Stormwater Design Standards Manual

City of Charleston, South Carolina

March 15, 2013

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Revisions

Date	Revision
June 2008	Draft Stormwater Design Standards Manual
February 2009	Stormwater Design Standards Manual – Draft Final
January 2010	Stormwater Design Standards Manual - Final
February 2011	Stormwater Design Standards Manual – Updated Final
March 2013	Stormwater Design Standards Manual – Updated Final

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CHAPTER 1 – GENERAL INFORMATION

1.1 Purpose

The purpose of this manual is to establish the minimum standards for the design of the City's stormwater system and to address issues related to construction, development and re-development projects within the City of Charleston. This manual describes the policies and procedures that shall be used by the Engineering Division of the City of Charleston's Department of Public Service to implement the City's ordinances related to stormwater. This manual shall:

1. Provide the construction, development and re-development application submittal requirements and approval process.

2. Provide the technical design standards, to include standards which address flow rates, runoff volume, and pollutant load/concentration, as well as specific standards during construction, development and re-development and for long-term post construction, post development and post re-development performance.

3. Provide general information on measures to improve water quality, prevent illicit discharges, and minimize stormwater runoff impacts due to construction activity, development and re-development.

4. Provide other protection provisions related to stormwater discharges such as wetlands and watercourse conservation.

This manual is 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 procedures, techniques, and innovative stormwater Best Management Practices (BMPs) be submitted with supporting documentation. However, the use of such approaches shall be substantiated with submitted documentation by design engineers showing that the proposed design is equal to, or exceeds the traditional procedures in terms of performance and economic feasibility.

1.2 Disclaimer

The Stormwater Design Standards Manual is not intended as a textbook or a comprehensive engineering design reference. It was developed under the assumption that the user possesses a thorough understanding of stormwater control design, construction, and land development. References to guidance documents from federal, state, and local agencies are given throughout this manual and are only for the purposes of providing additional information to users.

1.3 Scope

The scope of this manual is limited to the requirements related to stormwater management as reviewed and approved by the Engineering Division of the Department of Public Service.

The requirements in this manual and in other City ordinances should be reviewed carefully to ensure that all requirements are being met. Construction, development and re-development projects may also be impacted by other state requirements and federal requirements such as the NPDES Construction General Permit.

The City shall not issue a construction activity application approval until notice of coverage from SCDHEC under the NPDES General Permit for Stormwater Discharges from Large and Small Construction Activities is received by the Engineering Division of the Department of Public Service. Those projects not subject to NPDES requirements must still comply with all applicable City ordinances.

1.4 Design Standards Manual Organization

This manual contains five chapters, organized to present technical and engineering procedures along with the criteria needed to comply with the State of South Carolina's Stormwater Management and Sediment Reduction Act, the NPDES General Permit for Stormwater Discharges from Regulated Small Municipal Separate Storm Sewer Systems (MS4s) No. SCS030000 and the City of Charleston's stormwater ordinances. Chapter 1 provides general information on stormwater management and its importance, and definitions for terms used throughout this manual. Chapter 2 describes the application process for obtaining the City's approval of a construction activity application. Chapter 3 contains specific design criteria and the site design credit system. Chapter 4 describes the inspection and enforcement process. Chapter 5 contains references for designing components of the stormwater management system.

1.5 Authorization

This manual has been prepared under the direction of the Engineering Division of the Department of Public Service, which has been granted the authority by the City of Charleston's City Council to develop engineering design standards and enact programs and policies to ensure compliance with state and federal laws for the purposes described above. A detailed description of the laws, regulations, and assigned authorizations to the City of Charleston is provided below.

1.5.1 Stormwater Related Regulations and Permits

1.5.1.1 Clean Water Act

Federal Water Pollution Act, as amended by the Clean Water Act (CWA) requires the reduction of water pollution and gives the Environmental Protection Agency (EPA) the congressional authority to develop programs to improve the health of navigable waters. EPA in response developed regulations that created a program of discharge permits as part of the National Pollutant Discharge Elimination System (NPDES) to regulate point sources from a variety of discharges. The 1987 amendments to the CWA extended NPDES permits to industrial discharges, including stormwater runoff associated with land disturbing activity. The 1987 CWA Amendments also require NPDES permitting for stormwater runoff from urbanized areas. A MS4 NPDES permit is required based on population. Authority to administer the NPDES permit program was delegated to state agencies, such as SCDHEC, by the EPA.

1.5.1.2 South Carolina Coastal Zone Management Act

The Federal Coastal Zone Management Act (CZMA) of 1972 provides grants to states that develop and implement federally approved coastal zone management plans. The Office of Ocean and Coastal Resource Management (OCRM), a division of the South Carolina Department of Health and Environmental Control (DHEC), implements this management plan for the state's eight (8) coastal counties as established by the Coastal Zone Management Act of 1976. Within the coastal zone, the program provides authority to review any project requiring a state permit (certification), a federal permit or license (including NPDES), federal funding, as well as direct federal activities to determine if the project is consistent with the policies and procedures of the S.C. Coastal Zone Management Program.

1.5.1.3 South Carolina Pollution Control Act

The South Carolina Pollution Control Act (PCA) was originally enacted in 1950 and was last amended in 1970 during the initial stages of the environmental movement. It was written very broadly and is applicable to essentially any activity that could negatively impact the environment by requiring attainment of a permit and implementation of measures to mitigate potential negative impacts.

1.5.1.4 South Carolina Stormwater Management and Sediment Reduction Act

The South Carolina Stormwater Management and Sediment Reduction Act of 1991 (SMSRA) S.C. Code Ann. §§ 48-14-10 et seq. was enacted to address the increase in stormwater runoff rate and quantity, the decrease of rainwater infiltration, and the increase in erosion associated with the extensive urban development occurring throughout the state. The Act gave legislative authority to SCHEC to enact programs to meet its purpose.

1.5.1.5 NPDES Permit for Stormwater Discharges Associated with Industrial Activity

All stormwater runoff from "industrial activities" is considered an illegal discharge without an NPDES discharge permit. These permits require certain industries to develop and implement a Stormwater Pollution Prevention Plan (SWPPP), which must include appropriate Best Management Practices (BMP) to minimize pollution to receiving waters. There are two general types of industrial activity permits: "construction related" and "other". Coverage under the NPDES General Permit for Stormwater Discharges from construction activities is required for all construction sites that disturb one-half (½) or more acres of land. Coverage is required for all construction activities within ½ mile of a receiving water. The requirements for obtaining and complying with this type of permit are the focus of this manual.

1.5.1.6 NPDES MS4 General Permit SCR030000

The City of Charleston is required to have a National Pollutant Discharge Elimination System (NPDES) permit to discharge stormwater from MS4. Because land disturbance activities contribute to the discharge of pollutants, the NPDES permit requires that the City of Charleston encourage, promote, and implement certain practices, programs, and procedures for the purpose of reducing or limiting discharge of pollutants into receiving waters of the State. The permit requires that the City of Charleston develop and implement a Stormwater Management Program to control the discharge of pollutants from its MS4 to the maximum extent practicable (MEP).

1.5.1.7 City of Charleston Ordinances, Regulations, and Standards

The City of Charleston has promulgated and adopted ordinances and standards based on State and Federal regulations to address concerns associated with uncontrolled stormwater runoff. There are a number of ordinances and standards for the City that may affect construction activities, and the development and re-development of land such as:

1. Zoning,
2. Building,
3. Floodplain,
4. Stormwater Management Ordinances,
5. Design, Development and Preservation, and
6. Utilities.

Other ordinances and standards may also be applicable and should be consulted as necessary.

1.6 Updates to the Stormwater Design Standards Manual

This manual is intended to be a dynamic document. As design technology and criteria evolve and change or it becomes evident that additional measures are needed to ensure the public general welfare, this manual shall be amended with City Council's approval. This manual can also be found on the City of Charleston's website at www.charlestoncity.info.

