SB-1, SB-2), if Design Aids from SCDHEC BMP Manual (2005) are used to determine trapping efficiencies.
12. Silt fencing shall be placed at the toe of all fill slopes and soil berms and below disturbed areas where the size of the area is no more than ¼-acre per one hundred (100) feet of silt fence length. The maximum slope length behind the fence is 100 feet and the maximum gradient behind the fence is 2H:1V.

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13. The following nonstructural site management practices shall be utilized on the plans where applicable:
- a. Minimize site disturbance to preserve and maintain existing vegetative cover,
 - b. Limit the number of temporary access points to the site for land disturbing activities,
 - c. Protect off-site and downstream locations, drainage systems and natural waterways from the impacts of erosion and sedimentation,
 - d. Phase and sequence construction activities to minimize the extent and duration of disturbed soil exposure, and
 - e. Implement an ongoing inspection and maintenance plan. Suggested maintenance schedules are given in SCDHEC (2005).
14. Sediment storage volumes shall be calculated for all sediment controls to determine the required clean-out frequencies and maintenance schedules. The Universal Soil Loss Equation (USLE) and subsequent modifications or other acceptable methods that determine sediment yield may be used to predict the required sediment storage volumes for specific sediment control structures.
15. To encourage the development and testing of innovative alternative EPSC BMPs, alternative management practices that are not included in the Manual may be allowed upon review and approval by the County Engineer. To use an alternative BMP, the design professional shall submit substantial evidence that the proposed measure will perform at least equivalent to currently approved BMPs contained in the Manual. Evidence may include, but is not limited to:
- a. Supporting hydraulic and trapping efficiency calculations.
 - b. Peer review by a panel of registered professional engineers.
 - c. Research results as reported in professional journals.
 - d. Manufacturer's literature.
16. Detailed EPSC plans shall comply to the maximum extent practicable with the following specific standards and review criteria:
- a. Sediment tracking control shall be implemented using stabilized construction entrances that are to be located and utilized at all points of ingress/egress on a construction site. The contractor must take necessary action to minimize the tracking of mud onto the paved roadway construction areas. The contractor shall daily remove mud/soil from pavement, as may be required.
 - b. Crossings of waterways during construction should be minimized and must be approved by the County Engineer and possibly the U. S. Army Corps of Engineers (USACOE). Encroachment into stream buffers, riparian areas and wetlands should be avoided when possible.
 - c. Topsoil shall be stockpiled and preserved from erosion or dispersal both during and after site grading operations when applicable.

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- d. Stabilization measures shall be initiated as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than fourteen days (14) after work has ceased, unless activity in that portion of the site will resume within twenty-one (21) days. Hydroseeding as often as possible is encouraged. Stabilization of disturbed areas is one of the best approaches for erosion prevention and sediment control.
 - e. All slopes must be stabilized through grassing, hydroseeding, synthetic or vegetative matting, diversion berms, temporary slope drains, etc. and must be performed within two (2) working days after the necessary grading (temporary or permanent) has been achieved.
 - f. A site is considered stabilized once the entire disturbed area has a vegetative cover with a density of 70%. Seeding should be accompanied or replaced with erosion control mats as necessary to achieve this density. Final or permanent stabilization is considered achieved once the entire disturbed area has a permanent vegetative cover with a density of 70%. Final stabilization shall be implemented within fourteen (14) days of completion of all construction activities. After final stabilization is achieved, all control measures shall be removed from the site
 - g. Temporary structural controls installed during construction shall be designed to accomplish maximum stabilization and control of erosion and sedimentation, and shall be installed, maintained, and removed according to the specifications set forth in the Manual and project specifics developed as part of the stormwater management plan. All temporary structural controls shall be designed to control the peak runoff resulting from the ten (10) year storm event.
 - h. All permanent structural controls, including drainage facilities such as channels, storm sewer inlets, and detention basins, shall be cleaned out as part of the project closeout process.
 - i. Linear projects (utility lines, road construction) over, under, or along a water body shall include measures and controls which adequately protect the water body from undue impact. Such work should be coordinated with the installation of erosion prevention and sediment control measures so that disruption is minimized. Every effort should be made to install utilities during the initial construction phases. Trench sharing is encouraged to the extent practicable.

17. The grading plan should include the following general measures at a minimum:

- a. The finished cut and fill slopes to be vegetated should not be steeper than 3H:1V. The finished grades of cut and fill slopes to be vegetated with vines and/or groundcovers should not be steeper than 1H:1V.
- b. Cuts or fills should not be so close to property lines as to endanger adjoining property without adequately protecting such properties against erosion, sedimentation, slippage, settlement, subsidence, or other damages.
- c. Subsurface drainage should be provided in areas having a high water table to intercept seepage that would affect slope stability, bearing strength or create undesirable wetness.

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- d. No fill shall be placed where it can slide or wash onto another property.
 - e. Fill shall not be placed adjacent to channel banks where it can create bank failure, reduce the capacity of the stream, or result in downstream sediment deposition.
 - f. All borrow and disposal areas should be included as part of the grading plan.
 - g. Adequate channels and floodways should be provided to safely convey increased runoff from the developed area to an adequate outlet without causing significant channel degradation, or increased off-site flooding.
 - h. The site should be graded to direct flows to appropriate controls.

18. EPSC plan shall have the following information contained in a cohesive, organized, and easy to follow format:

- a. Location of all erosion and sediment control structures on construction documents;
- b. Delineation of all sensitive features (wetlands, streams, ponds, existing stormwater structures, etc.) and potential sediment sources;
- c. Installation sequencing and maintenance plan and schedules for all EPSC BMPs during and after construction;
- d. Provisions to preserve topsoil and limit the amount of total disturbed area;
- e. Details of site grading;
- f. Design details and calculations for all EPSC structures;
- g. Protection of all storm drain inlets and outlets;
- h. Explanation of any computer models or software used with highlights of and/or notes on the output data;
- i. Locate temporary and permanent soil disposal areas, haul roads, and construction staging areas to minimize erosion, sediment transport, and disturbance to existing vegetation;
- j. All necessary certifications by the person responsible for the activity. This includes the stormwater management plan, CAA and Covenants. Proper preparation of the EPSC Plan if necessary, by a registered engineer.

3.5.2.2 TYPICAL EPSC DESIGN PROCEDURES

The design procedures will vary depending on the EPSC BMP. Many of the BMPs listed in Tables 3.9 – 3.16 do not need to be “designed” using calculations, such as surface roughening or dust control. Others require the use of equations or design aids to properly design. SCDHEC has two handbooks, the BMP Handbook (SCDHEC 2005) and the Stormwater Management and Sediment Control Handbook (SCDHEC 2003) that provide the procedures and equations needed to design some of the EPSC BMPs listed in Tables 3.9 – 3.15. Example problems are given for most types. As with the design of any BMP, engineering judgment will be needed on most applications. Proper design must be complemented with proper installation and routine maintenance in order for BMPs to be effective and to adhere to the provisions of this section.

3.6 STORMWATER DRAINAGE SYSTEM DESIGN STANDARDS

This section provides the design requirements for various storm sewer drainage/collection system components including: design storms, velocities; and, pipe and inlet sizes. Storm drainage systems shall include all storm drainage structures and pipes that convey runoff. These systems are commonly referred to as lateral closed systems.

1. Storm drain pipes:

- a. Storm drainage lines shall be staked at each box or at intervals that would be sufficient to check alignment and grade of the construction with the approved plans. The use of lasers to augment control is encouraged.
 - The minimum size storm drainage pipe allowable shall be fifteen (15) inches in diameter. The minimum size pipe allowed under a public roadway, within the public right-of-way, and/or downstream of public right-of-ways shall be 18”. Only concrete pipes are allowed in the County right-of-ways.
- b. The minimum allowable slope for storm drainage pipe shall be one-half of one (1) percent [0.005 ft/ft] or a minimum flow velocity of three (3) feet per second at all flow levels. Maximum allowable slope for storm drainage pipe is twenty (20) percent.
- c. Drainage system installation must be such that stormwater discharge is not concentrated on adjacent property owners and that the velocity is less than erosive limits for the site soils. At pipe outfalls, this normally requires the use of a rip-rap apron, placed on filter fabric and lightly grouted, for a minimum distance equal to or greater than six (6) pipe diameters.
- d. Type and class of storm drainage pipe, as well as the construction of pipe culverts, shall be in accordance with Sections 714 of the SCDOT specifications. The proposed use of any type of storm drainage pipes other than reinforced concrete pipe (RCP) shall be considered on a case by case basis.
- e. A minimum of one (1) foot of cover shall be provided for all RCP storm drainage pipes under unpaved roads or any other situation in which no roadway or other structure is to cover the pipe. For pipe under any paved surface, the minimum cover is twelve (12) inches. Contact the County Engineer for minimum depths in other situations (e.g. other pipe types).

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- f. Storm drainage pipe shall be placed to minimize length running under pavement. Where it is necessary for a pipe to cross the roadway, it preferably shall be placed at a ninety (90) degree angle, and in no case at less than forty-five (45) degrees. All cross lines in the roadway shall be compacted in twelve (12) inches lifts to ninety-five (95) percent Standard Proctor maximum density and to one hundred (100) percent Standard on the last twelve (12) inches.
 - g. Any "open" storm drainage cross line pipe shall extend out to the toe of the roadway embankment; in no case will the end of the pipe be within the five foot roadway shoulder.
 - h. Storm drainage pipe discharging into a drainage channel shall intersect the channel in a manner such that the interior angles measured from their centerlines of flow, is greater than, or at most equal to ninety (90) degrees. Rip-rap, or other suitable protection, is required from the outlet point to the bottom of the channel and on the opposite channel bank to prevent scour and erosion.
 - i. Storm drainage pipe discharging into a wet pond or lake shall have the discharge invert above the permanent pool elevation and rip-rap or other energy dissipation structures shall be placed from the outlet point to pool level. Submerged systems should be avoided.
 - j. If submerged systems cannot be avoided, o-ring jointed pipe is required.
 - k. A maintenance access point shall be available within every 200 feet for 15-18" diameter pipe, every 400 feet for 24" pipe and every 500 feet for larger storm drainage lines.
 - l. The 100-year, 24-hour storm event shall be used to check all drainage designs in Special Protection Areas for flood hazards at adjacent structures and/or property.
 - m. Hydraulic grade line and head loss calculations for determining water surface elevations shall be performed for all systems connections.
 - n. Calculations should be performed for the appropriate design storm event (see General requirements section above).
 - o. For storm drainage systems with less than five (5) connections, Manning's Equation shall be acceptable for sizing the capacity of drain pipes for non-submerged conditions where the free water surface elevation is below the crown of the pipes. The Saint-Venant equations (full dynamic wave), which are used in many common engineering programs, shall be employed in larger design situations.
 - p. Storm drain profile plots should be included in the set of construction plans.
 - q. Storm drainage systems shall be designed to convey stormwater runoff by gravity flow unless otherwise approved.
 - r. For very flat flow lines, flow velocities shall increase progressively throughout the system. Upper reaches of the pipe system may have flatter slopes than the lower end of the system.

2. Ditches and Swales:

Open ditch drainage may be used, provided that such ditches are “V” or trapezoidal ditches with side slopes not exceeding the following requirements based upon maximum depth:

- a. Depths up to and including five (5) feet – Side slope ratio of 1.5:1 (1.5 horizontal to 1 vertical).
- b. Depths greater than five (5) feet but no more than seven (7) feet – Side slope ratio of 3:1 (3 horizontal to 1 vertical).
- c. At the option of the developer any open ditch may be piped in lieu of these requirements. As a minimum the drainage system must be piped from the right of way to the rear property line on residential lots.
- d. No drainage ditch shall exceed a maximum depth of seven (7) feet.
- e. Swales shall have side slopes of 4:1 (4 horizontal to 1 vertical) or flatter.

3. Culverts:

- a. Proper consideration of inlet and outlet control shall be given in the design of culverts and outlets.
- b. The pipe, appurtenant entrance and outlet structure should properly account for water, bed-load, and floating debris at all stages of flow.
- c. There should be no unnecessary or excessive cause of property damage.
- d. The outlet should be designed to resist undermining and washout.
- e. Culvert design shall include all cross drainage facilities that transport stormwater runoff under roadways. Culvert selection techniques can range from solving empirical formulas, to using nomographs and charts, to comprehensive mathematical analysis for specific hydraulic conditions. The models used for these calculations are listed below. Other widely accepted models may be used, but must be approved by the County Engineer. Designs shall be based upon SCDOT requirements where applicable.
- f. Culverts under roadways shall be designed using the twenty five (25) year storm event as a minimum, but critical roadways shall be designed using a higher storm event. Ponding on the upstream end of the culvert is acceptable as long as the roadway is not overtopped during the precipitation event. Ponding or backwater effects shall not impact any new or existing structures and recede after the storm event in a time period acceptable to the County Engineer.
- g. Additional hydraulic capacity shall be required as necessary to prevent backwater effects that may adversely impact upstream property or structures.
- h. Acceptable models for designing culverts include, but are not limited to:
 - ICPR
 - HY8
 - Pond Pack

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- HEC-RAS
 - Flow Master
 - HydroCad

All natural primary and/or major drainage channels which are located within, or along the property line of an improvement, development or subdivision shall be protected by the developer as follows:

- a. The existing channel lying within or along the property line of a subdivision or parcel of land proposed for development or redevelopment shall be straightened, widened, and improved to the extent required to prevent overflow, resulting from a fifty (50) year frequency rainfall.
- b. Site improvement shall provide for the grading of all building pads to an elevation where all building pads will not be subject to overflow from the one hundred (100) year frequency flood and in a manner that will provide for a rapid runoff of stormwater.
- c. Whenever channel improvements are carried out, sodding, backsloping, cribbing, and other bank protection practices shall be designed and constructed to control erosion from the anticipated conditions and flow resulting from a fifty (50) year frequency rainfall.
- d. An existing natural drainage channel shall not be located in a street easement unless it is placed in an enclosed storm sewer except under the following conditions:
 1. Where a paved street surface at least two (2) lanes wide is provided on both sides of a paved or stabilized bank channel so as to provide access to abutting properties.
 2. When a condition exists as outlined above, adequate space shall be dedicated as right-of-way to provide for maintenance of the paved drainage channel.
- e. Culverts, bridges, and other drainage structures shall be constructed in accordance with the specifications and design criteria of Berkeley County when the County shall have present or future maintenance responsibility.
- f. No open natural storm drainage course shall be permitted within seventy-five (75) feet of the rear or side of a building to the top of the edge of the drainage facility or vice versa, or 35' from impervious parking areas unless exceptional site planning opportunity is afforded and the improvement will not be jeopardized by flooding or erosion.

All secondary drainage channels which are within, or immediately adjacent to an improvement or subdivision shall be protected and improved by the developer as follows:

- a. Secondary drainage channels which have a primary function of collecting surface water from adjacent properties or intercepting and diverting side hill drainage shall be sodded, bank stabilized or piped.
- b. Developments-
 1. In single-family residential, duplex or apartment-townhouse-condominium development, site grading shall be carried out in such a manner that surface water from each dwelling lot will flow directly to a storm sewer, sodded swale, or paved street with storm drainage without crossing more than (4) adjacent lots in overland flow and with no adverse effects to adjacent property.

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2. In commercial, industrial and institutional development, roofs, paved area, yards, courts and courtyards shall be drained into a storm drainage facility.
 - c. Surface water collected on roadways shall be diverted to a drainage facility at satisfactory intervals to prevent overtopping the centerline of the road during a ten-year frequency rain for minor residential roadways and during the twenty-five year frequency for collector roadways. Design frequency may vary with the classification of street, highway, or land use in the area. Drainage areas allowed for surface flow on streets at the point of diversion shall not exceed twenty (20) acres, regardless of flow.

4. Headwalls and Outlets:

All exposed ends of pipes shall be protected by a flared end section (limited to pipes 36" or less in diameter) or one of the following type headwalls:

- a. A concrete or brick plastered with grout, headwall is preferred; it is required on culverts located in major defined drainage channels. An acceptable design detail is provided at http://www.scdhec.gov/environment/ocrm/pubs/tech_docs_water.htm
- b. A rip-rap headwall is acceptable for pipes 24" or less in a number of situations; if used, it should conform to the standard details provided at: http://www.scdhec.gov/environment/ocrm/pubs/tech_docs_water.htm. Note that this technique requires the use of both filter fabric and grout.
- c. Storm drainage or pond outfalls must be carried to an existing drainage outfall such as a pipe, ditch, etc.
- d. No new point discharge onto adjacent property, where there was not an existing point discharge, is allowed without the property owner's written permission. Discharge points created with new development shall connect to an existing drainage system, whether natural or man-made. The new outlet may not cause flooding or in any way degrade the existing drainage system and proof of such shall be provided. In some cases, conveyance must be constructed from the new development to a point of discharge into the existing system and shall be done at the owner's expense. In these cases, the owner is responsible for obtaining all necessary easements and agreements to construct such drainage improvements.
- e. Outlets will not be allowed to discharge on fill slopes.

5. Energy Dissipation:

- a. All outlets should be sufficiently stabilized. Calculations shall be provided justifying the design and material used (e.g. riprap aprons geometry and diameter).
- b. If riprap aprons are used, filter fabric is to be installed beneath all riprap.
- c. Level spreaders, plunge pools, etc. shall be properly designed and installed at the proposed outlet(s).

6. Storm drainage structures

(Catch basins, yard inlets, manholes, and junction boxes, control structures, etc.):

- a. Materials and construction shall be as specified in Section 719 of the SCDOT (2007) specifications.
- b. When the depth of a storm drainage structure exceeds four and one-half (4-1/2) feet, rungs/steps shall be provided for ascent and descent. (Steps are to be ASTM-C-478, or equivalent.)
- c. The inside dimension of all the storm drainage structures shall be a minimum of three (3) feet by three (3) feet. Sides shall be plastered with grout.
- d. All pipes entering or leaving shall not protrude more than four (4) inches into the box.
- e. All roadway catch basins shall be SCDOT Type 9, Type 16, Type 17 or Type 18 Catch Basins based on the application.
- f. Maximum roadway catch basin inlet capacity for an inlet shall be determined based on the following:

For inlets at sag, capacity shall be based on weir flow (unsubmerged). The depth flow shall be limited to the curb depth, but may be further limited by the allowed spread, detailed below. In sag conditions, a 15% factor of safety shall be used to account for debris/clogging. Ponding at the sag location shall be limited to 24 hours after the storm event.