1.7 Stormwater Management

Construction, development and re-development have the potential to alter the natural drainage patterns, flow rates, and volumes of water in the environment. Construction, development and re-development can directly or indirectly change the physical, chemical, and biological conditions of natural waterways. When land is developed or re-developed, the natural hydrology of the watershed is disrupted and traditionally, stormwater systems have facilitated the efficient

removal of not just runoff, but associated pollutants into receiving waters. Clearing land removes vegetation that intercepts and slows rainfall runoff. Grading removes the benefits of topsoil, compacts the subsoil, and fills in depressions that provide natural storage. As a result of land development and re-development, infiltration is decreased and rainfall that once seeped into the ground runs off the surface at an accelerated rate.

1.7.1 Effects of Construction Activities, Development and Re-development on Watershed Hydrology

Construction, development, re-development and urbanization have the following impacts on receiving waterbodies:

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

1.7.2 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 construction, development and re-development. 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; and,
- Maintenance schedules for construction and post construction activities.

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

- Pre-submittal site meeting/site visit;
- Review of site development requirements;
- Detailed site analysis and supporting calculations;
- Creation of a Stormwater Concept Plan;
- Design aspects of the stormwater management plans; and,
- Completion and approval of the construction activity application.

1.7.3 Innovative Design Approach

When designing for land disturbance activities, the design should 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, long-term). If an innovative stormwater design approach is to be used, the design engineer shall 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 volume 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;

- BMPs implement stormwater management by using simple, structural and nonstructural methods along with or in place of traditional stormwater management structures when applicable; and,

- 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.

Innovative approaches to site design often focus on source control for stormwater runoff that limit the amount of runoff generated and incorporate BMPs throughout the site. These types of design concepts are described in detail in several sources including*:* Georgia Stormwater Manual, Volume 1: Policy Guidebook, First Edition, Atlanta Regional Commission, August 2001; and, Low-Impact Development Design Manual, Prince George's County Maryland (1999a, 1999b).

1.7.4 Best Management Practices and Site Planning Process

The first step in addressing stormwater management begins in the site planning and design stage of the construction, development and re-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 engineer.

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 construction, post-development and post re-development impervious areas and maintain natural characteristics of the pre-construction, pre-development and pre-re-development site conditions. Therefore, the post-construction, post-development and post-re-development curve number and time of concentrations are maintained more closely to the pre-construction, pre-development and pre-re-development conditions. This reduces the overall hydrologic and hydraulic impact of the construction, development and re-development.

1.7.4.1 Maintaining site resources and natural undisturbed areas

Conservation of site resources and natural undisturbed areas helps to reduce the post-construction, post-development and re-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; and,
- Wetlands.

1.7.4.2 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 constructed, developed or re-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 construction activities, development and re-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; and,
- Consider the use of energy dissipation devices, such as level spreaders, at all discharge points. Such devices should also be considered for discharge points into ponds and other basin-type BMPs. More information on these devices is provided in Chapter 3.

1.7.4.3 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 construction, development and re-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 overflow parking;

- Increase the amount of vegetated parking lot "islands" that can also be utilized for stormwater management practices such as bioretention areas; and,

- Disconnect impervious surfaces by directing runoff to adjacent pervious areas so that runoff can be filtered and infiltrated.

1.7.4.4 Utilization of natural features for stormwater management

Structural stormwater drainage controls are traditionally designed to remove stormwater runoff quickly 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;

- The use of vegetated swales instead of curb and gutter applications to allow for more storage of stormwater runoff, lower peak flow rates, a reduction in erosive runoff velocities, and the capture and treatment of pollutants; and,

- 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.

1.7.4.5 Engineered/proprietary devices

The City of Charleston 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 devices, sock and tube erosion control devices, and advanced vegetation producing methodologies. The Engineering Division of the Department of Public Service shall evaluate any and all such devices specified for a given project and require for each drawings, specifications, and discussions as to the applicability of the product, expected performance, and required maintenance. The Engineering Division shall reserve the right to require that certain devices be installed or certain devices be prevented from use.

1.8 Engineering Design Accountability

This manual shall assist engineers, plan reviewers, inspectors, and contractors in the design and layout of most land disturbance projects. 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; and,
- Current versions of design texts, manuals, technical documents and research.

The design engineer shall thoroughly investigate field conditions and coordinate all design efforts with the City of Charleston. Construction plans, site plans, details, calculations, construction specifications, and other technical documents must be designed, stamped, and sealed by a professional engineer or Tier B Land Surveyor actively licensed in the state of South Carolina, unless otherwise stated in this manual. The design engineer 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 the plans during the design phase.

1.9 Severability

It is the declared intent of the City that if any portion of this Stormwater Design Standard Manual is ruled to be invalid or unconstitutional by any court with adequate jurisdiction over the City of Charleston, then such portion shall be considered to have been selectively removed from this manual without affecting the overall applicability, validity or enforceability of any remaining provisions of this manual, and it is the intent of the City that such remaining provisions shall continue in full force and effect.

1.10 Language and Interpretation of Text

The following language rules are applicable to the Stormwater Design Standards Manual:

- The imperative case is always mandatory. The words “shall” and “must” are always mandatory. These actions must be performed unless sufficient engineering justification is submitted to City officials within the Engineering Division and written approval has been specifically granted. The word “should” indicates an action that is highly recommended under most conditions. The word “may” indicates an allowable action or choice that is usually beneficial in meeting the minimum City requirements;

- Use of the singular or plural case of a noun shall not affect the applicability of this manual, or any other law, regulation, or ordinance, unless the context of the sentence specifically indicates that the singular/plural case affects the intended use or function on a scientific or engineering basis. The use of a singular or plural noun does not necessarily indicate whether to design or construct a single unit or multiple units;

- Any reference to the Engineering Division of the Department of Public Service shall mean the duly authorized representatives, sections or employees under the Director's supervision who have delegated responsibilities. Areas of delegated responsibility may include, but are not limited to: review and approval of plans, review and approval of survey plats, interpretation of standards or requirements, approval of special conditions, review and issuance of approvals, inspections and field investigations, enforcement actions, issuing notices of violation, conducting public meetings, etc.;

- The use of "and" shall imply conjunction of items in lists of required elements, in which all items must be complied with. The use of "or" shall imply the disconnection of items in lists of required elements, in which either or one or the other items in the list must be complied with; and,

- The rules of verbal construction found in the Stormwater Management Ordinance apply to this manual.

1.11 Contact Information

The following City of Charleston Departments should be contacted for any questions, clarifications, or other information related to stormwater management and this manual. Additionally, information may be found on the City's website at www.charlestoncity.info.

General Stormwater Questions
75 Calhoun Street
Third Floor
Charleston, SC 29401
Phone: (843) 724-3761
Fax: (843) 724-7198

Stormwater Technical/Design Questions
Phone: (843) 724-3777
Fax: (843) 724-7198

Building Permits/Inspections
Phone: (843) 937-8670
Fax: (843) 973-7254

1.12 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 City of Charleston's Stormwater Management Ordinance or authorizing regulations listed in Section 1.4 or in applicable FEMA regulations. The Engineering Division of the Department of Public Service shall have the right to define or interpret any other word or term contained within this manual.

1. Accommodate: water elevation not exceeding the crown of the pipe or culvert crossing under a roadway; coming within 12-inches of the top of the ditch or channel for the design storm; or encroaching on more than 1/3 of a travel lane for street drainage, curbs, and gutters for the design storm event.

2. Building: (1) a permanent enclosed construction 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. Channel: a stormwater conveyance open to the atmosphere flowing under the influence of gravity, including, but not limited to, natural waterways, canals, ditches, swales, and flumes.

4. Culvert: enclosed symmetrical channel of comparatively short length installed to convey water from one side of an embankment to the other, typically under a roadway, and mainly used to divert stream or rainfall runoff to prevent erosion or flooding on highways.

5. Construction or Construction Activity: is activity involving clearing, grading, transporting, filling, or any other activity which causes land to be exposed to the danger of erosion, or which might create an alteration to an existing drainage way or other component of the City's stormwater management system or facility.

6. Contour: an imaginary line, or its representation on a contour (topographic) map, joining points of equal elevation.

7. Detention: the collection and storage of stormwater runoff in a surface or sub-surface facility for subsequent controlled discharge to a receiving water.

8. Development or Re-Development: any of the following actions undertaken by a person, a firm, a governmental agency, a partnership, a limited liability company, or any other individual or entity, without limitation:

   a. any division or subdivision of a lot, tract, parcel, 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.

9. Ditch: a drainage channel in the earth created by natural or artificial means to convey surface and/or subsurface water, flowing continuously or intermittently. Ditches are generally smaller than those conveyances referred to as channels.

10. 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.

11. Drainage Facility: any component of the drainage system.

12. Drainage System: the surface and/or subsurface system which collects and conveys stormwater and surface water, and includes all watercourses, waterbodies, receiving waters, and wetlands.

13. Elevation: height in feet above a given known datum, such as NGVD29.

14. Embankment or Fill: a deposit of soil, rock or other material placed by man.

15. Final Stabilization: having 70% or more of the entire site with permanent coverage in good condition.

16. Flood: a temporary rise in the level of water which results in the inundation of areas not ordinarily covered by water.

a. Two (2) year flood: The flood having a fifty (50) percent chance of being equaled or exceeded in any given year.

b. Five (5) year flood: The flood having a twenty (20) percent chance of being equaled or exceeded in any given year.

c. Ten (10) year flood: The flood having a ten (10) percent chance of being equaled or exceeded in any given year.

d. Twenty-five (25) year flood: The flood having a four (4) percent chance of being equaled or exceeded in any given year.

e. Fifty (50) year flood: The flood having a two (2) percent chance of being equaled or exceeded in any given year.

f. One hundred (100) year flood: The flood having a one (1) percent chance of being equaled or exceeded in any given year.

17. Grading: any displacement of soil by stripping, excavating, filling, stockpiling, or any combination thereof, including the land in its excavated or filled state.

18. 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.

19. Level spreaders: structures that are designed to uniformly distribute concentrated flow over a large area. Level spreaders come in many forms, depending on the peak rate of inflow, the duration of use, the type of pollutant, and the site conditions. All designs follow the same principle:
    a. Concentrated flow enters the spreader through a pipe, ditch or swale.
    b. The flow is retarded, energy is dissipated.
    c. The flow is distributed throughout a long linear shallow trench or behind a low berm.
    d. Water then flows over the berm/ ditch, theoretically, uniformly along the entire length.

20. Operator: means the person who is operating the property, the operator's agent, or any other person who acts in the operator's behalf.

21. Outlet facility: stormwater management facility designed to regulate the elevation, rate, and volume of stormwater discharge from detention facilities.

22. 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 construction, development or re-development activity.

23. Pre-Development Conditions: those conditions, in terms of the existing topography, vegetation and rate, volume or direction of stormwater runoff, which exist prior to the time the applicant commences any construction, development or re-development activity.

24. Project: improvements and structures proposed by the applicant to be built on a defined site as part of a common plan of construction, development or re-development.

25. Rate: volume of water passing a point per unit of time, generally expressed in cubic feet per second (cfs).

26. Receiving Water(s): 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.

27. Retention: the collection and storage of stormwater runoff without subsequent discharge to surface waters.

28. Retrofit: the process of altering an existing drainage system to function properly or more efficiently than currently exists.

29. Runoff: that part of rainfall that is not absorbed into the site but flows over the site as surface waters.

30. 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.

31. Sedimentation: the process which operates at or near the surface of the ground, which deposits soils, debris and other materials either on other ground surfaces or in the waterbody.

32. Sedimentation Facility: any structure or area which is designed to retain suspended sediments from collected stormwater runoff, to include sediment basins.

33. 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.

34. Special Protection Area - are areas within the City that require some additional stormwater management controls due to existing problems. A Map indicating the City's special protection areas is provided in Appendix K.

35. Storm Frequency: rate of likely recurrence of a rainstorm (see Flood definition for further detail).

36. Stormwater Management Plan: a drainage system plan which fully indicates necessary land management and treatment measures, including a timetable of the schedule for their installation, which will effectively minimize soil erosion and sedimentation and which is approved as provided herein for application to a particular area or parcel of ground. This plan includes the technical report containing all engineering calculations and construction drawings.

37. 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.

38. Subdivision: The division of a tract of land or of a parcel of land into two (2) or more lots, building sites, or other divisions, for the purpose, whether immediate or future, of sale, legacy, or building developments which includes any of the following:

    a. The creation of a new City road or the alteration of an existing road

    b. The need for drainage, sedimentation or flood control measures,

    c. The installation of a water delivery system, or

    d. The installation of a sanitary sewerage system.

    Subdivision shall not include the division of a tract of land wherein each lot created meets the standards of the City of Charleston Department of Public Service regarding the use of individual wells and septic tanks and does not involve any of the activities referenced in items (a) through (d) above. When appropriate to the context, the term subdivision relates to the process of subdividing or to the land area subdivided.

39. Swale: a vegetated open channel for the purposes of conveying stormwater with side slopes no steeper than 3H: 1V. The cross-sectional shape may be triangular or trapezoidal.

40. Vegetation: all plant growth, especially trees, shrubs, mosses, and grasses.

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

42. Wetlands: means lands that have a predominance of hydric soil, are inundated or saturated by water or groundwater at a frequency and duration sufficient to support a prevalence of hydrophytic vegetation typically adapted for life in saturated soil conditions, and, under normal circumstances, do support a prevalence of hydrophytic vegetation. Normal circumstances refer to the soil and hydrologic conditions that are normally present without regard to whether the vegetation has been removed. Wetlands shall be identified through the confirmation of the three wetlands criteria: hydric soil, hydrology, and hydrophytic vegetation. All three criteria shall be met for an area to be identified as wetlands. Wetlands generally include swamps, marshes, and bogs.

CHAPTER 2 – CONSTRUCTION ACTIVITY APPLICATION AND APPROVAL PROCEDURES

This chapter provides developers, owners, engineers, contractors, and others with the information needed to obtain an approval of a stormwater management plan from the Department of Public Service as required for certain construction, development and re-development activities within the City of Charleston. This chapter describes conditions when City approval is needed, the types of applications used by the Department of Public Service that apply to different situations, application package requirements, and when and if variances are applicable.

2.1 Duty to Comply

Unless otherwise allowed by the Stormwater Management Ordinance or this Manual, the surface of land in the City of Charleston 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 Department of Public Service. Construction, development and re-development activities cannot commence prior to approval from the Department of Public Service and other City Departments as necessary.

2.2 Construction Activity Application Approval Procedures

All construction activity applications shall be made by either mail or hand delivery to the City of Charleston. Construction activity applications for review and approval under this chapter may be obtained by contacting the Department of Public Service and initiated by: (1) petition of all the owners of the property that is the subject of the application; or (2) the owners' authorized operators. The application package will then be distributed to other necessary City departments for their review and approval. Once an application is approved by the Department of Public Service, documentation of such approval and a signed set of construction plans shall be issued through TRC. The Department of Public Service may require applicants that need certain permit coverage from any state or federal agency to have such permits in hand prior to approving a construction activity application.

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

Whenever the procedures of the City expressly state that applications are to be submitted after a pre-submittal meeting (see Section 2.3.4.1), applicants shall be responsible for scheduling and attending such meetings. When pre-submittal meetings are required, an application shall not be accepted until the pre-submittal meeting has been conducted.

Once a complete application has been forwarded to the Department of Public Service, the Department of Public Service shall review the application and either approve, deny, make comments, or request additional information from the applicant as part of the TRC or SRC process.

If review comments or requests for additional information is required or a denial is issued, a letter detailing the comments, requests, or reasons for the denial will be mailed to the applicant. Prior to replying to this letter, a meeting between the Department of Public Service and the engineer/developer may be required to be scheduled and attended by the applicant. If a meeting is required, the applicant may submit a reply after the meeting has been held.