For inlet on grade, theoretical capacity shall be considered in the design the longitudinal and cross slopes, and gutter depression. The length of the gutter opening must be such that the gutter efficiency is 80% of the theoretical capacity. Several equations and nomographs are available in the literature for determining the theoretical capacity. Maximum flow depth shall be limited to the depth of curb.

- g. Catch basins and yard inlets shall be designed to accommodate a given flow such that ponded water is removed within 24 hours and does not cause flooding to adjacent buildings or other structures.
- h. Storm drainage structures will be located outside curve radii.
- i. Storm drainage structures shall contain a minimum drop of 0.2 feet from invert in to invert out.
- j. Floors of Storm drainage structures shall be of concrete and contain "formed troughs" to help channel flow.
- k. Storm drainage structures, the elevation at the crown of any inlet pipe shall be equal to or greater than the crown of the outlet pipe.
- l. Area around all catch basins shall be backfilled in six (6) inch to eight (8) inch lifts, compacted to ninety-five (95) percent Standard Proctor maximum density.
- m. Inlet protection shall be provided at all inlets into the stormwater system during construction and until project closure procedures have been completed or notification from the County Engineer has been given stating that an acceptable level of stabilization has been achieved. Guidance on design, installation and maintenance of inlet protection can be found in SCDOT (2007).

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- n. Roadway inlet spacing shall be based partly on the maximum spread of water into the roadway. For the appropriate design storm, at least one full travel lane width must be available during the rain event for all roads. Inlets up-gradient of a road intersection, sag inlets, or the last inlet for a given system must be designed with sufficient capacity to handle the entire flow, such that there is no flow through/bypass.
 - o. Maximum depth in which the water may pond above or around an inlet must not threaten surrounding permanent structures or facilities including vehicular or pedestrian traffic.
 - p. Inlets placed in collector roadway gutter lines must be spaced to prevent flow from entering road intersections and to not exceed a maximum spread of 6-feet, or one-half of a travel lane, whichever is greater, and based on maximum inlet capacity.
 - q. In depth design procedures for inlet and storm sewer design may be referenced in AASHTO (1999), USDT (2001b), Mays, L., (2001), and Yen (2001). Culvert design guidance is found in USDT (2001a).
 - r. All manhole lids and catch basins shall contain the Berkeley County water quality logo or an alternate design approved by the County Engineer. Contact the County Engineer for information on how to obtain logos.

3.7 OPEN CHANNEL HYDRAULICS

Open channels shall include all permanent storm drainage channels including swales, culverts, and diversions. These storm drainage systems shall be designed based upon the following criteria:

1. All open channels shall be uniform and shall be stabilized to prevent erosion in a manner approved by the County Engineer. A number of acceptable techniques are shown in the current version of the SCDHEC (2005).
2. The design of open channels shall be based on Manning's Formula where backwater effects from obstructions and/or tailwater is not present. Flow velocities for the 10-year storm event must be less than five (5) ft/sec (two and one-half (2.5) ft/sec in bare sandy soils) or the channel surfaces must be adequately lined, e.g., rip-rap, concrete.
3. The minimum channel grade shall be 0.005 ft/ft, unless supporting calculations show that there will be no pools or standing water areas formed in the channels at smaller slopes.
4. Design conditions can be assumed to be steady, uniform flow.
5. Except for roadside ditches, the side slopes of grassed lined channels without Erosion Control Blankets or Turf Reinforcement Matting shall be no steeper than 3H to 1V.
6. Channels may be designed with multiple stage levels with a low flow section to carry the 2-year storm event and a high flow section to carry storms of larger frequencies.
7. Berkeley County allows vegetated channels. Guidance on the design of these type channels can be found in Haan et. al. (1995) or by using computer software that is capable of calculating channel stability and capacity.

8. Additional hydraulic capacity shall be required as necessary to prevent backwater effects that may adversely impact upstream property or structures.
9. Acceptable models for designing open channels include, but are not limited to:
 - ICPR
 - HY8
 - Pond Pack
 - HEC-RAS
 - Flow Master
 - HydroCAD

Table 3.16 Maximum Permissible Velocities for Vegetated Channels

Cover	Permissible Velocity (ft./sec.)*					
	Erosion Resistant Soils % Slope			Easily Eroded Soils % Slope		
	0-5	5-10	> 10	0-5	5-10	> 10
Bermuda Grass	8	7	6	6	5	4
Bahia Buffalo Grass Blue Gamma Centipede Grass Tall Fescue Kentucky Bluegrass Red Canary Grass	7	6	5	5	4	3
Grass-legume Mixture	5	4	NR	4	3	NR
Lespedeza Sericea Weeping Lovegrass Kudzu Alfalfa Small Grains Temporary Vegetation	3.5	NR	NR	2.5	NR	NR

*Allow velocities over 5 ft/sec only where good cover and maintenance will be provided. If poor vegetation exists due to shade, climate, soils or other factors, the permissible velocity shall be reduced by 50 percent.

NR = Not Recommended

Sources: Elementary Soil and Water Engineering, Shwab et. al. and Hann et. al. (1995)

General guidance on open channel design can be found in USDT (1996, 2001).

3.8 SPECIAL PROTECTION AREAS

In an effort to address some of the most critical water resource problems that exist in the County, Special Protection Areas have been established. Those wishing to develop or redevelop lands within these protected areas will be required to comply with the minimum standards listed in the preceding sections as well as a more stringent set of design criteria detailed below. These generally focus on either a water quantity (reduce or prevent frequent and/or extreme flooding) or a water quality problem (prevent or reduce degradation of riverine, estuarine, coastal ecosystems or maintain a designated use(s)). At such times that maps are made available to the public, the County Engineer will inform applicants on whether or not a proposed project is required to comply with additional design criteria listed in the following sections. The maps are not included in the manual due to expected changes in the designated areas, particularly those associated with TMDLs.

3.8.1 WATER QUANTITY ISSUES

Flooding problem areas exist in many locations around the County to the point that stormwater controls have become overwhelmed, or where controls were never adequately designed or installed to control runoff. The ability to maintain a system is also suspected to be contributing to some of the frequent flooding. In an effort to relieve existing flooding problems, the following list of design criteria will be required in designated areas. The requirement in conjunction with the enforcement of other design criteria listed in the sections above, are required to provide the necessary controls.

1. The post-development, peak discharge rates are restricted to half ($\frac{1}{2}$) the pre-development rates for the 2 and 10-year storm event or to the downstream system capacity, whichever is less.
2. The post-development runoff volumes for the 2-year frequency 24-hour duration storm events above the pre-development level shall be stored for a period of 24-hours on average before release.

Additional criteria may be established on a case by case basis.

3.8.2 WATER QUALITY ISSUES

In conjunction with the NPDES permitting program, SCDHEC, through delegated responsibility from EPA, must identify and mitigate impaired waterbodies. Impaired waterbodies are identified through a monitoring program, the results of which are compared against water quality standards developed to protect designated uses of individual waterbodies. Impaired waterbodies are those that do not meet these standards and cannot be used for their designated purposes, such as fishing, swimming, recreation, and/or support of aquatic life. In accordance with Section 303 of the Clean Water Act, states must release a bi-annual report of the impaired waterbodies. Waters listed on the 303(d) list will eventually have a TMDL developed, which represents the daily amount of a particular pollutant that a waterbody can receive and still meet the water quality standard for its designated use(s). A list of the 303(d) waterbodies can be found at <http://www.scdhec.gov/environment/water/tmdl/index.htm>.

1. List the nearest SCDHEC Water Quality Monitoring Station (WQMS) that the site's stormwater discharges drain to and the waterbody on which it is located.
2. If nearest WQMS is listed on the most current 303(d) List of Impaired Waters and if site's stormwater construction discharges contain the pollutant of impairment and if the site disturbance 25 or more acres, qualitative and quantitative assessment (described in Section 3.4C of SCR100000) shall be provided and include at a minimum, calculations that show:

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- a sites pollutant load for all pollutants of concern (see Table 3.5),
 - the trapping effectiveness of the chosen BMPs, and
 - that the runoff discharged through the last water quality BMP has a water quality level equal to or better than the in-stream standard or as required by an applicable TMDL.
3. Evaluation of selected BMPs if nearest WQMS listed on the most current 303(d) List of Impaired Waters and if site's stormwater construction discharges contain the pollutant of impairment and if site disturbance less than 25 acres. Such evaluations may reference published values on BMP effectiveness.
 4. If a TMDL has been developed for the nearest WQMS and if the site's stormwater construction discharges contain the pollutant of impairment, show that measures and controls meet assumptions and requirements of TMDL (may need to contact SCDHEC Watershed Manager for assistance).

CHAPTER 4 - INSPECTIONS & ENFORCEMENT

This chapter establishes inspection and enforcement guidelines to be followed by the County.

4.1 BERKELEY COUNTY STORMWATER MANAGEMENT INSPECTIONS

The County will inspect applicable construction sites from initial land clearing to final stabilization. The purpose of these inspections will be to check for compliance with the stormwater management plan approved by the County Engineer and County Stormwater Management Ordinance. Maintenance inspections will also be performed on stormwater management systems and facilities throughout their useful life. For each system or facility installed or retrofitted during an approved construction project, the applicant must have submitted a maintenance schedule and plan. County Inspector will be checking for adherence to this plan and any necessary changes that may arise after installation. County inspections are not to be construed as a relaxation of the requirements on owners/operators to conduct self-inspection in accordance with any applicable local, State or Federal stormwater requirements.

4.1.1 STORMWATER MANAGEMENT INSPECTOR DUTIES/RESPONSIBILITIES

Berkeley County Inspector shall inspect and enforce the requirements of the County Stormwater Management Ordinance. The job duties/responsibilities of a County Inspector shall include, but not be limited to, the following:

1. Conduct and document site inspections during construction to ensure compliance with the approved stormwater management plan. Frequency of inspections will be determined by County staff on an as needed basis.
2. Ensure that the approved stormwater management plan, and the construction plans are on the project site and are properly being followed and implemented.
3. Conduct post-construction inspections to ensure that permanent maintenance is being performed in accordance with the maintenance schedules and Covenants of Permanent Maintenance of Stormwater Systems (Covenants) for the various stormwater management facilities in the approved stormwater management plan.
4. Issue enforcement orders, as necessary, to the owner/operator when any portion of the work does not comply with the approved stormwater management plan or work is occurring without appropriate approval or permitting. The enforcement process and types of orders is detailed in Section 4.3.
5. Perform a final inspection upon the completion of the stormwater system to determine if the system is constructed in accordance with the approved stormwater management plan.
6. Take immediate action if the owner/operator fails to comply with the approved stormwater management plan and an imminent hazard exists as a result. The County Inspector should address the situation and notify any applicable local, State and Federal agencies.
7. Maintain accurate and comprehensive project inspection files ensuring all relevant information is entered in the files to be maintained in the County Engineering Department.

4.1.2 INSPECTION PROCESS AND PROCEDURES

As per Berkeley County's Stormwater Management Ordinance, the County Engineer or an authorized representative/designee (County Inspector) may enter upon all properties for regular inspections, periodic investigations, enforcement and to effectuate the provisions of the Ordinance. Upon refusal by any owner/operator to permit a County Inspector to enter upon the property or continue an inspection, the County Inspector shall terminate the inspection or confine the inspection to portions of the property to which no objection is raised. The County Engineer or his designee shall document the refusal and the grounds for such and promptly seek appropriate compulsory process.

Upon completion of a during construction site inspection, the County Inspector should, at a minimum, include the following in his inspection report:

1. Date and location of the site inspection.
2. Whether the approved stormwater management plan, and construction plans have been properly implemented and maintained.
3. Identification of any approved plan or BMP deficiencies.
4. Any corrective actions needed.

Upon completion of a post-construction maintenance inspection, the County Inspector should, at a minimum, include the following in this inspection report:

1. Date and location of the site inspection.
2. Whether the activities identified in the approved maintenance plan and schedule and Covenants have been properly implemented, completed, and maintained.
3. Identification of any maintenance deficiencies.
4. Any corrective actions needed.

4.2 PERMITTEE INSPECTION RESPONSIBILITIES

In accordance with any applicable local, State and Federal stormwater requirements including, but not limited to, the NPDES Construction General Permit (CGP), owner/operators are responsible for conducting during construction and post-construction site inspections. Records of such inspections should be kept for a minimum of five (5) years and must be made available to Berkeley County upon request.

4.3 ENFORCEMENT

If the County determines that a project is in non-compliance with the County's Stormwater Management Ordinance, then the County Inspector may direct conformity by proceeding with the appropriate enforcement action. The types of enforcement tools available to the County include a Correction Order, Notice of Violation (NOV), Stop Work Order and Civil/Criminal Penalties. The enforcement mechanism to be utilized will depend on the circumstances as described in the following sections.

4.3.1 CORRECTION ORDERS

The County Engineer typically issues a Correction Order for first offenses of non-compliance with the County Stormwater Management Ordinance and the approved stormwater management plan. The purpose of the Correction Order is to give notice of the deficiencies, identify expected corrective results and provide a reasonable timeframe to the contractor prior to the County taking further action to get a problem resolved. Correction Orders shall be submitted in writing, but a verbal notice may be given if the deficiency needs immediate correction to prevent offsite or downstream impacts. The County Engineer shall issue Correction Orders within five (5) working days of an inspection. All Correction Orders, verbal or written, shall be noted in the project file.

Correction Orders may be issued in such cases, but not be limited to, when there is:

1. Failure to comply with the approved stormwater management plans to include failure to have properly installed and/or maintained BMP measures.
2. Failure to properly maintain permanent stormwater management structures.
3. Failure to notify the County Engineer before beginning work on a phase of an approved project.
4. Failure to call for a final site inspection.

A Correction Order should at a minimum include, but not be limited to, the following:

1. Nature of the violation(s).
2. Proposed penalty.
3. Required corrective actions.
4. The time period for correcting the violation(s).

4.3.2 NOTICES OF VIOLATION (NOV)

If a Correction Order has been previously issued and there are either subsequent non-compliance issues or failure to complete the items on the Correction Order within a specified time period, then a Notice of Violation may be issued. In addition, for violations that do not involve a safety issue or an imminent threat of serious damage to the environment and/or public or private property, a Notice of Violation may be issued for, but are not limited to, the following:

1. If construction activities have been initiated and no BMP measures are in place, or are not working to prevent sediment from leaving the site.
2. Failure to have work inspected and approved before restarting construction activities after a stoppage of work.

A Notice of Violation (NOV) should at a minimum include, but not be limited to, the following:

1. Nature of the violation(s).
2. Proposed penalty.

-
3. Notification that a Stop Work Order may be issued or that permits for the site may be suspended or revoked if there is continued non-compliance.
 4. Required corrective actions.
 5. The time period for correcting the violation(s).

4.3.3 STOP WORK ORDER

A Stop Work Order may be issued for, but are not limited to, the following:

1. Construction activities are occurring without an approved stormwater management plan.
2. Past enforcement actions taken by the County (Correction Orders, Notice of Violations) to remedy a situation(s) have not been properly addressed with appropriate and prompt action to the satisfaction of the County Engineer.
3. Non-compliance with the plans has resulted in a health or safety issue.
4. Offsite sedimentation resulting from non-compliance with the approved stormwater plan has eliminated or severely degraded a use in a downstream waterbody or that such degradation is imminent.
5. Offsite sedimentation resulting from non-compliance with the approved stormwater management plan has caused severe damage to adjacent, downstream or upstream property.

A Stop Work Order may allow or require correction of violations, but no other construction activities may occur. The Stop Work Order shall state that failure to comply may result in the suspension or revocation of any remaining permits issued for the site and/or civil penalties being issued.

4.3.4 CIVIL PENALTIES

The County may issue a Civil Penalty if a Notice of Violation and/or Stop Work Order has not been complied with or there has not been substantial progress in complying with the Notice of Violation and/or Stop Work Order. In addition, a Civil Penalty may be issued when there are repeated, recurring violations at the same site or when there are repeated, recurring violations by the same responsible party. Violations may subject the owner/operator to Civil Penalties of not more than \$1,000 for each violation. Each separate day of a violation constitutes a new and separate violation.

4.3.5 CRIMINAL PENALTIES

In addition to any applicable civil penalties, any person who negligently, willfully, or intentionally violates any provision of the Stormwater Management Ordinance shall be guilty of a misdemeanor and shall be punished within the jurisdictional limits of the magistrate's court. The County may issue a uniform summons citation for a violation of this Ordinance. Fines imposed under the NOV may not exceed \$500.00 per violation and/or thirty (30) days in jail. Each day of a violation shall constitute a new and separate violation.

CHAPTER 5 - REFERENCES

This chapter lists the various references used in the manual and if available, websites where they can be retrieved.

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Appendix A

Construction Activity Application (CAA)



BERKELEY COUNTY STORMWATER MANAGEMENT PROGRAM

CONSTRUCTION ACTIVITY APPLICATION

Sites within Regulated Area and disturbing one-half (1/2) acre or more

For Official Use Only

Date Received: _____

Application No: _____

I. Owner Information

Owner (Company or person): _____
Contact Person: _____ Company EIN: ____ - ____ - ____
Address: _____
City: _____ State: _____ Zip: _____
Phone: (Day) ____ - ____ - ____ (Mobile) ____ - ____ - ____ (Fax) ____ - ____ - ____
Email address: _____

II. Operator Information

Company or person: _____
Contact Person: _____ Company EIN: ____ - ____ - ____
Address: _____
City: _____ State: _____ Zip: _____
Phone: (Day) ____ - ____ - ____ (Mobile) ____ - ____ - ____ (Fax) ____ - ____ - ____
Email address: _____

III. Contractor Information

Company or person: _____
License #: _____
City: _____ State: _____ Zip: _____
Phone: (Day) ____ - ____ - ____ (Mobile) ____ - ____ - ____ (Fax) ____ - ____ - ____
Email address: _____

IV. Plan Preparer Information

Plan Preparer: _____ S.C. Registration #: ____ - ____ - ____
Company/ Firm: _____ S.C. COA #: ____ - ____ - ____
Mailing Address: _____
City: _____ State: _____ Zip: _____
Phone: (Day) ____ - ____ - ____ (Mobile) ____ - ____ - ____ (Fax) ____ - ____ - ____
Email address: _____

V. Project Information

A. Project Name: _____

Location (street address, nearest intersection, etc.): _____

Tax map # (list all): _____

Disturbed area (to the nearest tenth of an acre): _____

Total area: _____ Impervious area: _____

B. Is this project part of a Larger Common Plan for Development or Sale (LCP)? Yes No

LCP/Overall Development Name: _____

Check here if this is the first phase.