If the reply from the applicant does not contain all of the requested information, another letter is mailed by the Department of Public Service to the applicant. The applicant must then reply with the requested information. This process will continue until all information needed by the Department of Public Service has been received.

2.3 Construction Activity Applications

2.3.1 SFR Applications

All Single Family Residential (SFR) construction shall require the submittal of a complete building permit application. This application requires the completion of an Erosion Prevention and Sediment Control certification form by the owner or contractor that measures will be installed and maintained so as to prevent the discharge of sediment-laden runoff and to prevent the construction from causing non-compliance for any adjacent construction activities that may be under another City, State, or Federal permit.

2.3.2 Small Construction Activity Application – (Type I)

Any construction, development or re-development activity that falls within the following parameters shall use a Type I application:

- All construction, development or re-development activities disturbing ½ acre to one acre and not within ½ mile of a receiving water.
- All construction, development or re-development activities disturbing less than ½ acre and that are within ½ mile of a receiving water.

The applicant shall complete the Small Construction Activity Application form and the Erosion Prevention and Sediment Control (EPSC) certification. This certification requires that measures

be installed and maintained so as to prevent the discharge of sediment-laden runoff and to prevent construction from causing non-compliance issues for any adjacent construction activities that may be under another City, State, or Federal permit.

2.3.3 Medium Construction Activity Application - (Type II)

Any construction, development or re-development activity that falls within the following parameters shall use a Type II application:

- All construction, development or re-development activities disturbing at least one acre, but less than five acres, regardless of proximity to a receiving water.
- All construction, development or re-development activities disturbing ½ acre to one acre within ½ mile of a receiving water.

Some medium projects may be required to comply with conditions for Large Construction Activities such as those developments that have a high potential for waterbody impacts as determined by the Department of Public Service. The following submittal requirements shall be provided as part of a complete application:

1. Application Form: This form as shown in Appendix A serves as the City's form and NOI to SCDHEC-OCRM. All information requested shall be completely filled in. All certifications shall be signed.

2. Site Narrative: A narrative shall be submitted with the application describing the site in general, purposes of the construction activity, topographic and soil information, adjacent properties and owners, waterbodies receiving stormwater runoff (existing and proposed), anticipated starting and completion dates of the various stages of the construction activities and the expected date of final stabilization, existing water quality and flooding issues, and anticipated impacts and benefits. If applicable, the narrative shall also contain justification for variances, waivers, or other special conditions for the site. Also, if applicable, wetland and water body disturbance issues shall be discussed along with details on the status of necessary permit applications to the USACE. If a TMDL is in place for the receiving waterbody, the narrative shall describe how the project will comply with the TMDL.

   The narrative shall also discuss the roles and responsibilities of all co-responsible parties and others involved in the construction, development or re-development activity.

3. A sketch of the project area to accompany the narrative containing the following:

   a. 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;

b. Identification of all areas within the site that will be included in the construction activities and a calculation of the total disturbed area; and,

c. Location of temporary and permanent stormwater management controls.

4. Stormwater Technical Report:

Two (2) copies of the technical report shall be prepared by a certified professional engineer and be submitted as part of the application package. This report shall consist of maps, supporting design calculations for the proposed stormwater system, and erosion measures used during construction, and shall include, but not be limited to, the following:

a. Pre-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, development and re-development activity is evaluated;

b. 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 stormwater plan shall demonstrate control of runoff quantity and quality in accordance with the design criteria provided in Chapter 3;

c. Stormwater management system design to include:

i. A description of the stormwater management system, methodologies to be used in their design, existing and proposed runoff patterns, outfalls, offsite runon, and critical downstream areas;

ii. Map(s) showing the location of all existing and proposed stormwater management control facilities and outfalls;

iii. Supporting calculations which demonstrate that the system meets the City of Charleston's requirements for runoff rates, volumes, and pollutant loads. The following computations shall be included: hydrographs, routing of hydrographs through system components, estimates of trapping efficiencies of each BMP used, pipe and open channel capacity, velocity calculations, and water surface elevations. All system components shall have standard details and specifications;

iv. Calculations shall also be provided for energy dissipation, fill slopes and embankments, and channel stabilization; and,

v. Explanation and discussion of models used in the design.

d. If the project is located in a Special Protection Area, a comprehensive evaluation of engineering calculations and analysis shall be included that demonstrates the project will not negatively impact current drainage conditions and complies with state and federal conditions on stormwater discharges;

e. Erosion and sediment control plan to include:

   i. A description of the erosion and sediment control facilities selected;

   ii. Map showing the location of all erosion and sediment control facilities;

   iii. Design calculations of each measure, including trapping efficiencies. Each measure shall also have a standard detail and specification; and,

   iv. Explanation and discussion of models used in the design.

f. Downstream analysis calculations showing the effect of post-development design flows on downstream stormwater conveyance systems and channels;

g. Watershed delineation maps with consistent sequential notations;

h. 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;

m. General description of the adjacent property and description of existing structures, buildings, and other fixed improvements located on surrounding properties; and,

n. Discussion of site access issues and easements to be obtained and provided to the City.

5. Construction Plans:

Signed, certified construction plans with Certificates of Authorization are to be included as part of the approval application in the number required as per TRC requirements. The information required on the construction plans shall include,

but is not limited to, the following list. Other items may be required by the Department of Public Service. Some items may be included in other components of the application package, but this shall be adequately noted on the construction plans. D-Size or larger plan sheets/drawings are required. Drawing scale shall be large enough to show required detail at the discretion of the Department of Public Service.

a. North arrow and scale;

b. Property lines, adjacent landowners' names, and land use conditions;

c. Legend;

d. Registered engineer's seal;

e. Certificate of Authorization seal;

f. Existing and proposed contours and land uses;

g. Limits of disturbed area;

h. Delineation of wetlands and waters of the state;

i. Easements;

j. Stormwater system profiles with existing and proposed ground elevations;

k. Construction sequence (include implementation of all stormwater and sediment controls in the first phase of construction);

l. Locations of all temporary and permanent control measures;

m. Details for all temporary and permanent control measures;

n. Grassing and stabilization specifications and schedule;

o. Maintenance requirements (for temporary and permanent controls);

p. Construction entrance and exit;

q. Tree protection, preservation, and overall landscaping plan with appropriate species selection and screening for ponds and other components required by the City of Charleston's Zoning Ordinances;

r. Details and specifications of all necessary construction components;

s. Location map;

t. A cover sheet that shall contain, at a minimum, the following items:

i. Project name;

ii. Engineers contact information to include name, mailing address, telephone, and fax;

iii. Owner or operator, contact information to include name, mailing, address, telephone, and fax;

iv. Vicinity map;

v. Table of contents; and

vi. Tax map number.

u. All drawing elevations shall be based on the NGVD 29 or NAVD 88 datum and referenced to the state plane coordinate system NAD 83 FIPS 3900 feet;

v. The following standard notes shall be shown on the plans. This list is not meant to be exhaustive and other notes shall be included as necessary:

i. Slopes which exceed eight (8) vertical feet shall be stabilized with synthetic or vegetative mats, or hydroseeded. 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 after work has ceased, except as stated below:

- Where stabilization by the 14th day is precluded by snow cover or frozen ground conditions, stabilization measures shall be initiated as soon as practicable.

- Where construction activity on a portion of the site is temporarily ceased and earth-disturbing activities will be resumed within 14 days, temporary stabilization measures do not have to be initiated on that portion of the site.

iii. All sediment and erosion control devices shall be routinely inspected every seven days or every fourteen days and after each rainfall occurrence that exceeds one-half inch. The inspection schedule shall be clearly stated on the plans and in the Erosion and Sediment Control Plan. Damaged or ineffective devices shall be repaired or replaced;

iv. Provide silt fence and/or other control devices to control soil erosion during utility construction. All disturbed areas shall be cleaned, graded, and stabilized with grassing.

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 shall take necessary action to minimize the tracking of mud onto the paved roadway from construction areas. The contractor shall daily remove mud and soil from pavement, as may be required;

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; and,

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.

6. Activities shall have a complete set of plans and specifications to include, but not be limited to, the following items, as appropriate:

a. Lot layout/site plan and staking;

b. Acreage;

c. Road plan/profiles;

d. Storm drainage plan/profile;

e. Drainage areas (both on and off-site) with characteristics;

f. Sediment and erosion control;

g. Utilities (water and sanitary sewer);

h. Post-construction stormwater management facilities; and,

i. Traffic patterns with temporary (construction) 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 shall be extended beyond the site boundary lines. While some of these items lend themselves to combining information on a single sheet/drawing, care shall be taken to ensure that plans are not overcrowded or cluttered. The lot layout sheet shall show a tie distance from the primary entrance of the proposed project to the nearest existing intersection.

7. All available or used bench marks and all elevations shall be shown on this or other applicable sheets. At least one bench mark shall be available or established on or near (within survey instrument sight distance) the site. The bench mark shall be referenced to NGVD 29 or NAVD 88.

8. The applicant shall provide a tentative construction time schedule for the development. Sediment and erosion control measures shall be some of the first work at a site and such implementation shall be demonstrated on the plans. The schedule shall also provide for coordination with the responsibilities of all parties and other contractors, including those installing utilities.

9. Specifications for all components of construction activities related to grading, utilities, sediment and erosion control, temporary and permanent vegetation, water quality BMPs.

10. Maintenance Schedules and Maintenance Covenants.

2.3.4 Large Construction Activity Applications – (Type III)

A Type III application shall be completed for all construction, development and re-development activities which disturb an area that is five acres or greater. The following submittal requirements shall be provided as part of a complete application:

1. Pre-submittal meeting: This meeting is intended to coordinate stormwater management needs such as impaired water and existing flooding problems. The meeting shall be scheduled by the applicant and attended by the applicant prior to submitting a Type III application. The meeting may be held in conjunction with other concept and early-stage meetings, however the Department of Public Service may require separate and additional meetings.

2. Items 1-10 identified in Section 2.2.3 for Medium Construction Activities.

3. Stormwater Master Plan

    a. For large construction activity applications which are located in Special Protection Areas, a stormwater Master Plan is required to be submitted prior to the submittal of the complete package. The Master Plan is to be created to give the design engineer the opportunity to propose a site layout and to propose stormwater controls to the Department of Public Service.

The Master Plan shall be submitted by hand or mail, and can be incorporated for discussion at the pre-submittal meeting.

b. The master plan can be a preliminary sketch of the site and shall contain the following items:

   i. Site layout showing buildings, roads, parking areas, utilities, and grassed or landscaped areas;

   ii. Vicinity map;

   iii. Pre- and post-development primary runoff patterns and discharge points; and,

   iv. Location/distances to Waters of the State and all other existing natural features such as wetlands, ponds, lakes, floodplains, and stream buffers.

c. The applicant should be prepared to discuss the following items:

   i. All modeling methodologies to be used;

   ii. 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; and,

   iii. Preliminary variance requests.

2.4 Utility Applications

If SCDHEC does not issue a general permit to cover utility construction activities, the City of Charleston requires that companies performing utility installations shall obtain City approval prior to beginning work. This shall be done whether the utility installation is done as part of another construction project (e.g. phone line extension) or an independent project (e.g. gas force main). A complete application shall include the following items:

a. Site Narrative: The narrative shall describe the installation to be performed and the measures that will be used for erosion prevention and sediment control. Inclusion of typical design details is preferred, but simple sketches may be used. Details shall include, at a minimum, temporary and final stabilization measures and silt fencing. Supporting calculations should be provided as necessary, but are required if disturbing greater than one acre;

b. A sketch of the location and type of erosion prevention/sediment control practices if a water body crossing is necessary. If a USACE permit is

needed, a copy of the permit application shall also be included. City approval will not be issued until USACE approval is obtained;

c. A signed Erosion Prevention and Sediment Control certification form agreeing to the conditions of the City approval and NPDES permit if applicable. The certification form is provided in Appendix A; and,

d. A Type I, Type II, or a Type III Construction Activity Application may be required by the Department of Public Service.

2.5 Changes to Approved Applications

Any revisions to the approved plans and construction documents shall be submitted in writing to the Department of Public Service along with any subsequent fees established in this Manual. Changes shall not be implemented until review and approval is given by the Department of Public Service. Revisions for stormwater management issues may include, but are not limited to, pipe size and grade alterations that affect hydraulic capacity, changes to easement boundaries 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.

2.6 Approved Applications

The owner is required to maintain at least one copy of the City approved construction plans and technical reports on the project site and make them available upon request by the City of Charleston. The Department of Public Service will conduct inspections during the construction phase. Frequency and specific times and dates of these inspections will be done at the discretion of the Department of Public Service.

2.7 Transfer of Responsibility

In certain cases and as requested by an applicant, approval to conduct construction activities may be transferred from one applicant or responsible party to another. The most obvious example of this is when a developer readies a piece of property for a new neighborhood by performing grading activities, utility installation, the building of roads, then turns the property over to a homebuilder(s). In such cases, the applicant shall make the City of Charleston and SCDHEC aware of plans to transfer responsibility of the approval and associated stormwater management issues through completion of the transfer form in Appendix D. A transfer of responsibility is also allowed for phases within a project. At the time of transference, the City of Charleston/SCDHEC will issue the Notice of Termination for the responsible party and issue a new set of approval plans to the new responsible party. If a transfer is not requested using the appropriate form, the current responsible party will continue to be held responsible for stormwater management issues at the site. No work shall be performed during the process of transferring responsibility and an application for transference shall only be made and granted after a construction phase has been completed.

2.8 Closeout

At the conclusion of the construction, development or re-development activities, the owner is responsible for making sure a site is stabilized with established vegetation, paved areas and stormwater conveyances clean of debris and sediment, and that stormwater controls are working properly. The owners shall complete and submit a Close-out Application Form as found in Appendix A. A 2-year warranty of the installed stormwater system shall be signed by the owner and submitted to the Department of Public Service.

2.8.1 Stormwater Video Inspection

All closed conveyances (pipes, boxes, etc.) to be owned and maintained by the City shall be inspected with a video system showing the condition of the installed sections prior to recording the final plat and acceptance of the system by the City of Charleston. All video inspections shall be completed in fully dewatered conditions at the expense of the owner. The video files shall be submitted to the City as part of the closeout procedure. Pipes shall be video inspected again at the end of the 2-year warranty period following the same requirements as the initial video inspection. All video inspections shall be reviewed by a Professional Engineer or another qualified individual under the direct supervision of a Professional Engineer. A qualified individual is a person who is knowledgeable in the principals and practices of the installation of storm drain pipe and who possess the skills to assess the quality of the installation. A report documenting the inspections shall be prepared by the Engineer and submitted to the City at the expense of the owner. All video shall comply with the following requirements:

a. Color video submitted on a CD or DVD in a high-resolution digital format compatible with City-approved and available software and equipment.

b. All visual observations will be recorded on a log inspection form incorporating at a minimum the following items:

i. Date and time televised;

ii. Operator name;

iii. Starting and ending manhole (Sta. number, street name, etc.);

iv. Pipe diameter (inches), geometry, and material;

v. Location of laterals (feet);

vi. Location of broken pipe, offsets, obstructions, or notable items (feet);

vii. Location of sags and standing water (feet);

viii. Location of inflow and infiltration (feet); and,

ix. Location of dry weather flow (feet).

c. The notation of footage (starting at 0.0 feet at the beginning manhole and moving upstream through the pipe) shall be superimposed on the video and be recorded in increments of tenths of feet.

Any problems found shall be corrected by the owner. Upon confirming such corrections are complete and the site is ready, the Department of Public Service will release any remaining bonds and notify the TRC. The Department of Public Service may require additional items in order to closeout a project.