Previous state permit/file no.? _____ Previous NPDES coverage number: SCR10 _____

C. Type of Construction Activity (check all that apply):

- Commercial Residential: Single-family Linear (Roads, utility lines, etc.)
 Institutional Residential: Multi-family Site Preparation (No new impervious)
 Industrial Re-development Other: _____

VI. Waterbody Information

A. Nearest receiving waterbody(s): _____ Distance to this waterbody (feet): _____

Next/Nearest named receiving waterbody(s): _____

B. Wetlands/ Waters of the State

Waters of the U.S./ State	On the site?	If yes, delineated/ identified?	Impacts?	Amount of impacts
a. Jurisdictional wetlands	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	____ Ac ____ Feet
b. Non-jurisdictional wetlands	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	____ Ac ____ Feet
c. Other (List): _____	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	____ Ac ____ Feet

If yes for delineation, has documentation of the delineation from the USACOE been provided? Yes No N/A

If yes for impacts, has a USACOE permit been applied for or obtained for those impacts? Yes No N/A

If yes, provide copy of the approved USACOE permit.

C. Special Protection Areas*

1. Are there any flooding problems downstream of or adjacent to this site? Yes No

If yes, see attached instruction.

2. Are any portions of the site located in a designated floodplain? Yes No

If yes, what are the FIRM Numbers? _____

3. List the nearest DHEC water quality monitoring station(s) [WQMS(s)] to which stormwater (SW) discharges will drain and the corresponding waterbody(s). _____

3.1. Is this WQMS listed on the most current 303(d) List for Impaired Waters? Yes No

a. If yes for (3.1), list the impairment(s). _____

b. If yes for (3.1) will SW discharges from your site contain the pollutant(s) of impairment? Yes No

c. If yes for (b) will use of the proposed BMPs ensure that the site's discharges will not contribute to or cause further water quality standard violations? Yes No

3.2. Has a TMDL(s) been developed? Yes No

a. If yes for (3.2), list the waterbody _____
list the impairment(s). _____

b. Has the standard been attained for the impairment(s)? Yes No

- c. If no for (b), will SW discharges from your site contain the pollutant of impairment? Yes No
- d. If yes for (c), are your discharges consistent with the assumptions and requirements of the TMDL(s)? Yes No
- e. If no for (d), will use of the selected BMPs ensure that the site's discharges will not contribute to or cause further water quality standard violations? Yes No

*Projects located in the Special Protection Areas may require a pre-submittal meeting.

VII. Signatures and Certifications

A. One copy of the stormwater plan, all specifications and supporting calculations, forms, and reports are herewith submitted and made a part of this application. I have placed my signature and seal on the design documents submitted signifying that I accept responsibility for the design of the system. Further, I certify to the best of my knowledge and belief that the design is consistent with the requirements of the Berkeley County Stormwater Management Ordinance and the Berkeley County Stormwater Design Standards. (This should be the person identified in Section IV)

Printed name of Plan Preparer

Signature of Plan Preparer

S.C. Registration #

B. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

I hereby certify that all construction and associated activity pertaining to this site shall be accomplished pursuant to and in keeping with the terms and conditions of the approved plans. I also certify that a responsible person will be assigned to the project for day-to-day control. I hereby grant authorization to Berkeley County the right of access to the site at all times for the purpose of on site inspections during the course of construction and to perform maintenance inspections following the completion of the land-disturbing activity.

Printed name of Owner/Operator**

Signature of Owner/Operator

Title/ Position

**In such cases where an operator signs the certification, a copy of the maintenance agreement between the owner and operator as required by the Stormwater Management Ordinance must be submitted with this application.

Instructions

Completing the Application:

You must type or print legibly. You must include the original, signed application form, one copy of the stormwater plan, and one copy of all other supporting documentation with the initial submittal. A checklist of all the documents necessary to obtain Construction Activity Application approval is available online.

Who Must Submit an Application:

Any construction project located within "Regulated Area" as defined in the Stormwater Management Ordinance and disturbing one (1) acre or more unless exempted in the Ordinance and/or Manual.

"Regulated Area" is defined in the Stormwater Management Ordinance as "the boundaries of Berkeley County's urbanized areas as determined by Decennial Census Data from the United States Bureau of the Census. Regulated Area also includes any portion of the County that is so designated by Berkeley County Council. The Regulated Area designated by Berkeley County Council coincides with the area defined as "Service Zone 1" by the "Transportation Impact Fee Ordinance for Unincorporated Berkeley County" (Ordinance No. 06-11-75)". The Regulated Area can be viewed from Berkeley County Website:

<http://gis.berkeleycountysc.gov/disclaimer.html> GIS Mapping → GIS Internet Mapping (MS4 Regulated Area)

Projects located in the Berkeley County Regulated Area submit to:

Berkeley County Engineering
1003 Highway 52
Post Office Box 6122
Moncks Corner, S. C. 29461-6120
843.719.4127

I. Owner Information

- The official or legal name of the owner shall be listed. If the owner is a company, then a Permit Contact person shall be listed. This can be someone other than the person that has signatory authority for the company. All correspondence regarding this permit application will be sent to Permit Contact at the address listed.
- Owner is defined in the Stormwater Management Ordinance as the "property owner, or any person who acts in his own behalf, that submits an application for approval to disturb land or vegetation or encroachment and the person, if so designated by default or on legal documents, as the responsible party for maintenance of a stormwater system(s) and facility(s)".
- The Company EIN is the Employer Identification Number as established by the U.S. Internal Revenue Service.

II. Operator Information

- The official or legal name of the operator should be listed. If the operator is a company, then a Permit Contact person shall be listed. This can be someone other than the person that has signatory authority for the company. All correspondence regarding this permit application will be sent to Permit Contact at the address listed.
- Operator is defined in the Stormwater Management Ordinance as the "the person who is operating the property, including an operator or person who is in charge of any activity related to land disturbance, construction or post construction stormwater quality or quantity".
- The Company EIN is the Employer Identification Number as established by the U.S. Internal Revenue Service.

III. Contractor Information

- The name of the Company shall be listed.
- The Company License # is the License number as established by the State.

IV. Plan Preparer Information

- Enter the name and registration number of the stormwater plan preparer. S.C. COA is the company's S.C. Certificate of Authorization. Enter N/A for S.C. COA if the firm does not have a COA or the preparer is an individual. If an email address is entered, the County Engineer may contact the plan preparer via email.

Note: Typically, the plan preparer must be an engineer licensed in the State of South Carolina. For certain construction activity, the plan preparer may be someone other than a licensed engineer. However, this must be approved in advance by the County Engineer.

V. Project Information

A. The Project/ Site Name should be a unique or distinguishing name (e.g., not Proposed Subdivision). The Department should be notified in writing if the Project/ Site Name changes.

County: If the project is in multiple counties, list all counties and indicate in which county the majority of the project will be.

The total and disturbed areas should be rounded to the nearest tenth of an acre. For subdivisions, if the exact build-out is not known, the disturbed area can be estimated using the following equation: Disturbed area = 2(Maximum Footprint of House)(# of lots) + Road/ Right-of-Way areas + Other easements/ disturbance. Please note that the County must be notified if the actual disturbed area is greater than the disturbed area listed on the application.

B. Institutional includes schools and other publicly owned projects, except linear projects. Site Preparation includes clearing, grubbing, and grading only; no new impervious areas shall be proposed if this activity type is checked.

VI. Waterbody Information

A. The nearest receiving waterbody is the nearest waters of the State to which the site's stormwater will discharge. If this waterbody is unnamed, then provide a description that references the nearest, named waterbody (e.g., tributary to Grove Creek). If the site's stormwater discharges to multiple waterbodies, then list all such waterbodies and attach additional sheets, if necessary.

C. Special Protection Areas: If yes for (2), then the extent of the flooding problems and the effect of this project on those problems must be explained in the checklist under Project Narrative. For design criteria, see checklist under Special Protection Areas.

VII. Certifications

A. The same licensed professional must sign and seal the application, drawings, calculations, and supporting documentation.

B. A person with signatory authority for the project owner/ operator must sign the application. The plan preparer cannot sign the application for the project owner/ operator. The plans, all reports, including monthly reports, and any information requested by the Engineering Department must be signed by a person with signatory authority for the project owner/ operator or a duly authorized representative.

- Corporation: A responsible corporate officer (e.g., president, vice-president, certain managers)
- Partnership or Sole Proprietorship: A general partner or the proprietor, respectively
- Municipality, State, Federal or Other Public Agency: Principal executive officer or ranking elected official

Office Mechanics and Filing

This form and supporting documentation will be kept in the Engineering Department files.

Appendix B

Covenants for Permanent Maintenance of Stormwater Systems



BERKELEY COUNTY STORMWATER MANAGEMENT PROGRAM
COVENANTS FOR PERMANENT MAINTENANCE
OF STORMWATER SYSTEMS

THE TERM STORMWATER SYSTEMS MAY REFER TO WATER QUANTITY AND/OR WATER QUALITY FACILITIES, AND BEST MANAGEMENT PRACTICES, BMPS (i.e., detention basins, retention basins, stormwater ponds, stormwater wetlands, water quality buffers, swales, ditches, pipes, inlets, separators, filtering devices, water quality structures, etc.)

THIS Covenant made and entered into this _____ day of _____, 20____, by and between (Insert Full Name of property owner) _____ hereinafter called the "Owner", and Berkeley County, South Carolina hereinafter called the "County".

WHEREAS, the Property Owner is the owner of certain real property described as Berkeley County Tax Map Number, (TMS#) _____ as recorded by deed in the Berkeley County Register of Deeds (ROD), Deed Book _____ Page _____, hereinafter called the "Property;" and

WHEREAS, the Owner is proceeding to, or has, made improvements on the Property; and

WHEREAS, the Site Plan/Subdivision Plan known as (Name of Plan/Development) _____

hereinafter called the "Plan," which is expressly incorporated herein by reference, as approved, or to be approved, by the County, provides for the construction and maintenance of stormwater facilities, BMPs, and improvements within the confines of the Property; and

WHEREAS, the County requires that on-site stormwater facilities, BMPs, and improvements as shown on the Plan be constructed and adequately maintained by the Owner, its successors and assigns, including any homeowners association;

WHEREAS, the Owner, its successors and assigns, understands that the execution and adherence to the provisions of this Covenant is a condition precedent to the County's permitting, and/or approving the Site Plan, Storm Water Management Plan, and/or Subdivision Plan for the Property and the development located thereon;

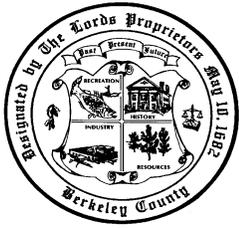
NOW, THEREFORE, in consideration of the foregoing premises and mutual covenants the parties hereby agree as follows:

1. The on-site stormwater facilities, BMPs, and, improvements shall be constructed, operated, and maintained by the Owner, its successors and assigns, in accordance with the approved Plan and specifications identified in the Plan, as well as in accordance with State and federal requirements, the Berkeley County Stormwater Management Ordinance and Stormwater Design Standards Manual, and any and all other applicable County ordinances.

2. The Owner, its successors and assigns, including any homeowners association, shall adequately maintain the stormwater facilities, BMPs, and improvements on the Property. Adequate maintenance required by this Covenant shall include, but is not limited to, scheduled and corrective maintenance as described on/in the approved Plan and/or as described in the Berkeley County Stormwater Design Standards Manual for all stormwater facilities, BMPs, and improvements intended to manage and/or control stormwater on the Property, with such facilities, BMPs, and improvements to expressly include, but not be limited to pipes, drainage structures, ditches, swales, vegetation, berms, pond areas, outlet structures, maintenance shelf(s) and access roads, or any other improvement associated with stormwater on the Property but excluding any such improvements located on, under, or within any publicly owned or dedicated rights-of-way in which State or County has accepted maintenance of the roadways and/or drainage facilities. Adequate maintenance is herein defined as keeping such stormwater facilities, BMPs, and improvements in good working condition such that they satisfactorily perform their intended design functions.
3. The Owner, its successors and assigns, shall inspect the stormwater facilities, BMPs, and improvements as described on/in the approved Plan and/or as described in the Berkeley County Stormwater Design Standards Manual to assure safe and proper functioning of the stormwater facilities, BMPs, and improvements located on the Property. Any and all deficiencies identified during such inspections shall be repaired as necessary at the Owner's expense. A detailed repair plan may be required to be prepared by a professional engineer, licensed in the State of South Carolina.
4. The Owner, its successors and assigns, hereby grants permission to the County, its authorized agents and employees, to enter upon the Property and to inspect the stormwater facilities, BMPs, and improvements as deemed necessary by the County for purposes of protecting the public health, safety or welfare, for purposes of investigating or inspecting any reported or suspected deficiencies in the stormwater facilities, BMPs, and improvements on the Property, for purposes of responding to or investigating citizens' complaints relating to the management or control of stormwater on the Property, or for any other purpose deemed necessary by the County. The County shall provide the Owner, its successors and assigns, with a copy of any inspection findings, as well as a directive to commence with any required repairs. To the extent that the County does not agree with or to the contemplated repairs proposed by the Owner, the County may submit an alternate repair plan to the Owner or require the Owner to submit a detailed repair plan prepared by a professional engineer, licensed in the State of South Carolina.
5. In the event the Owner, its successors and assigns, fails to maintain the stormwater facilities, BMPs, and improvements on the Property in good working condition acceptable to the County, or fails to make repairs as specified in the inspection report within a reasonable time frame as established by the County, with such time frame not to be shorter than thirty (30) days, the County may enter upon the Property and take any and all action necessary to correct deficiencies identified in the inspection report. The Owner, its successors and assigns, shall be responsible for any and all expenses incurred by the County in taking such corrective action. This provision shall not be construed to allow the County to erect any structure of a permanent nature on the land of the Owner outside the easement for the stormwater management/BMP facilities. It is expressly understood and agreed that this Covenant imposes no obligation or responsibility on the County to routinely maintain or repair any stormwater facilities, BMPs, and improvements located on the property.
6. In the event that the County performs or undertakes work of any kind pursuant to this Covenant or expends any funds or resources in performance of said work for labor, use of equipment, supplies, material, and the like, the Owner, its successors and assigns, shall reimburse the County upon demand, within thirty (30) days of receipt of same.
7. This Covenant shall impose no liability on the County with respect to the maintenance or repair of any stormwater facilities, BMPs, and improvements on the Property, nor does the County assume any obligation

Appendix C

Checklist for CAA



BERKELEY COUNTY STORMWATER MANAGEMENT PROGRAM

CHECKLIST FOR CONSTRUCTION ACTIVITY APPLICATION

The following checklist shows the components that must be provided by the applicant with the completed Construction Activity Application.

The submitted information typically includes three parts: the application, the technical engineering calculations and discussions, and the construction documents (plans, details, specifications).

I. APPLICATION FORM

- All application items must be completed and answered sufficiently.
- Signatory authority (original signatures) must be provided where requested.

II. TECHNICAL REPORT/ENGINEERING CALCULATIONS

1 REPORT COMPOSITION:

- 1.1 Table of Contents
- 1.2 Report should be put together in a manner that facilitates review
- 1.3 Report prepared by licensed professional
- 1.4 One copy to be submitted.

2 MAP(S):

- 2.1 Include north arrow and scale on all maps.
- 2.2 Outlined project location.
- 2.3 Labeled road names.
- 2.4 Nearest waterbodies, discharge points, and waters of the State.
- 2.5 Location of any nearby protected areas (waters, wetlands, etc.)
- 2.6 Topographic information showing runoff patterns/overland flow paths.
- 2.7 Soil types.
- 2.8 100-year floodplain contours, location of floodway.
- 2.9 Wetlands.

3 PROJECT NARRATIVE:

- 3.1 A description of the site in general, purposes of the construction activity, issues with upstream, downstream, and adjacent properties, waterbodies receiving stormwater runoff, issues with site soils, existing water quality and flooding issues, anticipated impacts (quality, upstream/downstream structures, etc.) and benefits (open space, treatment, maintenance, etc.), and reasons for waiver request.
- 3.2 A summary table to include at least the following:
 - Total and disturbed area
 - Soil Type(s)
 - Nearest receiving water body(s)

- List of BMPs for water quality and quantity
- 10-year & 100-year flood elevation if located in flood plain.

3.3 A summary table of existing and proposed runoff flows, volumes, and pollutant loads.

3.4 A discussion of issues relating to other State and federal permits needed or regulations to be followed.

3.5 A summary of the maintenance plan and schedule of the stormwater facilities, BMPs, and any improvements on the property for construction site and post-construction, and arrangements for construction site and post-construction maintenance responsibility.

4 WATERS OF THE STATE, INCLUDING WETLANDS:

4.1 Delineation of all waters of the State (WoS) located on the site, including wetlands, shown and labeled on plans.

4.2 If impacts to WoS, outlined areas of impacts and labeled that no work can begin in this area until all necessary USACOE permits and SCDHEC 401 certifications have been obtained.

4.3 Double row of silt fence provided in all areas where a 50' undisturbed buffer cannot be maintained between the disturbed area and the WoS.

4.4 Minimum 10' maintenance buffer provided between last row of silt fence and WoS; or, if buffer not provided, then statement from P.E. on plans indicating how silt fence will be installed and maintained without impacts to WoS.

Note: If there are proposed impacts to WoS, then applicant must contact the USACOE and/or S.C. DHEC Water Quality Certification, Standards & Wetlands Programs Section to determine additional requirements before submitting this NOI.

Note: If WoS are to be impacted, work cannot be performed in these designated areas until all necessary permits have been acquired.

Note: If USACOE permit is required for construction of a permanent stormwater management structure, County final approval cannot be granted until all applicable State and federal permits have been obtained. A preliminary approval is issued instead.

Note: A 50-foot buffer between a sediment trap/basin and WoS and wetland areas is recommended.

5 HYDROLOGIC ANALYSIS:

5.1 Drainage area maps clearly delineating the sub basins/watersheds for pre and post developed conditions. The sub basins/watersheds must correspond to the pre and post developed calculations.

5.2 Pre and post developed hydrologic analysis calculations for the 2-year, 10-year, 25-year, 50-year, and 100-year storm events, at each outfall point. Analysis should be performed at the same points and with the same drainage area for both pre and post developed conditions. The analysis must correspond to the delineated drainage area maps for pre and post developed conditions.

5.3 Analysis performed using SCS 24-hour storm (Rational Method not acceptable) or other if acceptable to the County Engineer.