2.8.2 Stormwater Record Drawings

As part of the project closeout process, a full size hard copy and one electronic PDF format copy of the record drawings, properly identified, executed, and certified shall be delivered to the Engineering Division. File format, data standards, and other information shall conform to the current data submittal requirements as issued by the City of Charleston GIS Division. Additionally, the record drawings for stormwater facilities shall contain the following information:

2.8.2.1 Piped Drainage Systems

a. Enter actual values beside planned values on the approved construction plans.
b. Show elevations to the nearest 0.01'. Actual elevations within 0.10' of the planned values are sufficient except where higher accuracy is needed to indicate positive flow.
c. Diameter, material and class of all pipes.
d. Type of joint of all pipes (O-Ring, T&G, etc.).
e. Invert of pipe at outfall and all structures.
f. Slope and lengths of all pipe.
g. Structure type and elevations (top of grate, throat elevation, etc.)
h. Location of all pipe and structures in relation to drainage easements on plan view.
i. Centerline roadway elevations at all low points and other stormwater crossings.
j. Length, depth, and width of all outfall protection as specified.

2.8.2.2 Open Channel Drainage Systems

a. Enter actual values beside planned values on the approved construction plans.
b. Show elevations to the nearest 0.1' except where higher accuracy is needed to indicate positive flow.
c. Actual elevations within 0.1' of the planned values are sufficient except where higher accuracy is needed to indicate positive flow.
d. Slope of all open channels.

e. For swales 1' or less in depth, show actual side slopes and spot invert elevations at a frequency of at least every 100'.
f. For swales or ditches greater than 1' in depth, show top of bank and toe of slope designations and elevations at a frequency of at least than every 100'.
g. For ditches 3' or greater in depth, generate actual 1' contours.
h. Location of ditch or swale in relation to drainage easements on plan view.
i. Length, depth, and width of all outfall protection or other erosion control as specified.

2.8.2.3 Stormwater Management Pond or Basin

a. Enter actual values beside planned values on the approved construction plans.
b. Show elevations to the nearest 0.01'. Actual elevations within 0.10' of the planned values are sufficient except where higher accuracy is needed to indicate positive flow.
c. Sufficient elevations along top of dam/pond to verify design elevation.
d. Sufficient elevations along toe of slope and bottom of pond to verify design elevation.
e. Generate actual 1' contours and provide a stage-volume table to confirm design volume.
f. Verify pond slopes and vegetative cover.
g. Location, elevations, slopes, and dimensions of all orifices, weirs, spillways, trash racks or any other aspects of outfall control.
h. Location, dimensions, and elevations of emergency spillway.
i. Outfall protection location and dimensions.
j. Water elevation in pond at time of survey, if applicable.
k. Provide location, dimensions, make or brand, model, serial number and maintenance manual for any engineered water quality treatment devices.

2.8.2.4 Certifications Statement

The record drawing must include the following statement:

"I hereby sign and affix my seal to certify confirm to the best of my knowledge that this record drawing accurately represents existing field conditions and that the comprehensive stormwater management system as constructed is in substantial conformance with the standards, dimensions and specifications of the approved construction plans."

_____
SC Registered Professional Engineer

2.9 Expiration of City Approval

A Construction Activity Application Approval will remain valid for up to five (5) years from the date of issuance, provided that the project is in compliance with the Stormwater Management Ordinance and this Manual and is not inactive for a period of twelve consecutive months. Construction, development and re-development activities shall be initiated within twenty-four (24) months of issuance of the City approval. Failure to initiate these activities will render the approval invalid at the end of the twenty-fourth month.

2.10 Variances

The Department of Public Service may grant a variance from the requirements of this stormwater design standards manual if exceptional circumstances applicable to a site exist such that strict adherence to the provisions of this manual:

1. Will result in unnecessary hardship; and,
2. Will not fulfill the intent of the manual.

A written request for a variance shall be required and shall state the specific variance sought and the reasons, with supporting data, why the variance should be granted. The request shall include all information 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 and quality control if the applicant can demonstrate that:

a. The proposed project will have no significant adverse impact on the receiving natural waterway or adjacent properties; or

b. The imposition of peak or volume control requirements of stormwater runoff would aggravate downstream flooding.

Final approval of a variance request will be given at the discretion of the Department of Public Service. The City is cognizant that the need for a variance may not be known during planning stages and only evident after considerable design work has been completed. The City intends to work with the owner and engineers during the design process to find a resolution as long as the above items are adequately demonstrated.

All variances approved, must be fully documented on a table similar to the one below. This table is to be included on the title sheet of the approved stamped construction drawings, and also in the title sheet of the project record drawings.

STORMWATER DESIGN STANDARDS MANUAL (SWDSM)
VARIANCES

APPLICABLE SECTION	DESCRIPTION OF THE VARIANCE	SUBMITTAL DATE	APPROVAL DATE

2.11 Encroachment Permits

An Encroachment Permit, which controls the impacts of traffic, storm drainage, and sediment entering upon public property and the public rights-of-way, shall be obtained from the SCDOT and/or the Engineering Department of the City of Charleston before construction begins. Applicants shall be aware of the City of Charleston's requirements which may differ from SCDOT's.

A copy of an Encroachment Permit application(s) to SCDOT shall be included in the construction activity application package. It is the applicant's responsibility to comply with all SCDOT Encroachment Permit application requirements. Approved encroachment permits are required prior to final approval of the application from the Department of Public Service.

2.12 Stormwater Facility Ownership and Responsibilities

In addition the responsibilities outlined in the Stormwater Management Ordinance and in other sections of this Manual, during any construction, development or re-development activity, the owner/operator shall be responsible for carrying out the proposed work in accordance with the approved plan, specifications, and time schedule, and in compliance with all requirements of the Stormwater Management Ordinance and this Manual. SCDHEC may request additional information from the applicant for NPDES permit compliance, which may result in changes to the technical report or construction plans. Any such changes shall be provided to the City as well. During construction, the owner shall conduct inspections of all temporary erosion and sediment controls on the site in accordance with the submitted and approved maintenance schedule, and if applicable, the NPDES permit from SCDHEC-OCRM.

Residential: Ownership of all stormwater facilities (BMPs, ponds, etc.) shall belong to the owner(s) of the parcel(s) or to the Home Owners Association (HOA). City shall maintain the stormwater conveyances (pipes, junction boxes, inlets, etc.)

Commercial: Ownership of the entire stormwater system (facilities, conveyances, BMPs, ponds, etc.) shall belong to the owner.

For any project, the owner of a portion or the entire stormwater system, as the case may be, shall be clearly designated before a construction activity approval will be given. Ownership shall also be recorded on the final plat. Ownership shall imply responsibility for maintaining the stormwater system, including all ponds and BMPs. 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 City of Charleston. Owners found altering such components will be required to remove any alterations.

2.13 Stormwater Facility Maintenance Plan

Each component of the stormwater management system shall have a maintenance plan as part of the application to conduct construction, development, and re-development activities. The plan shall also cover temporary measures used during construction in addition to the long term maintenance of the system.

In addition, the owner, HOA, and/or operator, will enter into a permanent maintenance agreement with the City of Charleston. This legal document, called *Covenants for Permanent Maintenance of Stormwater Facilities* (CPMSF), is recorded in the permanent land records with the Charleston County Register Mesne Conveyance Office, in addition to being fully described on the final plat. The CPMSF document is prepared with assistance from the Engineering Division and shall be signed and executed prior to the issuance of City approval of the final plat. The CPMSF shall address maintenance to be performed by a third party such as an operator or other contractor. However, the owner shall also be listed and is ultimately responsible for adherence to the maintenance requirements. An example of the Covenant template is provided in Appendix D.

2.14 Exemptions

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

1. 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 Code of Laws of South Carolina 1976, as amended.

2. Activities undertaken by persons who are otherwise regulated by the provisions of Chapter 20 of Title 48, the South Carolina Mining Act.

3. 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 an application prior to the start of the land disturbing activity.