5.4 Use rainfall data from South Carolina DHEC Storm Water Management BMP Handbook.

6 DETENTION ANALYSIS/DESIGN:

6.1 Analysis

6.1.1 Pond routing using a volume based hydrograph for the 2-year, 10-year, 25-year, 50-year and 100-year SCS 24-hour rainfall event (Drain:Edge, ICPR, HEC-1, SedCAD, HYDRAFLOW, etc. perform full pond routings: TR55 does not perform a full pond routing; rational method cannot be used).

6.1.2 Hydrologic and hydraulic calculations necessary to determine the impact of hydrograph timing modifications of the proposed land disturbing activity, with and without the pond (results of analysis will determine the need to modify the pond design or eliminate the pond requirement, see note below).

6.1.3 Inputs and outputs from analysis program.

- 6.1.4 Summary table of the peak inflows, peak outflows, and maximum water surface elevations (WSE) for the 2-year, 10-year, 25-year, 50-year and 100-year storm events for each pond.
- 6.1.5 Stage-storage-discharge relationship for the outlet structure of each detention structure.
- 6.1.6 If a rating curve for the outlet structure must be generated externally from the analysis program (Drain:Edge, HEC-1, HydroCAD), data and equations used to rate the outlet structure.

Note: The 10% rule in performing analysis is recommended. The hydrologic analysis should be conducted for the larger drainage area, where the site in question encompasses 10% of the total drainage area. For example, if your site is 10 acres, then the hydrologic analysis should be performed at the point downstream where the contributing drainage area, including your 10-acre site, is approximately 100 acres.

6.2 Design

- 6.2.1 The post-development discharge rates should be less than pre-development discharge rates for each outfall point for the 2-year and 10-year (and in some cases 25-year) storm events. If not, then a detention waiver must be requested.
- 6.2.2 Detail of outlet structure and cross-section of the dam/berm or pond bank, including elevations and dimensions that correspond to the calculations.
- 6.2.3 Orifice constructability considered (do not specify orifice diameters with increments of less than ¼”).
- 6.2.4 Maximum WSE for the 10-year storm event below the emergency spillway with 0.5-ft of freeboard between maximum WSE for the 10-year storm and the emergency spillway.
- 6.2.5 Maximum WSE for the 100-year storm event below the embankment with 0.5-ft of freeboard between maximum WSE for the 100-year storm and the embankment.
- 6.2.6 The volume within any structure (i.e., dry ponds etc.) used for water quantity control shall be drained from the structure within 72 hours.
- 6.2.7 Bottom of all detention and retention ponds graded to have a slope of not less than 0.5% and side slopes no steeper than 3:1.
- 6.2.8 If the pond is to be used for sediment control during construction, outlet structure should be sufficiently protected.
- 6.2.9 Permanent maintenance access to all permanent detention structures (easements may be needed for structures surrounded by lots).
- 6.2.10 As a minimum, infiltration systems must be designed in accordance with S.C. Reg. 72-307.C(11) [specify how items a-j have been addressed]

Note: Emergency spillways should not be built on fill slopes.

Note: Installation of a trash rack or other debris-screening device is recommended on all pond risers.

Note: Installation of sediment forebays is recommended at each outfall into the detention/ sediment basin.

7 HYDRAULIC DESIGN:

- 7.1 Design calculations for all conveyances, inlets, and outlets based on the contributing area, allowable velocities, and upstream and downstream conditions.
- 7.2 Upstream and downstream analysis showing the project will not impact new and existing structures or reduce downstream system capacity.
- 7.3 Check to make sure the proper design storms were used at the appropriate design points.

8 WATER QUALITY REQUIREMENTS:

- 8.1 All sites which disturb one-half (1/2) acre or greater shall have permanent BMP installed.
- 8.2 Permanent water quality addressed (all projects or LCP that disturb 5 or more acres)
 - 8.2.1 Wet ponds designed to catch the first ½” of runoff from the entire area draining to the pond and release it over at least a 24-hour period.

- 8.2.2 Dry ponds designed to catch the first 1" of runoff from the entire area draining to the pond and release it over at least a 24-hour period.
- 8.2.3 For areas not draining to a pond, show how permanent water quality requirements were addressed
- 8.3 Projects disturbing less than five (5) acres but within one-half (1/2) mile of a receiving water body in the Coastal Zone must meet Section III.C.3.XIII.A of the Coastal Zone Management Program Refinements. Designs must show that the first 1/2 inch of runoff from the entire site or the first one (1) inch of runoff from the built upon area, whichever is greater, can be stored onsite.
- 8.4 Waters of the U.S./State are not used for permanent water quality control (alternative means of treatment must be used if an existing pond is to be used for water quantity control).
- 8.5 The WQV requirement may be waived if treatment is instead provided by engineered devices. Applicability of such waivers will be based on submitted information showing that the device(s) has a design pollutant removal efficiency equivalent to a "dry" pond with a WQV of 1-inch. If the project is located within one thousand feet (1000') of shellfish beds, the pollutant removal equivalency must match a WQV of the first one and one-half inches (1 1/2") of runoff.
- 8.6 BMPs used strictly for water quality that will be capturing one (1) or more acres shall have a pretreatment device as part of the BMP or treatment system, such as a forebay or vault, to remove debris and coarser sediments.
- 8.7 All BMPs must have a maintenance plan and schedule for construction site and post construction. Suggested schedules and routine activities are provided in the SCDHEC BMP Manual (2005).
- 8.8 For projects that discharge either directly or indirectly into an impaired waterbody as determined through SCDHEC's listing of the waterbody on the most current 303(d) list or by the existence of an adopted TMDL by SCDHEC is discussed in section below (Section II.9) under Special Protection Areas.

The County Engineer reserves the right to require specific effluent limits for any pollutant from a site if necessary to ensure the water quality standards and other State and federal water quality regulations are met

9 SPECIAL PROTECTION AREAS:

- 9.1 List the nearest S.C.DHEC Water Quality Monitoring Station (WQMS) that the site's stormwater discharges drain to and the waterbody on which it is located.
- 9.2 Qualitative and quantitative assessment (described in Section 3.4C of SCR100000), if nearest WQMS is listed on the most current 303(d) List of Impaired Waters and if site's stormwater construction discharges contain the pollutant of impairment and if the site disturbance 25 or more acres.
- 9.3 Evaluation of selected BMPs if nearest WQMS listed on the most current 303(d) List of Impaired Waters and if site's stormwater construction discharges contain the pollutant of impairment and if site disturbance less than 25 acres.
- 9.4 If a TMDL has been developed for the nearest WQMS and if the site's stormwater construction discharges contain the pollutant of impairment, show that measures and controls meet assumptions and requirements of TMDL (may need to contact DHEC Watershed Manager for assistance).
- 9.5 Where flooding problems exist, explain any anticipated impacts of this project on the adjacent properties and downstream structures. In an effort to relieve existing flooding problems downstream of or adjacent to this site, the following list of design criteria will be required:
 - The post-development, peak discharge rates are restricted to half (1/2) the pre-development rates for the 2-year and 10-year storm event or to the downstream system capacity, whichever is less.
 - The post-development runoff volumes for the 2-year frequency 24-hour duration storm events above the predevelopment level shall be stored for a period of 24-hours on average before release.

10 SEDIMENTOLOGY:

- 10.1 BMPs should be properly placed (silt fence, inlet protection, construction entrance, rip-rap at outfalls, check dams etc.).
- 10.2 Trapping efficiency calculations showing that all sediment basins/ traps are capable of achieving a sediment

- trapping efficiency of at least 80% for the 10-year, 24-hour storm event, if more than 10 disturbed acres drain to a common point (stream, lake, etc.)
- 10.3 Sediment basins must be provided for storage for the 10-year, 24-hour storm event for disturbed conditions or 3600 ft³/ acre draining to the basin, if more than 10 disturbed acres drain to a common point (stream, lake, property line, etc.).
 - 10.4 Sediment traps only used for drainage areas of less than 5 acres.
 - 10.5 Sediment trap storage calculations, showing that 1800 ft³/ total acre draining to each trap is provided below the spillway.
 - 10.6 If trapping efficiency calculations are required for sediment traps, then provide peak outflow, (q_{po}), calculations; the 10-year, 24-hour storm event for construction conditions cannot overtop the trap's spillway.
 - 10.7 Sediment basins and traps designed for total area draining to them.
 - 10.8 Drainage area map outlining the area draining to each sediment basin/ trap.
 - 10.9 Copies of figures used to determine V_{15} (SV-1) and trapping efficiency (ST-1, SB-1, SB-2), if Design Aids from SCDHEC BMP Manual (2005) are used to determine trapping efficiencies.
 - 10.10 Silt fence only used in areas with drainage areas of less than ¼ acre per 100 linear foot of fence and not used in areas with concentrated flows.
 - 10.11 Clean-out stake, marked at ½ the designed sediment storage depth, provided in all sediment basins/ sediment traps.

Note: Consult the SCDHEC OCRM STORMWATER BMP Handbook for information on the design of these and other devices.

Note: The Design Aids in the SCDHEC OCRM STORMWATER BMP Handbook cannot be used to determine trapping efficiencies for structures in series. If the flow for the 10-year, 24-hour storm for construction conditions overtops the structure or the structure's spillway, then the Design Aids cannot be used. If multiple soil types are in the area draining to the structure, then the soil type with the smallest D_{15} for the appropriate depth should be used to determine the settling velocity, V_{15} ; an average D_{15} should not be used.

11 INLET PROTECTION:

- 11.1 Provided at all inlets (no hay bales).
- 11.2 Steel posts and buried fabric shown for filter fabric inlet protection.
- 11.3 Inlet protection details provided for pre-paving and after roadways have been paved.

12 SLOPE AND/OR CHANNEL STABILIZATION:

- 12.1 All slopes designed and stabilized properly.
- 12.2 All channels and diversion ditches must be able to handle the 10-year storm event with non-erosive velocities during construction and design storm event for post-construction.
- 12.3 Rock check dams provided in temporary diversion.
- 12.4 Installation detail for erosion control blanket (ECB) or turf reinforcement matting (TRM) if ECBs or TRMs to be used.
- 12.5 Slope drains provided where concentrated flows discharge onto a fill slope.

13 DISCHARGE POINTS:

- 13.1 Storm drainage or pond outfalls are carried to an existing drainage outfall such as a pipe, ditch, easement, etc.
- 13.2 No new point discharges onto adjacent property where there was not a point discharge previously without providing the adjacent property owner's written permission.
- 13.3 Level spreaders, plunge pools, etc. provided when the proposed outlet is near the property line.
- 13.4 Provided a 20-foot minimum buffer between the property line and the end of all pipes or energy dissipation measures are installed.

- 13.5 Outfalls shall not discharge on fill slopes.
- 13.6 All outfalls must be stabilized.
- 13.7 Riprap aprons sized appropriately.
- 13.8 Riprap detail shows apron dimensions and stone sizes.
- 13.9 Filter fabric installed beneath all riprap.

14 UTILITY/LINEAR PROJECTS:

- 14.1 Limits of disturbance include areas disturbed for utility line(s) installation.
- 14.2 Inlet protection provided at all existing inlets that receive flows from the disturbed areas; also add this as a note on the plans.
- 14.3 For all utility lines crossing WoS, narrative and detail showing sediment and erosion control measures provided on plans.
- 14.4 Note for construction entrances to be provided at all locations where construction traffic accesses a paved roadway.

15 POST-CONSTRUCTION MAINTENANCE PLAN AND SCHEDULE:

- 15.1 Description of maintenance plan to be used
- 15.2 Schedule of maintenance procedures (e.g., every 6 months)
- 15.3 Detailed or manufacturer-specific maintenance items for proprietary control devices (oil-water separators, etc.), underground detention structures, exfiltration systems and non-traditional stormwater controls (constructed wetlands, bioretention, etc.)
- 15.4 Typical maintenance items to be addressed
 - Ditches and swales to be cleaned (for sediments, debris, vegetative growth, etc), inspected and repaired.
 - Stormwater drainage pipes, catch basins to be cleaned, inspected and repaired. Clean-out must include the removal and legal disposal of any accumulated sediment and debris.
 - Grass to be mowed.
 - Trees to be removed from within the pond and on the embankment.
 - Trash and sediment to be removed from inside of and around the pond outlet structure.
 - Orifices to be cleaned and unclogged.
 - Outfall pipe to be cleaned, inspected, and repaired.
 - Sediment accumulation to be removed from pond.
 - Pond bottom to be regraded to provide proper drainage towards the outlet discharge point.
 - Energy dissipator to be cleaned and repaired.
 - Emergency spillway, if applicable, to be inspected and repaired.
 - Erosion on side slopes, if present, to be addressed.
- 15.5 Specific maintenance items particular to more complex structures.

16 ACCESS:

Project layout has considered access for maintenance and inspection of stormwater facilities during and after construction.

17 DETENTION WAIVER:

- 17.1 If the 2-year and 10-year post development flow rates exceed the pre-development rates, waivers from detention may be granted on a case-by-case basis.
- 17.2 Justification shall be provided in a separate written request and demonstrate that:
 - The proposed project will have no adverse impact on the receiving natural waterway or upstream, downstream or adjacent properties; or

- The imposition of peak control requirement for rates of stormwater runoff would aggravate downstream flooding.
- 17.3 Waiver request signed by the project's Professional Engineer.
- 17.4 Waiver from water quality criteria is not allowed. However, another equivalent method or criteria will be reviewed (applicant should provide all the necessary information to make a decision).

III. CONSTRUCTION PLANS

- One complete set of plans and one complete set of technical report/engineering calculations for review.
- Once review is complete and comments are satisfied the following plans must be submitted to Engineering Department for stamping:
 - Four sets of full size plans
 - One set of half size plans
 - One set of technical report/engineering calculations
 - An electronic copy of the plans in pdf format on a CD-ROM
 - Additional sets if needed by the owner/project engineer

Note: One set of the approved and stamped plans must be on-site at all times during construction.

1. GENERAL ITEMS:

- 1.1 All sheets 24" x 36".
- 1.2 Engineer stamp and signature on every sheet.
- 1.3 Correct Scale and North Arrow.
- 1.4 Location map.
- 1.5 Property lines, adjacent landowners' names, and existing site conditions (locate buildings, structures, driveways, etc. onsite/offsite), critical or protected area.
- 1.6 Legend.
- 1.7 Existing elevations and contours for the entire site. Contours are to be tied to a known datum (for example, NGVD 29, NAVD 88 datum), no **assumed** elevations, (1' interval is the minimum).
- 1.8 Limits of the disturbed area.
- 1.9 Lot Layout.
- 1.10 Delineation of WoS, including wetlands with letter from US Army Corps of Engineers, if applicable.
- 1.11 All existing and proposed easements.
- 1.12 Construction sequence & details (include implementation of all stormwater, erosion and sediment controls).
- 1.13 Locations and details of all temporary and permanent erosion and sediment control measures.
- 1.14 Construction entrance/exit.
- 1.15 Grassing and stabilization details and specifications.
- 1.16 Individual lot erosion control plan (applicable to all subdivisions).
- 1.17 Roadway plan and profiles with existing and proposed ground elevations.
- 1.18 Revision block utilized.

2. STORMWATER DRAINAGE SHEETS

- 2.1 Drainage area maps for existing and proposed conditions, outlining delineated sub basins, sub basin characteristics (watershed identifier, Curve Number, Tc, Area length, Slope), and the areas draining to all BMPs on site. Off-site drainage areas must be included on the map.
- 2.2 Labeling must be consistent with Technical Report/Engineering Calculations.
- 2.3 Proposed grading plan for the entire disturbed area.
- 2.4 Catch basin locations must be outside intersection curve radii.
- 2.5 Adequate drainage easements for any and all drainage structures located outside the road rights-of-way.
- 2.6 Adequate maintenance shelf around the entire pond(s) and along ditch(s) must be provided.

- 2.7 Label all storm drainage structures.
- 2.8 Water surface elevation in ponds and basins for all design storm events.
- 2.9 Storm drainage at roadway crossings to have one foot of cover minimum.
- 2.10 Minimum 18-inch RCP pipe under roadway (no decreases in pipe size in the downstream direction).
- 2.11 Crown elevation of inlet pipes equal or greater than crown elevation of outlet pipe.
- 2.12 Steps must be provided for all stormwater drainage boxes greater than 4.5 feet deep.
- 2.13 A minimum of 3'X3' size box is required for all storm drain boxes/inlets.
- 2.14 A table with calculated design flows for each pipe.
- 2.15 Hydraulic grade lines on profiles of storm pipe.
- 2.16 Existing and proposed grade on profiles of storm pipe.
- 2.17 Details of all stormwater drainage facilities and BMPs (catch basins, manholes, junctions boxes, detention basins, retention basins, ponds, pond outfall structures, emergency spillways, ditches, swales, stormwater wetlands, headwalls, rip-rap aprons, water quality buffers, oil/water separators, sand filtering devices, water quality structures, curb and gutter, etc.).
- 2.18 Typical roadway cross section(s), roadway cross sections(s) at wetland crossing

3. UTILITY SHEETS

- 3.1 Water and sewer plans including horizontal alignment of all lines and structures within rights-of-way and easements.
- 3.2 Pipe sizes and materials.
- 3.3 Invert elevations of all sanitary sewer pipes entering and exiting the manholes.
- 3.4 Bottom elevation, top elevation and/or rim elevation of all sanitary sewer manholes.
- 3.5 Water and sewer details.
- 3.6 Utility main(s) and service(s) at roadway crossings to have minimum three feet of cover.
- 3.7 Utility service(s) at ditch crossing to have minimum 18" of separation from the ditch design flow line elevation.
- 3.8 All fire hydrants must be located at/near the right-of-way line.
- 3.9 Manholes, valves or utility boxes must not be located within the curb and gutter section and/or within the roadway pavement section.
- 3.10 No conflict box.

4. STANDARD NOTES:

Notes as required by State and federal agencies and any additional notes for compliance with Berkeley County requirements.

IV. DOCUMENTS:

Following additional documents are needed prior approval of Construction Activity Application:

- A Berkeley County Encroachment Permit Application if applicable.
- A copy of the approved SCDOT Encroachment Permit Application if applicable.
- A copy of a geotechnical report when needed.
- A copy of the recorded Covenants for Permanent Maintenance of Stormwater Systems by the property owner.
- A copy of the maintenance agreement between the operator and property owner where an operator other than the property owner is the responsible party for maintenance activities of stormwater systems.
- A copy of the approved Notice of Intent (NOI) for Stormwater Discharges from Large and Small Construction Activity.
- A copy of SCDHEC's Certificate of Coverage under the Construction General Permit (CGP).