2.15 Fees

For all land disturbing activities, the following fees shall apply:

1. Stormwater Plan Review Fee:

$100.00 per disturbed acre rounded up to the next whole acre (up to $2,000 maximum)

2. Stormwater Inspection Fee to Authorize Commencement of Construction:

For Each Inspection:
$25.00 for less than 1 acre site
$100.00 for 1 to 5 acre site
$200.00 for 5.01 to 10 acre site
$400.00 for 10.01 or more acre site

3. Transfer Fees:

$100.00 for each property ownership transaction

Fees are subject to change per approval from the City Council. These fees are separate from all other fees charged by the City or other agencies with jurisdiction over construction, development, or re-development projects. All fees are to be paid separately.

Inspection fees are only for the initial inspection and approval of all stormwater BMPs on the construction site prior to the authorization of commencement of construction. If all BMPs are not installed and operating as per the approved set of construction plans during the initial inspection, commencement of construction shall not be authorized, re-inspection shall be necessary, and additional inspection fees shall apply as per the schedule above.

CHAPTER 3 - DESIGN REQUIREMENTS

This chapter provides engineers, designers, developers, and others with the necessary information needed to develop adequate systems that will control the rate, volume, and pollutants released from construction, development and re-development projects. These design requirements have been developed based on common engineering practices and references to State and Federal requirements, engineering publications, and other municipal and academic guidance.

It is a 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 the City of Charleston through proper planning, design, installation, and maintenance. All land shall be developed in a manner consistent with City Ordinances and this Manual. Specific methods and applications not covered in this section can and should be discussed with the Engineering Division for applicability. The following section details the criteria that shall be followed in the absence of specific watershed master plan criteria.

3.1 General Requirements

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

1. Site designs 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 construction, development and re-development. This includes maintaining or creating buffers and preserving natural areas;

    c. Limiting the drainage area to all BMPs and installing BMPs as soon as practical in the development process;

    d. Retaining and protecting natural vegetation and saving topsoil, for replacement on graded areas; and,

    e. Using temporary plant cover, mulching, hydroseeding, or BMPs to control runoff and protect areas subject to erosion during and after construction.

    f. Maintaining pre-development infiltration rates through soil amendments/treatments.

2. Stormwater quantity control:

a. **Runoff Rates:** Stormwater runoff generated from construction, development and re-development shall be controlled to predevelopment rates. Post-development discharge rates shall not exceed pre-development discharge rates for the 2, 10, and 25-year frequency 24-hour duration storm events.

b. **Road Protection:** For the purposes of road passage and hydraulic design, the capacity of a system to transport stormwater runoff shall be based on the size of the contributing drainage basin or subwatershed, and elevation criteria, as outlined below.

i. Minor Stormwater Systems: 0 - <40 Acres

All pipe systems, culverts, and channels which drain less than 40 acres shall be designed to accommodate flows resulting from a ten (10)-year frequency 24-hour storm. Minimum allowable pipe diameter shall be 15 inches.

ii. Collector Stormwater Systems: 40 - <100 Acres

All pipe systems, culverts, and channels draining at least 40 acres but less than 100 acres shall be designed to accommodate flows resulting from a twenty-five (25)-year frequency 24-hour storm.

iii. Major Stormwater Channels: 100 - <300 Acres

All drainage systems draining at least 100 acres but less than 300 acres, such as channel improvements, culverts or bridges along these channels, shall be designed to accommodate a flow resulting from a fifty (50)-year frequency 24-hour storm. Encroachment upon Major Stormwater Channels and the adjacent overflow land shall be avoided to the extent possible.

iv. Large Watersheds: 300 and more Acres

Bridges and culverts being constructed in natural channels, creeks, or rivers draining more than 300 acres, shall be designed to accommodate a flow resulting from a one-hundred (100)-year frequency 24-hour storm (precipitation event only). Encroachment upon these channels and the adjacent overflow land shall be avoided as much as possible.

The area outside a project area (i.e. offsite areas) that drains to a particular design point shall be included in determining the appropriate design storm. All hydrological computations shall be

based on the contributing watershed, not just the project area or disturbed area.

v. The minimum street center line elevation at finish grade shall be 6.5 feet above Mean Sea level in NGVD 29 or 5.52 feet above Mean Sea Level in NAVD 88.

c. **100-Year Storm Event Analysis:** All construction, development and re-development activities which disturb one (1) acre or more shall perform an hydraulic analysis to determine the impacts of the proposed development during 100-year 24-hour storm event (precipitation only).

The project shall not:

i. Increase the likelihood of dwelling flooding and property damage above current conditions;

ii. Increase water surface elevations or reduce system capacity in stormwater system and facilities upstream or downstream of the project. An increase or reduction shall be based on a comparison with pre-development conditions;

iii. Increase erosion potential and pollutant loads that would adversely impact the quality of receiving waters.

The analysis shall extend up to the top of the watershed and down to any perennial water of the state or to a point in which the project comprises 10% of the total contributing area, whichever occurs first. The analysis criteria shall include, but is not limited to:

a) Utilization of existing land use curve numbers for all developed areas outside the project.

b) The weighted curve number for the proposed development site shall be used for all undeveloped areas, except protected areas.

c) Flows shall be routed using an accepted hydrologic and hydraulic method.

Impacts of the proposed development will be based on water surface elevation changes. No proposed structures shall be flooded and no existing structures shall experience any additional flooding. Hydraulic backwater calculations using USACE's HEC-2 or HEC-RAS models, ICPR, or equivalent shall be provided. Other calculations may be required by the Public Service Director based on the severity of potential impact and the location of the project.

d. **Church Creek Drainage Basin Requirement:** For projects in the Church Creek Watershed per the Stormwater Management Ordinance (Sec 27-102): Within the area of the City delineated as the Church Creek Basin in the Master Drainage and Floodplain Management Plan dated May 1984, on file in the offices of the Department of Public Service, City Council finds that because of the topography and the limited stormwater infrastructure, homes and other developed properties in the basin have experienced severe flooding during rainstorms that did not exceed the design rainfall event. The infrastructure now in place is not sufficient to adequately handle the stormwater discharge of the development that has occurred to date, and stands to be further adversely impacted as additional development occurs. It is evident that absent the implementation of reasonable regulations and specific criteria for the design and construction of permanent stormwater management systems associated with new development in the basin, both existing and planned development will be threatened.

A special stormwater management area is established within which all new development must adhere to special stormwater management design standards, which shall be designated as the Church Creek Special Stormwater Management Area. This area shall be defined as that portion of the Church Creek basin that lies north of the existing railroad right-of-way, which is more specifically shown in the Master Drainage and Floodplain Management Plan dated May 1984 and the Stormwater Master Plan for the Church Creek Watershed on file in the offices of the Department of Public Service (hereinafter referred to as the "Church Creek Special Stormwater Management Area").

Within the Church Creek Special Stormwater Management Area, all permanent stormwater management systems associated with new development shall be designed and constructed to maintain the post-development peak flow rates at or below the pre-development peak flow rates, and to detain the excess runoff volume difference between the pre-development and post-development conditions for the design storm having a duration of 24-hours and frequencies of 2, 10, 25, 50 and 100 years for a period of twenty-four (24) hours, with tolerances for a peak flow rate match for the 25- and 50-year storm events being plus or minus ten (10) percent, with all others matching pre post-development conditions. Detention facilities meeting these standards shall be designed and constructed to contain the excess volume for the 24-hour period and the volume required to release the post-development peak flow rates at or below the pre-development peak flow rates, all as are more fully explained and specified in the Stormwater Master Plan for the Church Creek Watershed maintained on file in the office of the City Engineer, and which is incorporated herein by reference.