Appendix D

Approval Process for CAA



BERKELEY COUNTY STORMWATER MANAGEMENT PROGRAM

APPROVAL PROCESS FOR CONSTRUCTION ACTIVITY APPLICATION

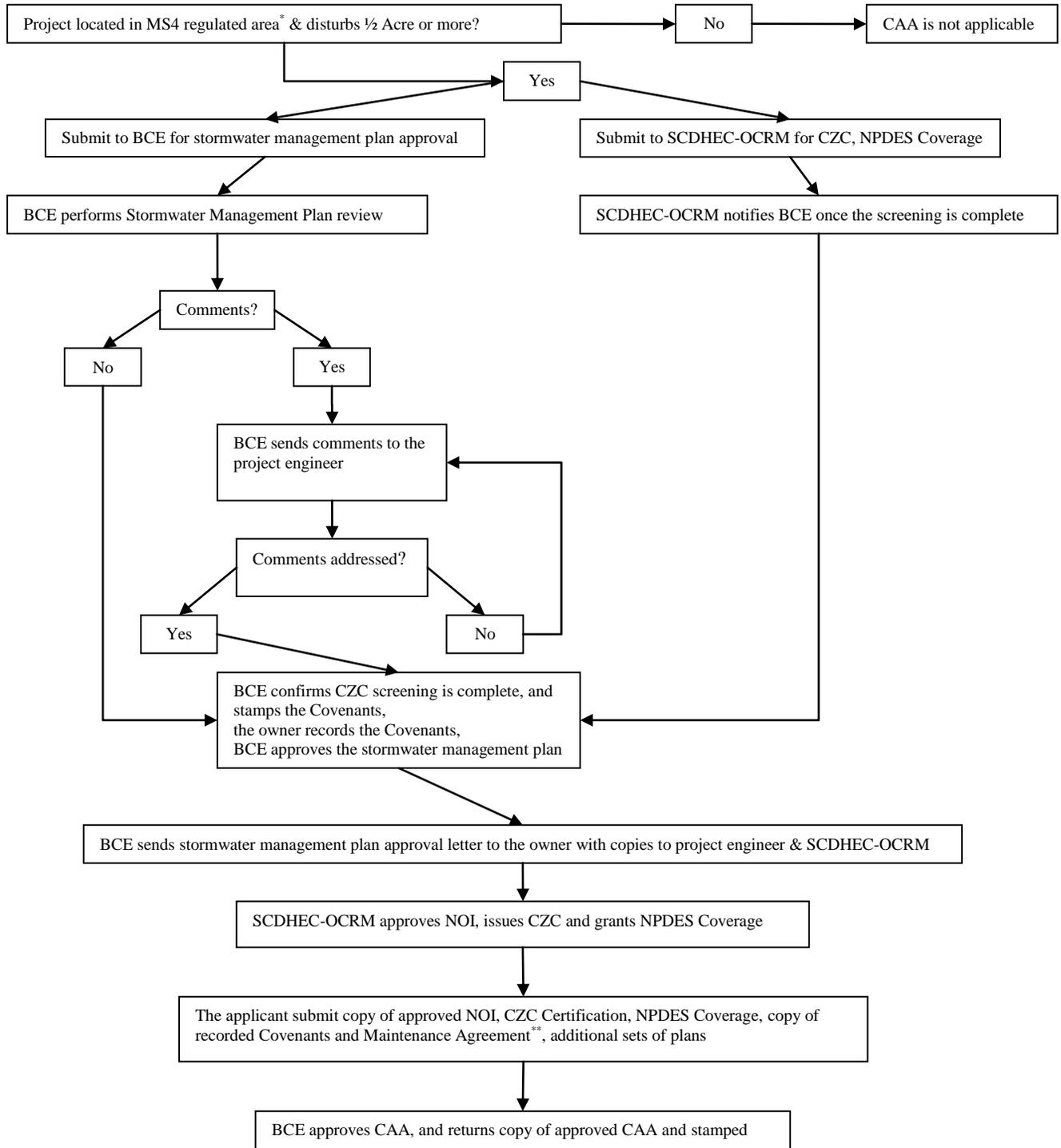
For projects (including subdivision plan, site/stormwater management plan, and encroachment permit application plan) located within **regulated area** (can be viewed from Berkeley County GIS Mapping Service: <http://gis.berkeleycountysc.gov/disclaimer.html> - MS4 Regulated Area) **and** disturbing **1/2 acre** or more:

1. Documents necessary to submit to Berkeley County Engineering (BCE) for stormwater management plan approval:
 - i. Completed "Construction Activity Application" (CAA)
 - ii. One complete set of plans
 - iii. One set of technical report/engineering calculations
 - iv. **Copy** of the SCDHEC-OCRM Notice of Intent (NOI)
 - v. Encroachment permit application if applicable
 - vi. Covenants for Permanent Maintenance of Stormwater Systems (Covenants) signed and notarized. If someone other than the owner is the responsible party for maintenance activities of stormwater systems, a maintenance agreement between the operator and owner must be submitted along with the Covenants.
2. Once all BCE comments are addressed and review is complete, and BCE receives notification from SCDHEC-OCRM that Coastal Zone Consistency (CZC) screening is complete:
 - i. BCE stamps the Covenants and returns the Covenants to the owner.
 - ii. The owner records the Covenants in the Office of the Berkeley County Register of Deeds.
 - iii. BCE approves the stormwater management plan.
 - iv. BCE sends the approval letter to the applicant with copies to the project engineer and SCDHEC-OCRM. **This approval of the stormwater management plan does not constitute, in any way, the right to start construction.**
3. SCDHEC-OCRM approves NOI, issues CZC Certification and, authorizes coverage under the NPDES Phase II Construction General Permit (NPDES CGP).
4. Once the above steps are completed, the applicant submits:
 - i. A copy of SCDHEC-OCRM's approved NOI
 - ii. A copy of CZC Certification
 - iii. A copy of SCDHEC's letter authorizing coverage under NPDES CGP
 - iv. A copy of the recorded Covenants and maintenance agreement where applicable
 - v. Additional sets of the approved stormwater management plans based on the type of construction activity:
 - a. Subdivision (residential/commercial/industrial) with roads and drainage system to be accepted by the County: three sets of full size plans, one set of half size plan
 - b. Site/stormwater management plan associated with building permits – three sets of full size plans.
 - c. Linear (roads, utility lines, etc.)/encroachment permits/site preparation – two sets of full size plans.

Note: Additional sets if needed by the owner/project engineer.

 - vi. BCE approves CAA and returns a copy of the approved CAA and the stamped plans. **One set of the approved and stamped plans must be on-site at all times during construction.**

Construction Activity Application Review and Approval Flow Chart



BCE: Berkeley County Engineering
 CAA: Construction Activity Application
 CZC: Coastal Zone Consistency
 NPDES Coverage: NPDES Phase II Construction General Permit Coverage
 * Regulated area can be viewed from Berkeley County GIS Mapping: <http://gis.berkeleycountysc.gov/disclaimer.html> - MS4 Regulated Area **
 If someone other than the owner is the responsible party for maintenance activities of stormwater systems, maintenance agreement between the operator and owner must be submitted along with the Covenants

Appendix E

Minimum Stormwater Management BMPs



BERKELEY COUNTY STORMWATER MANAGEMENT PROGRAM

MINIMUM STORMWATER MANAGEMENT BEST MANAGEMENT PRACTICES (BMPS)

All construction activity disturbing less than one-half ($\frac{1}{2}$) acre, including single family residential, shall implement and comply with the following requirements. In addition, if the site is part of a larger common plan of development, stormwater management requirements and BMPs specified in the approved CAA for the larger common plan of development must be implemented.

1. The site shall have adequate erosion and sediment control measures as necessary to prevent the movement of sediment off the property, into wetlands, and receiving waters. These measures shall be installed within 24-hours of land disturbance and maintained until the project is stabilized. Proper construction of these measures can be found in SCDHEC's BMP Manual. Manufacturers recommended installation and maintenance procedures shall be followed as applicable.
 - The maximum distance from the crest of a hill to a section of silt fence is 100 feet. When the distance from a crest to the property boundary is greater than 100 feet, an intermediate row of silt fence shall be used or another control measure shall be employed.
 - The maximum slope steepness (perpendicular to silt fence line) is 2H:1V. When exceeded, slope drains shall be employed.
 - A maximum of $\frac{1}{4}$ acre drainage per 100 linear feet of silt fence should be used. When this is exceeded, an intermediate row of silt fence shall be used or another control measure shall be employed.
 - Sediment accumulated along silt fence shall be removed when it reaches $\frac{1}{3}$ the height of the fence.
2. Nearby stormwater inlets, manholes, etc. in the street or on this or adjacent property shall be protected through the use of sediment tubes, check dams, or inlet protection devices. These measures will be maintained throughout the construction process until the site is stabilized as detailed below.
3. Construction entrances shall be provided at entrances/exits (maximum of 2) as necessary. The stone in the entrance/exit shall be maintained throughout the construction process until the site is stabilized as detailed below. Sediment tracked onto streets shall be removed immediately for proper disposal.
4. Stabilization measures shall be initiated as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than fourteen days (14) after work has ceased, unless activity in that portion of the site will resume within twenty-one days. Existing/natural vegetation should be preserved as much as possible.
5. A site is considered stabilized once the entire disturbed area has a vegetative cover with a density of 70%. Seeding should be accompanied or replaced with erosion control mats as necessary to achieve this density. Final or permanent stabilization is considered achieved once the entire disturbed area has a permanent vegetative cover with a density of 70%. Final stabilization shall be implemented within fourteen (14) days of completion of all construction activities. After final stabilization is achieved, all control measures shall be removed from the site.

6. Site must be graded to achieve positive drainage away from the building(s). Positive yard drainage must be achieved as well.
7. Site must be graded to accommodate any existing offsite stormwater runoff and shall not block any existing runoff onto and throughout the site.
8. The construction activity will not cause or contribute in altering the natural drainage flow pattern of the site or adjacent properties. If the site is part of a larger common plan of development, the drainage must be constructed in accordance with the approved stormwater management plan.
9. The existing ground elevations at the property lines of a site must remain undisturbed and not altered unless a written agreement with the adjacent property owners has been obtained. If the site is part of a larger common plan of development, the site must be graded in accordance with the approved stormwater management plan.
10. Ensure good house keeping for proper use, storage, clean up and disposal of the various materials used during construction activities. Construction materials include concrete, cement, paint products, solvents, gas, oils, fertilizers, etc.
 - Construction debris and other waste shall be contained in a dumpster or covered with plastic. Covers that prevent exposure to precipitation shall also be used for stockpiles of soil.
 - Chemicals, paints, solvents, gas, oils and other materials shall be stored properly to prevent leaks and low exposure risk to precipitation and stormwater runoff. They must be disposed properly. Never clean brushes or rinse paint containers into a street, gutter or storm drainage structures. Clean up leaks/spills immediately. Never hose down pavement of surfaces where materials or chemicals have spilled. Use dry up method whenever possible.
 - Never dispose or dump concrete or washout from the mixing of concrete onto driveways, streets, gutters, or storm drainage structures. Concrete wash water shall be disposed in an area of soil away from surface waters where soil can act as a filter or evaporate the water. Remaining concrete shall be disposed of in a dumpster or otherwise removed from the site. Be aware that this water can kill vegetation. Store bags of cement and plaster in a dry place to protect from rainfall/sprinklers/wind and away from gutters/storm drainage structures.
 - De-watering water shall be disposed of in a pervious area. Discharge of sediment from dewatering operations shall be prevented from entering into storm sewers and surface waters.
11. Any and all on-site stormwater facilities, BMPs, and improvements must be adequately maintained by the owner, its successors and assigns in good working condition such that they satisfactorily perform their intended design functions.

Appendix F

Transfer of Ownership Application



BERKELEY COUNTY STORMWATER MANAGEMENT PROGRAM

1003 Highway 52 Post Office Box 6122
Moncks Corner, SC 29461-6120
843.719.4127 843.723.3800 843.567.3136
843.719.4695 fax

TRANSFER OF OWNERSHIP APPLICATION

- A. Project Name: _____
- B. CAA Number: _____
- C. NPDES Permit Coverage Number (if applicable): SCR10 _____
- D. New Applicant Name: _____
Address: _____
City: _____, State: _____
Zip: _____
Phone: _____ - _____ - _____ Mobile: _____ - _____ - _____ Fax: _____ - _____ - _____
Email Address (optional): _____
- E. Property Info: Check Box if same as above
Address: _____
City: _____, South Carolina
Zip: _____
Tax Map Number(s): _____
- F. Original Applicant Name: _____
Address: _____
City: _____, State: _____
Zip: _____
Phone: _____ - _____ - _____ Mobile: _____ - _____ - _____ Fax: _____ - _____ - _____
Email Address (optional): _____
- G. Transfer Information: Transfer Date (MM/DD/YYYY): ____/____/_____
a. Is the entire CAA being transferred to a new owner? Yes No
b. Is this a subdivision where only a lot or a group of lots are being transferred? Yes No
c. If Yes to Item G.b., list the lot, or group of lots being transferred.

- H. Other Information:
a. If there are no modifications being made to the plans, include five (5) sets of plans with signed Designer and Applicant's certification statements.
b. If this is a subdivision where a lot or group of lots are being transferred, include a plat sheet with the lot or group of lots that are being transferred clearly outlined.

Original Applicant's Certification

I hereby relinquish the responsibility and ownership of the CAA listed in Item B above. I realize that the construction responsibility for the identified project/lots/group of lots now belongs to the new applicant.

Original Applicant's Printed Name

Original Applicant's Signature

Date

New Applicant's Certification

I hereby certify that all construction and/or development will be done pursuant to this plan and I am responsible for the construction activities and related maintenance thereof. Berkeley County authorities will be allowed to enter the project site for the purpose of on-site inspections.

New Applicant's Printed Name

New Applicant's Signature

Date

Appendix G

Table of BMP Suggested Uses

EROSION PREVENTION BMP SUGGESTED USES

BMP	Slope Protection	Waterway Protection	Surface Protection	Enclosed Drainage	Large Flat Areas	Borrow Areas	Adjacent Properties
Erosion Prevention Measures	X	X	X	X	X	X	X
Surface Roughening	X		X				
Bench Terracing	X		X				
Temporary Seeding	X		X		X	X	X
Mulching	X				X	X	
Erosion Control Blankets and Turf Reinforcement Mats	X	X	X			X	
Final Stabilization	X		X		X		X
Topsoiling			X		X		
Permanent Seeding and Planting of Grasses	X		X		X		X
Permanent Ground Cover Plants	X		X				X
Sodding	X		X		X		X
Riprap or Aggregate	X	X	X				
Outlet Protection		X		X			X
Dust Control					X	X	X
Polyacrylamide (PAMs)	X		X	X	X	X	X

TEMPORARY SEDIMENT CONTROL BMP SUGGESTED USES

BMP	Slope Protection	Waterway Protection	Surface Protection	Enclosed Drainage	Large Flat Areas	Borrow Areas	Adjacent Properties
Temporary Sediment Control Structures	X	X	X	X	X	X	X
Storage Volumes and Maintenance Schedules		X		X			X
Temporary Sediment Basin		X	X	X			X
Multipurpose Basin		X	X	.X			X
Temporary Sediment Trap		X	X				X
Silt Fence	X	X					X
Rock Ditch Check			X				X
Stabilized Construction Entrance					X		X
Storm Drain Inlet Protection		X		X			X
Vegetated Filter Strips		X					X
Rock Sediment Dike		X	X				X

RUNOFF CONTROL AND CONVEYANCE BMP SUGGESTED USES

BMP	Slope Protection	Waterway Protection	Surface Protection	Enclosed Drainage	Large Flat Areas	Borrow Areas	Adjacent Properties
Pipe Slope Drains	X		X				
Temporary Stream Crossing		X	X				X
Runoff Conveyance Measures	X					X	X
Construction De-watering		X		X	X	X	
Level Spreader			X		X		X
Subsurface Drains			X		X		

STRUCTURAL STORMWATER QUALITY BMP SUGGESTED USES

BMP	Land Requirement	Single Family	Multi Family	Low Density Commercial	High Density Commercial	Low Density Industrial	High Density Industrial
Wet Storm Water Ponds	MODERATE - HIGH	X	X	X	X	X	X
Wet Extended Pond	MODERATE - HIGH	X	X	X	X	X	X
Micropool Extended Pond	MODERATE - HIGH	X	X	X		X	
Shallow Wetland	MODERATE - HIGH	X	X	X		X	
Extended Detention Shallow Wetland	MODERATE - HIGH	X	X	X		X	
Pond/Wetland System	MODERATE - HIGH	X	X	X		X	
Pocket Wetland	MODERATE	X	X		X		X
Bioretention Areas	MODERATE	X	X	X	X	X	X
Sand Filtration Facilities	LOW			X	X	X	X
Infiltration Trenches	MODERATE	X	X	X	X	X	X
Enhanced Dry Swales	HIGH	X	X	X		X	
Pre-Fabricated Control Devices	LOW		X	X	X	X	X

STRUCTURAL STORMWATER QUALITY BMP CHARACTERISTICS

BMP	Maintenance Burden	Costs	Aesthetically Pleasing	Provide Habitat	Drainage Area (Acres)	Soils
Wet Storm Water Pond	LOW	LOW	X	X	10 MIN 25 PREFERRED	HSG A SOILS MAY REQUIRE POND LINER
Wet Extended Pond with Aquatic Bench	LOW	LOW	X	X	10 MIN 25 PREFERRED	HSG B SOILS MAY REQUIRE INFILTRATION TESTING
Micropool Extended Pond	MODERATE	LOW	X	X	10 MIN	
Shallow Wetland	MODERATE	MODERATE	X	X	20 MIN	HSG A AND B SOILS MAY REQUIRE LINER
Extended Detention Shallow Wetland	MODERATE	MODERATE	X	X	20 MIN	
Pond/Wetland System	MODERATE	MODERATE	X	X	20 MIN	
Pocket Wetland	HIGH	MODERATE	X	X	5 MIN	
Bioretention Areas	LOW	MODERATE	X	X	5 MAX	CLAY OR SILTY SOILS MAY REQUIRE PRETREATMENT
Sand Filtration Facilities	HIGH	HIGH			5 MAX 2 PREFERRED	INFILTRATION RATE > 0.5 IN/HR
Infiltration Trenches	HIGH	HIGH			5 MAX	PERMEABLE SOIL
Enhanced Dry Swales	LOW	MODERATE			5 MAX	
Pre-Fabricated Control Devices	HIGH	HIGH	X (HIDDEN)		VARIES	NO REQUIREMENT

STRUCTURAL STORMWATER QUALITY BMP SUGGESTED USES

BMP	Water Quality	Channel Protection	Flood Protection	TSS Removal	Nutrient Removal	Metal Removal	Bacterial Removal
Wet Stormwater Pond	X	X	X	HIGH	MODERATE	MODERATE	MODERATE
Wet Extended Pond with Aquatic Bench	X	X	X	HIGH	HIGH	MODERATE	MODERATE
Micropool Extended Pond	X	X	X	HIGH	MODERATE	MODERATE	NO DATA
Shallow Wetland	X	X	X	HIGH	HIGH	MODERATE	HIGH
Extended Detention Shallow Wetland	X	X	X	HIGH	HIGH	MODERATE	HIGH
Pond/Wetland System	X	X	X	HIGH	HIGH	MODERATE	HIGH
Pocket Wetland	X	X		HIGH	HIGH	MODERATE	HIGH
Bioretention Areas	X			HIGH	MODERATE	MODERATE	NO DATA
Sand Filtration Facilities	X			HIGH	MODERATE	MODERATE	MODERATE
Infiltration Trenches	X			HIGH	MODERATE	HIGH	HIGH
Enhanced Dry Swales	X			HIGH	MODERATE	MODERATE	LOW
Pre-Fabricated Control Devices	X			HIGH	LOW-HIGH	LOW-HIGH	LOW-HIGH

STRUCTURAL STORMWATER QUALITY BMP TRAPPING EFFICIENCY

BMP	Pollutant Removal Efficiency %					
	Monitoring	TSS	TP	TN	Nitrate Nitrogen	Other
Surface Sand Filters	Yes	85	55	35	Neg	Bacteria 40-80 Metals 35-90
Perimeter Sand Filters	Yes	80	65	45	Neg	Hydrocarbons 80
Organic Sand Filter	Yes	95	40	35	Neg	Hydrocarbons 80 Soluble P Neg Metals 85
Gravel Filter	Yes	80	80	65	75	Hydrocarbons 85 Metals 50-75
Dry Enhanced Swales	Yes	90	65	50	80	Metals 80-90
Wet Enhanced Swales	Yes	80	20	40	50	Metals 40-70
Plain Drainage Channel	Yes	30	10	0	0	Bacteria Neg
Vegetated Drainage Channel	Yes	65	25	15	Neg	Hydrocarbons 65 Metals 20-50 Bacteria Neg
Vegetated Filter Strip	Yes	70	10	30	0	Metals 40-50

Should be used as a general guide to expected effectiveness and not for design purposes.

Appendix H Inspection Checklist



BERKELEY COUNTY STORMWATER MANAGEMENT PROGRAM

1003 Highway 52 Post Office Box 6122
Moncks Corner, SC 29461-6120
843.719.4127 843.723.3800 843.567.3136
843.719.4695 fax

INSPECTION CHECKLIST

Below are the items that County Inspectors will address during each site inspection.

1. Are contractor's maintenance logs available?
2. Are contractor's set of plans available on-site?
3. What is the current status of construction: beginning, middle, nearing completion, complete?
4. Have areas been clear cutting? If so, does the total area exceed the 10-acre limit?
5. Are there any waterbody impacts (sediment, oil, grease, etc)?
6. Are there any roadway impacts (sediments, damaged asphalt, etc.)?
7. Have any adjacent properties been negatively impacted? If so, what is the extent of the impacts?
8. Are there any air/dust impacts?
9. Are all tree protections in place and maintained? Enter any additional comments on tree protection.
10. Are all channels stabilized? Enter any additional comments on stabilized channels.
11. Is there any evidence of channel erosion? Enter any additional comments on channel erosion.
12. Are all inactive areas stabilized?
13. Are all inactive slopes stabilized?
14. Are all inactive stock piles stabilized?
15. Enter any additional comments on stabilization needs.
16. Are all erosion prevention and sediment control (EPSC) devices properly installed and maintained?
17. Do the EPSC devices provide adequate protection?
18. Are there any unneeded controls or are there any that need to be removed (closeout)?
19. Enter any additional comments on EPSC devices.
20. Are there any instances of erosion across the site? If so, what is the percentage?
21. Enter the re-inspection date based on condition of the site and offsite impact.
22. Enter any additional comments as necessary.
23. Is any enforcement action necessary?

Appendix I

Enforcement Forms



BERKELEY COUNTY STORMWATER MANAGEMENT PROGRAM

1003 Highway 52 Post Office Box 6122
Moncks Corner, SC 29461-6120
843.719.4127 843.723.3800 843.567.3136
843.719.4695 fax

CORRECTION ORDER

Date: _____

Name: _____

Address: _____

City: _____ State: _____ ZIP Code: _____

Project: _____

CAA No./Stormwater Management Plan No.: _____

This correction order serves as a warning concerning activities on your above mentioned site.

This warning is based on the results of a Berkeley County inspection on _____.

A verbal warning was also given to _____ at the time of the inspection.

A copy of our inspection report detailing the deficiencies is enclosed with this warning.

You have until _____ to correct the deficiencies noted on the inspection report. At that time a County Inspector will re-visit your site. Failure to comply with this warning is considered a violation of the Berkeley County Stormwater Management Ordinance and will result in the issuance of a **Notice of Violation and/or Stop Work Order.**

If you have any questions concerning this warning you may contact our office at 843-719-4174.

Signed by: _____

Printed Name: _____



BERKELEY COUNTY STORMWATER MANAGEMENT PROGRAM

1003 Highway 52 Post Office Box 6122
Moncks Corner, SC 29461-6120
843.719.4127 843.723.3800 843.567.3136
843.719.4695 fax

NOTICE OF VIOLATION

Date: _____

Name: _____

Address: _____

City: _____ State: _____ ZIP Code: _____

Project: _____

CAA No./Stormwater Management Plan No.: _____

You are hereby served notice that you are in violation of Berkeley County's Stormwater Management Ordinance at the above mentioned site. This violation is the results of a Berkeley County inspection completed on _____. A copy of our inspection report is enclosed with this violation.

Violation:

Corrective Action(s):

The corrective actions must be completed within **five (5) working days** of the date of this letter. Failure to comply with this Notice of Violation will result in an immediate **Stop Work Order** issued for your site and/or a **civil penalty in the amount of \$1,000/day for each deficiency**.

If you have questions concerning this violation you can contact our office at 843-719-4174.

Signed by: _____ Printed Name: _____



BERKELEY COUNTY STORMWATER MANAGEMENT PROGRAM

1003 Highway 52 Post Office Box 6122
Moncks Corner, SC 29461-6120
843.719.4127 843.723.3800 843.567.3136
843.719.4695 fax

NOTICE OF VIOLATION - STOP WORK ORDER

Date: _____

Name: _____

Address: _____

City: _____ State: _____ ZIP Code: _____

Project: _____

CAA No./Stormwater Management Plan No.: _____

You are hereby served notice that you are in violation of Berkeley County's Stormwater Management Ordinance at the above referenced site. A "**STOP WORK**" order is being posted on this property effective **IMMEDIATELY**.

This violation is due to failure to comply with a Notice of Violation issued on _____ and the results of a Berkeley County follow up inspection completed on _____. A copy of our inspection report is enclosed with this violation.

Your site must be inspected by a County Inspector prior to resuming any construction activity. Any activity other than work leading to compliance with this Stop Work Order can result in the issuance of a civil penalty in the amount of **\$1,000/day for each deficiency and/or 30 days in jail**.

If you have any questions concerning this warning you may contact our office at 843-719-4174.

Signed by: _____

Printed Name: _____

Appendix J

Berkeley County Stormwater Management Ordinance

07-07-44

BERKELEY COUNTY

STORMWATER MANAGEMENT ORDINANCE

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ORDINANCE NO. 07-07-44**AN ORDINANCE ESTABLISHING REGULATIONS TO DEVELOP AND ENFORCE A STORMWATER MANAGEMENT PROGRAM TO REDUCE THE DISCHARGE OF POLLUTANTS ASSOCIATED WITH STORMWATER RUNOFF AND BERKELEY COUNTY'S STORM SEWER SYSTEM.**

WHEREAS, uncontrolled stormwater runoff may have significant, adverse impact on the health, safety and general welfare of Berkeley County and the quality of life of its citizens; and

WHEREAS, Berkeley County is required by federal and State law to obtain a National Pollutant Discharge Elimination System (NPDES) permit from the South Carolina Department of Health and Environmental Control for stormwater discharges from Berkeley County's stormwater systems; and

WHEREAS, the NPDES permit requires that Berkeley County develop, implement, and enforce a storm water management program in its regulated area designed to reduce the discharge of pollutants from its small municipal separate storm sewer systems to the maximum extent practicable, to protect water quality, and to satisfy the appropriate water quality requirements of the Clean Water Act.

NOW, THEREFORE BE IT ENACTED by Berkeley County Council, in a meeting duly assembled, that the following stormwater management ordinance shall be adopted:

**DIVISION 1
GENERAL PROVISIONS****Sec. 1.1 Title.**

This ordinance shall be known as the "Stormwater Management Ordinance of Berkeley County, South Carolina."

Sec. 1.2 Authority.

This ordinance is adopted pursuant to the authority conferred upon Berkeley County by the South Carolina Constitution, Act No. 194 of the Acts and Joint Resolutions of 1971 enacted by the General Assembly of the State of South Carolina, approved April 23, 1971, in 1976 South Carolina Code of Laws Sections 4-9-30, 4-9-40, 5-7-30, and 5-7-60.

Sec. 1.3 Jurisdiction.

The boundaries and jurisdiction of this Ordinance shall encompass those portions of unincorporated Berkeley County defined as the "regulated area" and such additional areas lying inside the corporate limits of other governments as approved by Berkeley County Council.

Sec. 1.4 Findings.

Berkeley County Council makes the following findings:

(a) Uncontrolled stormwater runoff may have significant, adverse impact on the health, safety and general welfare of Berkeley County and the quality of life of its citizens. The potential impacts of uncontrolled stormwater can lead to the degradation of water quality and general riverine ecosystem through excessive or illegal pollutant discharges, erosion, and flooding thereby limiting or removing its designated and potential uses.

(b) Berkeley County is required by federal law [33 U.S.C 1342(p) and 40 CFR 122.26] and by State law [S. C. Code Reg. 61-9 122.32 & 122.33] to obtain a National Pollution Discharge Elimination System (NPDES) permit from the South Carolina Department of Health and Environmental Control ("SCDHEC") for stormwater discharges from Berkeley County's stormwater systems. The NPDES permit requires that Berkeley County develop, implement, and enforce a stormwater management program (SWMP) in its regulated area designed to reduce the discharge of pollutants from its small municipal separate storm sewer systems (SMS4) to the maximum extent practicable (MEP), to protect water quality, and to satisfy the appropriate water quality requirements of the Clean Water Act.

Sec. 1.5 Purpose.

(a) It is the purpose of this ordinance to protect, maintain, and enhance water quality and the environment of Berkeley County and the short-term and long-term public health, safety, and general welfare of the citizens of Berkeley County. This ordinance is also designed to minimize property damage by establishing requirements and procedures to control the potential adverse effects of increased stormwater runoff and related pollutant loads associated with both future development and existing developed land. Proper management of storm water runoff will further the purpose of this Ordinance to insure a functional drainage system, reduce the effects of development on land and stream channel erosion, attain and maintain water quality standards, enhance the local environment associated with the drainage system, reduce local flooding, maintain to the maximum extent practical pre-developed runoff characteristics of the area in terms of flow rate, volume and pollutant concentration, and facilitate economic development through residential, commercial, and industrial construction and development while mitigating associated pollutant, flooding, erosion, and drainage impacts.

(b) It is further the purpose of this ordinance to direct the development and implementation of a Stormwater Management Program (SWMP) and to establish legal authority which authorizes or enables Berkeley County at a minimum to:

- (1) Comply with State and Federal requirements related to stormwater management developed pursuant to the Clean Water Act;
- (2) Prohibit illicit discharges to Berkeley County stormwater management systems and facilities;
- (3) Control to the maximum extent practical the discharge to Berkeley County storm water management systems and facilities and receiving waters of spills, dumping, or disposal of materials other than storm water;
- (4) Address specific categories of non-stormwater discharges and similar other incidental non-stormwater discharges listed in the SWMP;
- (5) Require erosion and sediment controls to protect water quality on all applicable new and re-development projects both during and after construction;
- (6) Where necessary, require stormwater discharge rate and volume control during and following development, redevelopment, or construction;
- (7) Define and implement procedures of site plan review and site inspection of all applicable construction projects within regulated areas of Berkeley County;
- (8) Control the discharge from Berkeley County stormwater management systems and facilities of pollutants in such quantity that water quality standards are met or to otherwise address post-construction, long-term water quality. This includes the necessary means needed to comply with State and Federal regulations regarding stormwater management quantity and quality;
- (9) Define procedures for addressing citizen complaints of storm water-related issues within Berkeley County;
- (10) Provide for adequate long term operation and maintenance of Best Management Practices (BMPs);
- (11) Prior to applying for approval of construction activities within the Regulated Area of Berkeley County that require DHEC construction general permit coverage, the County must receive notification from DHEC's Office of Ocean and Coastal Resource Management (OCRM) that states the proposed project is consistent with the Coastal Zone Management Plan;

- (12) Carry out inspection, surveillance and monitoring procedures necessary to determine compliance and noncompliance with permit conditions and Ordinance requirements including the prohibition on illicit discharges to Berkeley County storm sewer system and receiving waters;
- (13) Encourage the use of non-traditional strategies to control stormwater discharges;
- (14) Encourage the creation of stream buffers and preservation of natural spaces to provide areas that could be used for flood storage, stormwater treatment and control, and recreation. Such areas may be required in special protection areas needed to protect, maintain, or enhance water quality and protect property from flooding problems;
- (15) Develop, implement, and enforce action plans to address pollutant load reductions required in impaired waterbodies and to work towards compliance with Total Maximum Daily Loads (TMDLs) established by EPA or SCDHEC and to work towards meeting water quality standards.
- (16) Enable enforcement of all said authorizations.

(c) It is still further the purpose of this ordinance to establish review authority for Berkeley County's Engineering Department for establishing consistency of construction projects with the Berkeley County SWMP.

Sec. 1.6 Construction and Scope

(a) The provisions of this Ordinance shall apply throughout those portions of unincorporated Berkeley County defined as the "regulated area" and such additional areas lying inside the corporate limits of other governments as approved by Berkeley County Council. The County Council will approve the designation of the "regulated area".

(b) The Berkeley County Engineer or his designee shall be primarily responsible for the coordination and enforcement of the provisions of this Ordinance and the SWMP.

(c) The application of this Ordinance and the provisions and references expressed herein shall be the minimum storm water management requirements and shall not be deemed a limitation or repeal of any other ordinances of Berkeley County or powers granted to Berkeley County by the State of South Carolina statutes, including, without limitation, the power to require additional or more stringent storm water management requirements. If site characteristics on new development and/or redevelopment indicate that complying with these minimum requirements will not provide adequate designs or protection for local property, residents, or the environment, the property owner, operator, or person responsible for land disturbing activities shall be required to provide additional and appropriate management practices, control techniques, system design, and engineering methods to attain an adequate level of protection.

Sec. 1.7 Severability.

Should any word, phrase, clause or provision of this ordinance be declared invalid or unconstitutional by a court of competent jurisdiction, such declaration shall not affect this ordinance as a whole or any part hereof except that specific provision declared by such court to be invalid or unconstitutional.

Sec. 1.8 Rules of Language and Interpretation

- (a) The word "shall" is mandatory; the word "may" is permissive.
- (b) The particular shall control the general.
- (c) Words used in the present tense shall include the future, and words used in the singular include the plural, and the plural the singular, unless the context clearly indicates the contrary.
- (d) All public officials, bodies and agencies to which reference is made are those of Berkeley County, unless otherwise indicated.

Sec. 1.9 Relationship with Other Laws, Regulations and Ordinances

Whenever the provisions of this Ordinance impose more restrictive standards than are required in or under any other law, regulation or ordinance, the requirements contained in this article shall prevail. Whenever the provisions of any other law, regulation or ordinance require more restrictive standards than are required in this article, the requirements of such law, regulation or ordinance shall prevail.

Sec.1.10 Amendments

Berkeley County Council, may, in its discretion and following procedures specified by State law, amend or change this Ordinance or adopt additional regulations or resolutions to implement this Ordinance, implement the SWMP, or to otherwise further the goal of protecting the quality of the waters into which Berkeley County storm sewer systems outfall.

Sec.1.11 Conflicting Ordinances Repealed

All ordinances or parts of ordinances related to storm water management in conflict with the provisions of this Ordinance are hereby repealed. This Ordinance shall prevail in any and all conflicts with guidelines, manuals, or other publications pertaining to storm water management.

Sec. 1.12 Definitions.

"Applicant" is a person, firm, governmental agency, partnership, or any other entity who seeks to obtain approval under the requirements of this Ordinance and who will be responsible for the land disturbing activity and related maintenance thereof.

"**As-built drawings**" are revised construction drawings that show in the installed location of the new facilities on a project, including the stormwater system. This term and "record drawings" shall be synonymous.

"**Best Management Practices (BMPs)**" are any structural or non-structural measure or facility used for the control of stormwater runoff, be it for quantity or quality control. BMPs also includes schedules of activities, prohibitions of practices, maintenance procedures, treatment requirements, operating procedures, and other management practices to control site runoff, spillage or leaks, sludge or waste disposal, drainage from raw material storage, or otherwise prevent or reduce the pollution of waters of the State.

"**Construction**" or "**Construction Activity**" is activity involving clearing, grading, transporting, filling, or any other activity which results in a change in the natural cover or topography that may cause erosion and contribute to sediment and alter the quality and quantity of stormwater runoff.

"**Construction Activity Application**" means the set of drawings, specifications, design calculations, and other documents necessary to demonstrate compliance with this Ordinance.

"**Department**" means the Berkeley County Engineering Department.

"**Design Manual**" refers to the Berkeley County Storm water Design Standards Manual.

"**Developer**" means any person, or others who act on his own behalf, who is required to submit an application for approval of construction activities and is thereafter responsible for maintaining compliance with this Ordinance and conditions of the approved application.

"**Erosion**" means the general process by which soils or rock fragments are detached and moved by the action of wind, water, ice, and gravity.

"**Easement**" is an authorization by a property owner to the general public, a corporation, or a certain person or persons for the use of any designated part of his property for a specific purpose.

"**Flood/flooding**" is a temporary rise in the level of water which results in the inundation of areas not ordinarily covered by water.

"**Hazardous material**" is any item or agent (biological, chemical, physical) which has the potential to cause harm to humans, other living organisms, or the environment, either by itself or through interaction with other factors.

"**Illicit connection**" means a connection to a Berkeley County stormwater management system or facility that results in a discharge that is not composed entirely of stormwater runoff except discharges pursuant to an NPDES permit (other than the NPDES MS4 permit for Berkeley County).

"Improper disposal" means any disposal other than through an illicit connection that results in an illicit discharge, including, but not limited to the disposal of used oil and toxic materials resulting from the improper management of such substances.

"Illicit discharge" or **"Illegal discharge"** means any activity which results in a discharge to a Berkeley County storm water management system or facility or receiving waters that is not composed entirely of storm water except (a) discharge pursuant to an NPDES permit (other than the NPDES MS4 Permit for Berkeley County) and (b) discharges resulting from the fire-fighting activities.

"Low Impact Development (LID)" is a set of principles and design components used to manage storm water runoff by mimicking natural conditions and limiting pollutant transport through source control.

"Maintenance" means any action necessary to preserve storm water system component, including conveyances, facilities and BMPs in proper working condition, in order to serve the intended purposes set forth in this ordinance and to prevent structural failure of such components.

"MS4" means municipal separate storm sewer system and includes all conveyances or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) which is (a) owned or operated by Berkeley County; (b) designed or used for collecting or conveying storm water; (c) not a combined sewer system; and (d) not part of a Publicly Owned Treatment Works (POTW).

"New Development" or **"Re-Development"** means any of the following actions undertaken by any person, including, without limitation, any public or private individual or entity:

- (a) division of a lot, tract, or parcels or other divisions by plat or deed;
- (b) the construction, installation, or alteration of land, a structure, impervious surface or drainage facility;
- (c) clearing, scraping, grubbing or otherwise significantly disturbing the soil, vegetation, mud, sand or rock of a site; or
- (d) adding, removing, exposing, excavating, leveling, grading, digging, burrowing, dumping, piling, dredging, or otherwise disturbing the soil, vegetation, mud, sand or rock of a site.

"NPDES" means National Pollutant Discharge Elimination System.

"NPDES MS4 permit" means the NPDES permit for storm water discharges issued by SCDHEC pursuant to the Clean Water Act and the federal stormwater discharge regulations (40

CFR 122.26) that allows for restricting pollutant loads as necessary to meet water quality standards.

"Operator" means the person who is operating the property, including an operator or person who is in charge of any activity related to land disturbance, construction or post construction stormwater quality or quantity

"Outfall" or **"Discharge point"** means the point where a Berkeley County stormwater management system or facility or other municipal and private systems discharges to waters of the State/United States.

"Owner" means the property owner, or any person who acts in his own behalf, that submits an application for approval to disturb land or vegetation or encroachment and the person, if so designated by default or on legal documents, as the responsible party for maintenance of a stormwater system(s) and facility(s).

"Person" means any and all persons, natural or artificial and includes any individual, association, firm, corporation, business trust, estate, trust, partnership, two or more persons having a joint or common interest, state or federal or an agent or employee thereof, or any other legal entity.

"Pollutant" means anything which may cause or contribute to exceedences of water quality standards, including but not limited to sediment, bacteria, nutrients, dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into water.

"Property Owner" means the legal owner of the property.

"Receiving waters" or **"receiving water body"** refers to any lakes, bays, sounds, ponds, impounding reservoirs, springs, wells, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Atlantic Ocean within the territorial limits of the State of South Carolina, and all other bodies of surface or underground water, natural or artificial, public or private, inland or coastal, fresh or salt.

"Regulated Area" refers to the boundaries of Berkeley County's urbanized areas as determined by Decennial Census Data from the United States Bureau of the Census. Regulated Area also includes any portion of the County that is so designated by Berkeley County Council. The Regulated Area designated by Berkeley County Council coincides with the area defined as "Service Zone I" by the "Transportation Impact Fee Ordinance for Unincorporated Berkeley County" (Ordinance No. 06-11-75).

"Regulation" means any regulation, rule or requirement prepared by and/or adopted by Berkeley County Council pursuant to this Ordinance.

"Spill" means any accidental or purposeful discharge of any pollutants, hazardous materials, or other substance which is otherwise potentially detrimental to the designated use of a receiving water.

"SWMP" means Berkeley County Storm water Management Program, which may describe the components to be used by Berkeley County to control stormwater discharges, address flooding, and meet water quality standards.

"Stormwater" means stormwater runoff, snowmelt runoff, and surface runoff and drainage.

"Stormwater management" means the collection, conveyance, storage, treatment and disposal of stormwater runoff in a manner to meet the objectives of this ordinance and its terms, including, but not limited to, measures that control the increased volume and rate of storm water runoff and water quality impacts caused by manmade changes to the land.

"Storm water management systems and facilities" means those natural and man-made channels, swales, ditches, swamps, rivers, streams, creeks, branches, reservoirs, ponds, drainage ways, inlets, catch basins, pipes, head walls, storm sewers, lakes and other physical works, properties, and improvements which transfer, control, convey, or otherwise influence the movement of storm water runoff, be it for quantity or quality control.

"TMDL" is a Total Maximum Daily Load wasteload allocation designation. It is a regulatory value developed to represent the amount of a pollutant that a waterbody can incorporate while meeting water quality standards. TMDL is further defined as the legal document developed by EPA and SCDHEC designating the pollutant load a permitted discharge is allowed to input into a waterbody.

"Variance" means the modification of the minimum stormwater management requirements contained in this Ordinance and the SWMP for specific circumstances where strict adherence to the requirements would result in unnecessary hardship and not fulfill the intent of this Ordinance.

"Watercourse" is any natural or man-made conveyance used to transport runoff from one location to the next.

"Watershed" is a drainage area or drainage basin contributing to the flow of stormwater into a receiving watercourse or water body."

"Water Quality" means those characteristics of storm water runoff that relate to the physical, chemical, biological, or radiological integrity of water.

"Water Quantity" means those characteristics of stormwater runoff that relate to the rate and volume of the stormwater runoff.

Sec. 1.13 Reserved.

DIVISION 2 ORGANIZATION AND ADMINISTRATION

Sec. 2.1 Berkeley County Stormwater Management Program.

The SWMP being developed by Berkeley County to implement the purposes of this Ordinance shall serve as the basis for directing Berkeley County's efforts to control stormwater and to comply with all applicable State and federal regulatory and permitting requirements. The SWMP and any modifications and/or revisions to the SWMP are incorporated by reference and is hereby a part of this Ordinance. The SWMP requirements and any modifications and/or revisions to the SWMP are to be complied with and shall be enforced in accordance with the provisions of this Ordinance.

Sec. 2.2 Coordination with Other Agencies.

The Engineering Department may coordinate Berkeley County's activities with other federal, State, and local agencies that manage and perform functions relating to the protection of receiving waters through written agreement. The Engineering Department should coordinate with State and Federal Agencies having jurisdiction.

Sec. 2.3 Right-Or-Entry

(a) The County Engineer or his designee shall have right-of-entry on or upon the property of any person subject to this Ordinance. The County Engineer or his designee shall, upon showing satisfactory credentials, be provided ready access to the necessary parts of the premises for the purposes of inspecting, monitoring, sampling, inventorying, examining and copying of records, and performing any other duties necessary to determine compliance with this Ordinance.

(b) Where the property owner or operator has security measures in force requiring proper identification and clearance before entry onto the premises, the person shall make necessary arrangements with the necessary parties so that, upon presentation of suitable identification, the County Engineer or his designee will be permitted to enter without delay for the purposes of performing such responsibilities identified in (a).

Sec. 2.4 Reserved.

DIVISION 3 STORM WATER QUANTITY AND QUALITY MANAGEMENT REQUIREMENTS

Sec. 3.1 Regulations.

(a) The Engineering Department shall be responsible for day to day coordination, implementation, and enforcement of this Ordinance and the SWMP as well as the long-term management of the County's drainage. Without limitation, the Engineering Department shall have the following authority:

- (1) To issue any approval, certification, or license that may be required to comply with this Ordinance.
- (2) To deny a connection to a Berkeley County stormwater management system or facility, if State requirements and this Ordinance are not met.
- (3) To create and enact a Berkeley County Stormwater Designs Standards Manual.

The Design Manual may be used to convey design and engineering standards, construction management processes and procedures, and other aspects necessary for compliance with this Ordinance.

- (i) The Designs Standards Manual shall be created by the Berkeley County staff with public input and adopted by County Council.
 - (ii) The Manual can be amended by the staff with notification to County Council.
- (4) To require the submittal of an application for all applicable construction activities that result in construction activities with a land disturbance area of greater than or equal to one (1) acre, or other sites as deemed necessary by the Storm water Design Standards Manual.

These applications must include a plan to control stormwater pollutants and other components detailed in Berkeley County's Stormwater Design Standards Manual.

- (5) To require the development of stormwater management and sediment/erosion control plans for all applicable new and re-development projects and enforcement of these plans.
- (6) To approve applicable construction activities and to require as a condition of such approvals, structural or non-structural controls, practices, devices, operating procedures, or other mechanisms to protect public and private property from flooding and erosion and attain TMDL-mandated pollutant load reductions and water quality standards.
- (7) To require performance bonds as necessary of any person to secure that person's compliance with approval, certificates, licenses, or authorizations issued by the Engineering Department pursuant to this Ordinance, the SWMP and Federal and State laws. The Engineering Department shall develop a process that organizes the closure of bonds and construction projects to accommodate development phases and property ownership transfers.

- (8) To conduct all activities necessary to carry out the SWMP and other requirements included in this Ordinance, and to pursue the necessary means and resources required to properly fulfill this responsibility.
- (9) To require appropriate post construction best management practices and appropriate continued maintenance of those best management practices.
- (10) To require maintenance bonds as necessary to ensure the long-term maintenance of storm water management best management practices.
- (11) To determine appropriate fees, to impose penalties, and to take necessary and appropriate actions to enforce this Ordinance.
- (12) To require encroachment permits as necessary.

Sec. 3.2 Prohibitions and Exemptions

No person shall (1) develop any land; (2) engage in any industry or enterprise; (3) construct, operate or maintain any landfill, hazardous waste treatment, disposal or recovery facility, or any other industrial or related facility; (4) dispose of any hazardous material or toxic substance or other pollutant; or (5) otherwise allow the transport of sediment and other pollutants associated with stormwater runoff beyond their property boundaries without having provided for compliance with this Ordinance.

In cases where an imminent threat to the health or safety of the general public or the environment is suspected, the County Engineer or his designee shall perform an assessment to determine if immediate action is necessary. Such assessment may be made with or without the consent of the owner or operator. If such consent is refused, the County Engineer or his designee may utilize the enforcement measures authorized in this Ordinance to remove such threat. In such cases, the owner or operator, as the case may be, shall reimburse the County for its direct and related expenses. If the owner or operator, as the case may be, fails to reimburse the County, the County is authorized to file a lien for said costs against the property, file an action in magistrate or civil court for recovery of incurred expenses, and enforce such actions in magistrate or civil court.

The following development activities are exempt from the provisions of this Ordinance.

(a) Land disturbing activities undertaken on forestland for the production and harvesting of timber and timber products and conducted in accordance with best management practices and minimum erosion protection measures established by the South Carolina Forestry Commission pursuant to Section 48-18-70 of the 1976 Code of Laws of South Carolina, as amended.

(b) Land disturbing activities on agricultural land for production of plants and animals, including but not limited to: forages and sod crops, grains and feed crops, tobacco,

cotton, and peanuts; dairy animals and dairy products; poultry and poultry products; livestock, including beef cattle, sheep, swine, horses, ponies, mules, or goats, including the breeding and grazing of these animals; bees, fur animals, and aquaculture. The construction of an agricultural structure that requires the disturbance of one or more acres, such as, but not limited to, broiler houses, machine sheds, repair shops, coops, barns, and other major buildings shall require the submittal and approval of a Construction Activity Application prior to the start of the land disturbing activity.

(c) Linear utility installation activities that are covered under their own DHEC approved utility general permit requiring associated assurance of proper stormwater management.

Sec. 3.3 Design and Engineering Standards.

Design and engineering standards must define the desired level of quality and performance for stormwater management systems on all applicable construction activities in order to meet the purpose of this Ordinance. The standards establish the minimum technical requirements needed to express compliance through calculations, maps and drawings, or others as necessary.

The Engineering Department is authorized to develop and adopt policies, criteria, specifications, and standards for the proper implementation of the requirements of this Ordinance, Federal and State laws, and the SWMP, and to provide a sound technical basis for the achievement of stormwater management, including water quality and quantity objectives. These standards may be presented in the Stormwater Design Standards Manual.

It shall be the responsibility of the property owner, operator, or person responsible for land disturbing activities to provide adequate controls to meet the design and engineering standards.

Sec 3.4 Construction Activity Application Approval Process

A Construction Activity Application submittal shall be made for all applicable construction activities for review by the Engineering Department. The entire application process and requirements will be described in the Design Standards Manual.

It shall be the responsibility of the applicant (property owner, operator, or person responsible for construction activities) to provide a complete application package that meets the requirements of this Ordinance, the SWMP, and other State and Federal regulations.

Sec. 3.5 Stormwater Design Standards Manual

The Engineering Department is authorized to develop and adopt a Stormwater Design Standards Manual. The Manual may include design standards, procedures and criteria for conducting hydrologic, hydraulic, pollutant load evaluations, and downstream impact for all components of the stormwater management system. Although the intention of the manual is to

establish uniform design practices, it neither replaces the need for engineering judgment nor precludes the use of information not presented. Other accepted engineering procedures may be used to conduct hydrologic, hydraulic and pollutant load studies if approved by the Engineering Department.

The Manual, if adopted, shall contain at a minimum the following components:

- (a) Construction Activity Application contents and approval procedures;
- (b) Construction completion and closeout processes;
- (c) Hydrologic, hydraulic, and water quality design criteria (i.e., design standards) for the purposes of controlling the runoff rate, volume, and pollutant load. Suggested reference material shall be included for guidance in computations needed to meet the design standards;
- (d) Information and requirements for new and re-development projects in special protection areas necessary to address TMDLs, known problem areas and other areas necessary to protect, maintain, and enhance water quality and the environment of Berkeley County and the public health, safety, and general welfare of the citizens of Berkeley County.
- (e) Construction document requirements;
- (f) Minimum easement requirements;
- (g) Required and recommended inspection schedules and activities for all components of the stormwater management system, including construction-related BMPs.

The Manual shall be updated periodically to reflect the advances in technology and experience gathered with time.

Sec. 3.6 Ownership and Berkeley County Participation

(a) Property owners are responsible for maintaining stormwater quantity and quality facilities and all conveyance structures located on their property. Prior to the issuance of an approved Application for Construction Activity, the property owner shall execute a legal document entitled "Covenants for Permanent Maintenance of Stormwater Systems". The property owner shall record the Covenants in the Office of the Berkeley County Register of Deeds. The location of the facility, the recorded location of the Covenants document, and a statement of the property owner's responsibility for maintenance shall be included and also shown on a plat. In the case of an operator other than the property owner, a copy of a maintenance agreement between the operator and the property owner shall be included with the Covenants, defining the operators' duties and responsibilities and that the property owner shall be responsible for maintenance activities upon the termination of the agreement.

(b) The property owner shall grant to Berkeley County a perpetual, non-exclusive, transferable easement, beginning or ending at a public street or other access point that allows for

public inspection and emergency repair of all components of the drainage system, including all conveyances and all water quantity and quality control facilities. At the request of the County Engineer or his designee, the property owner shall grant to Berkeley County right-of-ways.

(c) Stormwater quantity and quality control facilities shall be located so that required easements can be effectively used and ownership and maintenance responsibility can be clearly defined in deeds and plats.

(d) Berkeley County shall be responsible for maintenance activities for stormwater collection/conveyance systems associated with County accepted public roads and County projects.

(e) For projects that are not County accepted public road projects, Berkeley County may in its sole discretion either accept or decline ownership and maintenance of all or part of a storm water system.

(f) The minimum maintenance requirements will be performed at necessary intervals by the property owner or operator during construction and for as long as a storm water management system or component is in use. Failure to perform such activities will constitute a violation of this Ordinance.

(g) If a facility or any portion of the stormwater system is not being maintained as required, the County Engineer or his designee will notify the property owner or operator in writing. If the property owner or operator fails to repair or maintain the facility within the allotted time, the Engineering Department may authorize the work to be performed by the County or others. In such cases, the property owner or operator shall reimburse the County for its direct and related expenses. If the property owner or operator fails to reimburse the County, the County is authorized to file a lien for said costs against the property, file an action in magistrate or civil court for recovery of incurred expenses, and enforce such actions in magistrate or civil court.

(h) A property owner or operator may hire or contract others to perform necessary maintenance actions, but Berkeley County will hold the person named in the Covenants as the responsible party should legal actions described in (g) be necessary.

(i) When the County Engineer or his designee determines that additional storage capacity or pollution reduction beyond that required by the applicant for on-site storm water management is necessary in order to enhance or provide for the public health, safety and general welfare, to correct unacceptable or undesirable existing conditions or to provide protection in a more desirable fashion for future development, Berkeley County may:

- (l) require that the applicant grant any necessary easements over, through or under the applicant's property to provide access to or drainage for such a facility;

- (2) require that the applicant obtain from the owners of property over, through or under where the stormwater management facility is to be located, any easements necessary for the construction and maintenance of same;

Sec. 3.7 Maintenance, Construction, Inspection, and Closeout

Maintenance of the storm water management system is critical for the achievement of its purpose of controlling storm water runoff quantity and quality and the short-term and long-term public health, safety, and general welfare of the citizens of Berkeley County.

(a) A maintenance plan for the stormwater management system shall be included in the application to perform a construction activity, and must address activities to be conducted during and after construction. As part of the maintenance plan, the property owner or operator of such facility shall specifically agree, through recordation of Covenants, to be responsible for keeping the system and facilities in working order. The Engineering Department shall develop procedures to provide reasonable assurance that maintenance activities are performed for both Berkeley County and privately maintained systems. The Engineering Department shall also define procedures for transferring maintenance responsibilities to another entity.

(b) The Engineering Department shall define procedures for conducting site inspections during construction and until a stormwater management system or facility is no longer in use. Such inspections may be performed by County staff or an approved inspector. Berkeley County has the authority to levy fees for inspections and re-inspections as described in the Storm water Design Standards Manual.

(c) As part of any application to perform a construction activity, the applicant shall submit his own maintenance and inspection schedules to be implemented during construction and for as long as a storm water management system or facility is in use. Required and recommended schedules for BMP maintenance and inspection are to be provided in the Design Manual.

(d) If the construction is to be phased, no stage work, related to the construction of stormwater management facilities shall commence until the preceding stage of work is completed in accordance with an approved application to perform a construction activity. The procedure for construction phases beginning and ending and what constitutes such conditions shall be developed.

(e) The applicant shall notify the County Engineer or his designee before commencing any work to implement the approved Construction Activity Application and upon completion of any phase or designated component of the site. Notification schedules shall be provided for in the Design Manual. All self-inspections, maintenance actions, BMP replacements, and changes to the approved application shall be documented and presented upon request to the County Engineer or his designee.

(f) The construction project completion and closeout process must be completed by the Engineering Department prior to any of the following actions, as applicable:

- (1) The use or occupancy of any newly constructed components of the site.
- (2) Final acceptance of any road into the official Berkeley County road inventory or designation of road owner and associated stormwater management system.
- (3) Release of any bond held by Berkeley County.
- (4) Approval and/or acceptance for recording of maps, plats, or drawings, the intent of which is to cause a division of a single parcel of land into two or more parcels, and/or acceptable bonding is provided.

Sec. 3.8 Watercourse Protection

Every person owning or operating property through which a watercourse passes shall keep and maintain that part of the watercourse within the property free of trash, debris, and other obstacles that would pollute, contaminate, or significantly retard the flow of water through the watercourse. In addition, the owner or operator shall maintain existing privately owned structures within or adjacent to a watercourse so that such structures will not become a hazard to the use, function, or physical integrity of the watercourse.

To assist in the compliance with State and Federal laws and regulations, the Engineering Department may develop special protection areas which require additional control of stormwater quality and quantity than provided by minimum design standards. Such areas may consist of watersheds corresponding to established TMDLs, known flooding problems and pollution impairments, or other areas necessary to protect, maintain, and enhance water quality and the environment of Berkeley County and the public health, safety, and general welfare of the citizens of Berkeley County. These areas can be expected to change with time as development continues and as federal and state law demands.

New storm water systems created as the result of any new and re-development project shall be connected to the existing drainage system in a manner so as not to degrade the integrity of the existing system, whether natural or manmade, and shall have demonstrated this to the Engineering Department prior to project closeout. Discharge points shall be confined to connections with an existing natural or man-made drainage system. When there is a direct stormwater discharge into collection systems not owned and maintained by Berkeley County, the owners of these systems shall maintain the right to disapprove new connections to their system.

Sec. 3.9 Notification of Spills

Notwithstanding other requirements of law, as soon as any person responsible for a facility or the facility's operation and maintenance, or responsible for emergency response for a facility or operation has information of any known or suspected release of materials which are resulting or may result in illegal discharges or pollutants discharging into stormwater, the storm drain system, or waters of the State, said person shall take all necessary steps to discover,

contain, and cleanup any such releases. The person shall also take immediate steps to protect against future recurrences of the discharge. In the event of such a release of hazardous materials, including but not limited to oils, greases, engine fluids and fuels, chemicals, herbicides and pesticides, and fertilizers, said person shall immediately notify all necessary agencies of the occurrence. This shall include E911, Berkeley County Emergency Preparedness, and the Berkeley County Engineering Department. Such notifications of hazardous spills shall be confirmed by written notice addressed and mailed to the Engineering Department within five (5) business days of the spill event. In the event of a release of non-hazardous materials, said person shall record an on-site written record of the spill. The owner or operator of such facility shall retain an onsite written record of any and all spills that will include information on cleanup measures taken and the actions to prevent its recurrence. Such records shall be retained for at least five (5) years. Failure to provide notification of a release as provided above is a violation of this ordinance.

Sec. 3.10 Cleanup Procedures

Berkeley County may develop spill procedures on how spills are cleaned up, and who is responsible for the cleanup in terms of the activities to be performed and cost of such actions.

Sec 3.11 Reserved.

DIVISION 4 DETECTION AND REMOVAL OF ILLICIT CONNECTIONS AND DISCHARGES AND IMPROPER DISPOSAL

Sec. 4.1 Illicit Connections, Illicit Discharges, and Improper Disposal.

(a) It is unlawful for any person to connect any pipe, open channel, or any other conveyance system that discharges anything except stormwater or other approved discharges into a Berkeley County stormwater management system or facility or a Water of the State.

(b) It is unlawful for any person to continue the operation of any such illicit connection regardless of whether the connection was permissible when constructed. Improper connections in violation of this ordinance must be disconnected and redirected, if necessary, to the satisfaction of the County Engineer or his designee and any other federal, state, or local agencies or departments regulating the discharge.

(c) It is unlawful for any person to throw, drain, or otherwise discharge to a Berkeley County storm water management system or facility or to waters of the State or to cause, permit, or allow a discharge that is composed of anything except stormwater or unpolluted water which is approved by the Engineering Department.

(d) The Engineering Department shall develop procedures for detecting, tracking, and eliminating illicit discharges and improper disposals to the stormwater system.

(e) The County Engineer or his designee may require controls for or exempt the following discharges from the prohibition provision in (a), (b), and (c) above, provided that a reasonable determination is made that they are not a significant source of pollution:

- (1) Unpolluted industrial cooling water, but only under the authorization and direction of the County Engineer or his designee and if an appropriate Industrial NPDES permit is in place.
- (2) Water line flushing, diverted stream flows, rising ground waters, and uncontaminated pumped ground waters, and uncontaminated ground water infiltration.
- (3) Discharges from potable water sources, foundation drains, air conditioning condensation, landscape irrigation, springs, water from crawl space pumps, footing drains, lawn watering, individual car washing, dechlorinated swimming pool discharges, flows from riparian habitats and wetlands, and street wash water.
- (4) Discharges or flows from fire fighting.

(f) The Engineering Department may develop procedures for allowing other non-storm water discharges.

Sec. 4.2 Detection of Illicit Connections, Illicit Discharges, and Improper Disposal.

(a) The Engineering Department shall take appropriate steps to detect and eliminate illicit connections and illicit discharges to Berkeley County stormwater systems, including the adoption of a program to screen illicit discharges and identify their source or sources, perform inspections, and levy fines if not removed.

(b) The Engineering Department shall take appropriate steps to detect and eliminate improper disposal. These steps may include programs to screen for disposal, programs to provide for public education and public information, inspection, levying fines, and other appropriate activities to facilitate the proper management and elimination of improper disposal.

Sec 4.3 Waste Disposal Prohibitions.

No person shall throw, deposit, leave, maintain, keep, or permit to be thrown, deposited, left, or maintained, in or upon any public or private property, driveway, parking area, street, alley, sidewalk, component of the storm drain system, or water of the U.S., any refuse, rubbish, garbage, litter, pet fecal matter, or other discarded or abandoned objects, articles, and accumulations, so that the same may cause or contribute to pollution. Yard debris, including natural foliage, may be deposited in the public right of way but not in or on any stormwater conveyance structures, including inlets and gutters, but only if a collection service is available. Wastes in proper waste receptacles may be placed in the street for collection, but again only if

collection by or through Berkeley County is in place. No waste or yard debris shall be placed in the street without such a collection service.

Sec. 4.4 Reserved.

**DIVISION 5
MONITORING AND INSPECTIONS**

Sec. 5.1 Monitoring.

The Engineering Department may monitor the quantity and concentration of pollutants in stormwater discharges from the areas and/or locations designated in Berkeley County's SWMP.

Sec. 5.2 Inspections.

(a) The County Engineer or his designee, bearing proper credentials and identification, may enter and inspect all properties for regular inspections, periodic investigations, monitoring, observation measurement, enforcement, sampling and testing, to effectuate the provisions of this ordinance and the SWMP programs. Such inspections may be made at active construction sites or at any stormwater management system or facility in perpetuity. The County Engineer or his designee shall duly notify the owner of said property or the representative on site and the inspection shall be conducted at reasonable times.

(b) Upon refusal by any property owner to permit an inspector to enter or continue an inspection, the inspector shall terminate the inspection or confine the inspection to the areas where no objection is raised. The County Engineer or his designee shall document the refusal and the grounds for such and promptly seek appropriate compulsory process.

(c) In the event that the County Engineer or his designee reasonably believes that discharges from the property into a Berkeley County stormwater management system or facility may cause an imminent and substantial threat to human health or the environment, the inspection may take place at any time and without notice to the owner of the property or a representative on site. The inspector shall present proper credentials upon reasonable request by the owner or representative.

(d) Inspection reports shall be maintained in a permanent file located in the Engineering Department's office.

(e) At any time during an inspection or at such other times as the Engineering Department or his designee may request information from an owner or representative, the owner or representative may identify areas of his facility or establishment, material, or processes that contain or might reveal a trade secret. If the County Engineer or his designee has no clear and convincing reason to question such identification, all material, processes and information obtained within such areas shall be conspicuously labeled "CONFIDENTIAL - TRADE SECRET." The trade secret designation shall be freely granted to any material claimed to be such by the owner or representative unless there is clear and convincing evidence for denying

such designation. In the event the County Engineer or his designee does not agree with the trade secret designation, the material shall be temporarily designated a trade secret and the owner or representative may request an appeal of the Engineering Department's decision in the manner in which all such appeals are handled in this ordinance.

Sec. 5.3 Reserved.

**DIVISION 6
ENFORCEMENT, PENALTIES, AND ABATEMENT**

Sec. 6.1 Enforcement

(a) The County Engineer or his designee may initiate an enforcement action when violations of this Ordinance occur, including:

- (1) When the County Engineer or his designee finds that work done for new development and re-development fails to conform to the approved Construction Activity Application, or finds that the approved work has not been done;
- (2) When the County Engineer or his designee determines that an owner or operator has failed to maintain a stormwater management facility,
- (3) When the County Engineer or his designee determines that an owner of any property is causing or partially causing flooding, erosion, or non-compliance with water quality standards or this Ordinance.

(b) The County Engineer or his designee shall direct conformity to approvals and this Ordinance by written Notice of Violation (NOV). The NOV shall serve as a legal requirement to remove the violation(s). The written NOV shall be provided to the owner or the person responsible for land disturbing activities stating the nature of the violation, the amount of time in which to correct deficiencies, the date on which an inspection will be made to make sure that corrective action has been performed, and the proposed penalty structure if corrective action is not taken by the inspection date. It shall be sufficient notification to deliver the notice to the person to whom it is addressed, or to deposit a copy of such in the United States Mail, properly stamped, certified and addressed to the address used for tax purposes or the address provided on the Construction Activity Application. The NOV may address the entire site or a specific portion of the site so as not to unduly impede the development of areas being managed for the control of storm water runoff and associated pollutants.

(c) After the issuance of the NOV, the Berkeley County Engineer or his designee is hereby given the authority to proceed with enforcement actions which may include:

- (1) Issuing a written order to comply, to suspend work, or to revoke the approval issued;

- (2) Seeking redress through legal action;
- (3) Withholding the release of permanent electric power to the site or certificate of occupancy;
- (4) Withholding or revoking other permits related to the site; and/or
- (5) Levying fines.

(d) The County Attorney is hereby directed to take all legal actions necessary to correct situations described in (a), (b) and (c), including actions that are necessary to remove from the property such objectionable conditions constituting non-compliance with this Ordinance.

(e) Nothing contained in this Ordinance shall impair the right or ability of the County Attorney to exercise any and all other remedies available, of-law or in equity, including without limitation, the pursuit of injunctive relief, under emergency circumstances where there exists the danger of bodily injury or death.

(f) The authorized enforcement agency or its appointed agent may obtain injunctive relief to enjoin violations of the provisions of this Ordinance, and any person damaged as a result of such violations may, upon a proper showing of such damages, obtain payment therefore by a civil action.

(g) This Ordinance may be enforced by any other remedy of law or equity that the County Attorney is authorized to pursue, to include the authorities and powers conferred to local governments by the General Assembly of South Carolina. The penalties and other remedies provided in this Ordinance are cumulative and not exclusive, and may be independently and separately pursued against the same person for the activity constituting a violation of this Ordinance. The enforcement of any remedy provided herein shall not prevent the enforcement of any other remedy or remedies in other provisions of this Code or other laws and regulations.

Sec. 6.2 Fines

Any person violating any provision of this ordinance shall be subject to a fine of not more than one thousand dollars (\$1,000) for each violation. Each separate day of violation constitutes a new and separate violation. Notice of civil penalty shall be provided via the issuance of a uniform summons.

Sec. 6.3 Additional Legal Measures

(a) Where Berkeley County is fined and/or placed under a compliance schedule by the State or federal government for a violation(s) of its NPDES permit, and Berkeley County can identify the person(s) who caused such violation(s) to occur, Berkeley County may pass through the penalty and cost of compliance to that person(s).

(b) Berkeley County's attorney may institute injunctive, mandamus or other appropriate action or proceedings at law or equity, including criminal conviction, for the enforcement of this Ordinance or to correct violations of this Ordinance, and any court of competent jurisdiction shall have the right to issue restraining orders, temporary or permanent injunctions, mandamus or other appropriate forms of remedy or relief.

Sec. 6.4 Criminal Penalties

In addition to any applicable civil penalties, any person who willfully, with wanton disregard, or intentionally violates any provision of this Ordinance shall be guilty of a misdemeanor and upon conviction shall pay a fine of not more than \$500.00 or imprisoned for not more than thirty (30) days. Each day of violation shall constitute a new and separate offense.

Sect. 6.5 Corrective Action

In the event a violation of this Ordinance has not been corrected within the applicable time period for correction, Berkeley County, or its contractor, may enter upon the lot or parcel of land and correct the violation, and the costs incurred as a result of such action (including inspection, administration, labor and equipment costs) shall be collected from the bond, if in place and sufficient to cover such costs, or shall become a lien upon the property and shall be collected in the same manner as Berkeley County taxes are collected.

Sec. 6.6 Stop Work Order

The County Engineer, his designee, or other authorized personnel may issue a stop work order if it is found that a construction activity is being conducted in violation of this Ordinance.

The stop work order may allow or require correction of Notice of Violation (NOV) issues, but shall otherwise stop all other construction related activities. A stop work order may carry with it civil penalties as well. Any person in violation of a stop work order is subject to payment of all fees, bonds, and penalties prior to the lifting of the stop work order.

Sec. 6.7 Approval Suspension and Revocation

An approved Construction Activity Application may be suspended or revoked if one or more of the following violations have been committed:

- (a) Violations of the conditions of the Construction Activity Application approval;
- (b) Construction is not in accordance with the approved plans;
- (c) Non-compliance with correction notice(s) or stop work order(s);
- (d) The existence of an immediate danger to a downstream area (in the judgment of the County Engineer or his designee);

- (e) Other violations of this Ordinance.

Sec. 6.8 Reserved.

**DIVISION 7
VARIANCES**

Sec. 7.1 Design Criteria

The County Engineer may grant a variance only upon a determination that:

- (a) The variance will not be detrimental to the public health, safety, and general welfare of the County, and
- (b) The variance will not adversely affect the reasonable development of adjacent property, and
- (c) The variance is justified because of topography or other special conditions unique to the property involved, and the variance is not requested due to mere inconvenience or financial disadvantage, and
- (d) The variance is consistent with the objectives of this Ordinance and will not have the effect of nullifying the intent or purpose of this Ordinance, or any other pertinent County or State regulations.

A written request for a variance shall be required and shall state the specific variance sought and the reasons, with supporting data, a variance should be granted. The request shall include all information necessary to evaluate the proposed variance.

Sec. 7.2 Reserved.

**DIVISION 8
APPEALS**

Sec. 8.1 Appeals Process

Any person aggrieved by a decision, Notice of Violation, or denial of a variance by the County Engineer or his designee may appeal the same by filing a written notice of appeal with the Berkeley County Council within fifteen (15) days of the issuance of said decision, Notice of Violation, or denial of a variance. The Berkeley County Council will review the appeal and will either reverse or preserve the previous decision. In either case, a notice of appeal from the Berkeley County Council will state the reason for their appeal decision.

The Berkeley County Council shall hear such appeals in a quasi-judicial capacity within forty-five (45) days, at the next regularly scheduled meeting or such other time as may be

mutually agreed upon and will render a decision within ten (10) working days after the appeal has been heard.

If Berkeley County Council fails or neglects to repeal the said decision, Notice of Violation, or denial of a variance within sixty (60) days of the appeal request, the appeal of the said decision, Notice of Violation, or denial of a variance is automatically granted.

Any person aggrieved by the decision of the Berkeley County Council may appeal the decision to the Berkeley County Circuit Court in accordance with its rules and procedures.

Sec. 8.2 Reserved.

**DIVISION 9
CHARGES AND FEES**

Sec. 9.1 Funding.

In addition to all other charges, fees, and penalties, Berkeley County shall have the right to develop and impose a Stormwater Service Fee to fund implementation of this Stormwater Management Ordinance and its associated programs and plans. Establishment and revision of such fees shall be approved by Berkeley County Council.

Sec. 9.2 Connection to Conveyances.

The Engineering Department shall have the right to establish a schedule of appropriate fees for any person or property owner establishing a new discharge to Berkeley County stormwater management systems or to a wet weather conveyance. Such fee shall be payable as part of any application regulating the discharge of stormwater runoff (i.e. plan review and inspection fees). Application fees shall be established on the basis of facility classes relating to the quantity and quality of approved discharge. Establishment and revision of such fees shall be approved by Berkeley County Council.

Sec. 9.3 Plan review

Costs associated with plan review of land development construction documents other than those routinely performed by the Engineering Department may be assessed a fee to compensate for the cost in labor, equipment, and materials expended in the conduct of the review. Establishment and revision of such fees shall be approved by Berkeley County Council.

Sec. 9.4 Field inspection.

Costs associated with field inspection and re-inspections of land development or construction activities other than those routinely performed by the Engineering Department as part of compliance monitoring may be assessed a fee to compensate for the cost in labor, equipment, and materials expended in the conduct of the inspection. In addition, post-

construction maintenance inspection fees may be assessed by the Engineering Department. Establishment and revision of such fees shall be approved by Berkeley County Council.

Sec. 9.5 Reserved.

ADOPTED this 23rd day of July 2007.

S/Daniel W. Davis, Chairman
Berkeley County Council

Attest:

S/Barbara B. Austin, CCC
Clerk of County Council

First Reading: April 23, 2007
Second Reading: May 29, 2007
Public Hearing: June 25, 2007
Third Reading: July 23, 2007