3. Stormwater quality control:

   a. **Use of BMPs:** Stormwater runoff generated from construction, development and re-development shall be treated through the use of structural and/or non-structural practices. It is presumed that sufficient treatment is provided by the proposed BMPs if they are:

      i. Designed according to the specific performance criteria outlined in this manual;

      ii. Constructed properly; and,

      iii. Maintained regularly.

   b. **Special Protection Areas:** Stormwater discharges to special protection areas with sensitive resources or that have existing flooding or water quality problems [e.g., recreational waters, water supply reservoirs, Total Maximum Daily Loads (TMDLs), and 303(d) listed waterbodies] are subject to additional performance criteria.

   c. **Maintenance Agreement:** All BMPs shall have an enforceable operation and maintenance agreement to ensure the system functions as designed.

   d. **Re-Development Projects:** Re-development projects shall be governed by the same design criteria as new developments.

   e. **Sediment Basins:** Sediment basins and other BMPs shall be used during construction to remove heavy sediment loads from runoff waters leaving the disturbed area.

   f. **Disturbed Area Limit:** Clearing for installation of utilities and roads or for development shall be allowed, but limits have been established. The total disturbed area shall never exceed twenty-five (25) acres. The Engineering Division may reduce the total area that may be disturbed at a given time. Project areas exceeding 25 acres in disturbed area shall be phased to comply with this requirement. All clear cutting areas are to be clearly identified on construction documents. The decision to consider an activity as clear cutting (logging) versus land disturbance for development shall belong to the Public Service Director of their designee.

   g. **Wetlands**

      i. If wetlands are suspected to exist on the property, they shall be investigated and delineated by a qualified consultant. The US Army Corps of Engineers (USACE) and OCRM policies regarding wetlands shall be followed.

ii. 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 federal and state permits have been obtained.

h. **Vector Control:** All stormwater management and sediment control practices shall be designed, constructed, and maintained with consideration for the proper control of mosquitoes and other vectors.

i. **SC Building Code:** On all new construction or renovations required by the South Carolina Building Code to conform to requirements for new buildings, it shall be unlawful for any person to collect stormwater for deposit on any public street, sidewalk, or right-of-way, or otherwise suffer or permit, or by mechanical means, propel stormwater on such public street, sidewalk or right-of-way.

3.2 Hydrologic Computation Requirements

All hydrologic computations shall be completed using volume-based hydrograph methods acceptable to the Engineering Division of the Department of Public Service. The design storm duration for these computations shall be the 24-hour storm event based on a SCS Type III distribution with a 0.1-hour duration time increment and a 323 peaking factor. Typical hydrologic inputs include, but are not limited to, the following:

1. Rainfall depth or intensity;
2. NRCS soil classification and hydrologic soil group;
3. Land use;
4. Time of concentration; and,
5. Initial abstraction/surface storage.

The remainder of this section will provide basic information for the hydrologic calculations. The intent of the Manual is not to provide detail on every aspect of hydrologic computations, their limitations, assumptions, or appropriateness of use, but rather to present general guidance on commonly accepted standards.

3.2.1 Inputs

The 24 hour duration precipitation depths corresponding to various return periods to be used for projects in the City of Charleston are shown in Table 3.1.

Table 3.1: Design storm precipitation (inches) data for Charleston, S. C.

1-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
3.5	4.2	5.5	6.5	7.9	9.0	10.3

Soil types in the City of Charleston range from sands and sandy clays. Existing land use and corresponding runoff potential factors shall 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 Recommended Methodologies

The City of Charleston recommended methods and corresponding design circumstances are listed in Table 3.2 and 3.3 below. If other methods are used, approval shall first be given by the Department of Public Service. Complete source documentation shall be submitted for approval.

Table 3.2: Recommended methodologies based on land disturbance area

Method	Size Limitations*	Comments
(Modified) Rational Method	0 – 2 Acres	Acceptable for sizing individual culverts or storm drains that are not part of a pipe network or system. Not to be used for storage design.
"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/hydro/hydro-tools-models-tr55.html). The USGS regression equations for South Carolina can be obtained from the US Geological Survey website (http://water.usgs.gov/osw/programs/nffpubs.html). 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 managment systems and controls

Method	Rational Method	SCS Method
Large Watersheds		+
Storage/Sedimentation Facilities		+
Outlet Structures		+
Gutter Flow and Inlets	+	

Method	Rational Method	SCS Method
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 shall 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 City of Charleston will accept commonly used computer models. Other models may be accepted with appropriate documentation.

3.3 Water Quantity Control Requirements

Water quantity control is an integral component of overall stormwater management. Its purpose is to negate the effects of development during storm events. Quantity control is effectively flood control, reducing potential damage and health risks, but because uncontrolled runoff can cause erosion, it can also be a form of water quality control. The following design criteria shall be considered when determining the type(s) of quantity control(s) to be implemented in a project. For further information and documentation on the design, installation, and maintenance of stormwater quantity facilities see Paine, J., and Akan, A., (2001), ASCE & WEF (1994), and Mays (2001).

All designs of storage facilities utilized for stormwater quantity control and required downstream analyses shall be submitted as part of the engineering calculations.

1. **Runoff Rates:** Post-development discharge rates shall not exceed pre-development discharge rates for the 2, 10, and 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.

2. **Reservoir Routing:** Controls shall be designed by a traditional reservoir routing procedure.

3. **Emergency Spillways:** All ponds shall have an emergency spillway designed to pass the 100-year 24-hour storm event if the storage capacity is exceeded. All emergency spillways shall be armored to resist erosive flows. For systems of ponds the downstream most pond shall have an emergency spillway able to pass the 100-year event.

4. **Forebays and Engineered Devices:** All BMPs shall have a forebay to facilitate more efficient removal of debris and coarse sediments. These can be created through grading or a manufactured or engineered device.

   a. Forebays shall be placed upstream of the inlets into the main pond storage area.

   b. Unless a separate vault (engineered device) 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 geotextiles.

   c. Maintenance of forebays shall be performed once per year unless otherwise specified by a manufacturer. All designs shall consider the maintenance needs by ensuring equipment has adequate access to forebay and adequate clearance to perform dredging and cleaning operations. A visual marker shall be placed in the forebay to assist in monitoring sedimentation depth.

   d. The forebay shall be sized to contain 0.1 inches of runoff per impervious acre of contributing area. The forebay shall be a minimum of 2 feet deep. The volume in the forebay counts towards the total water quality volume requirements of the BMP (see Section 3.4.3.1, #3). As an alternative, the forebay may be designed to meet a sediment trapping efficiency of 60%.

5. **Underground Detention Systems:** Underground detention systems shall be designed using the following criteria:

   a. Underground detention systems shall only be used on non-residential properties and should be located downstream of other stormwater controls to ensure their longevity. Only bottomless systems with appropriate media for infiltration may be used for water quality purposes. Infiltration media shall be adequately protected and stabilized on all sides (top included) with appropriate geogrid or other material as approved by the Department of Public Service.

   b. The maximum contributing drainage area to be served by a single underground detention vault or tank is 10 acres.

   c. All systems shall be designed and laid out to facilitate maintenance. Systems shall be inspected at least once a year, but more frequently if

necessary. Systems that have accumulated 6 inches of sediment shall be cleaned upon discovery.

d. There is no minimum pipe diameter for an underground detention tank system as long as it can be demonstrated that the system can be appropriately maintained and all sediment can be adequately removed. The City encourages design elements used to capture sediment and allow for easy maintenance.

e. Underground detention systems shall meet structural requirements for overburden support and traffic loading as appropriate.

f. At a minimum, access shall be provided over the inlet pipe and outflow structure and at the end of each row that has the potential to capture sediment. Access openings can consist of a standard frame, grate or solid cover.

g. All underground detention systems shall be designed to hold at least 6 inches of sediment storage in addition to the required stormwater volume unless a header row or other pretreatment device such as a forebay is designed to capture sediment.

h. The feasibility of these devices for a given situation shall be evaluated by a soil scientist, geotechnical engineer, or other professional certified by the State of South Carolina in evaluating subsurface, groundwater, and soil conditions. Utilization of these systems is subject to approval by the Department of Public Service.

i. All installations of underground detention systems shall be done under the supervision of a representative of the manufacturer.

j. The underground detention facility shall not be brought online until full site stabilization.

6. **Limits of Detention Pool:** Any development that uses a parking area or other feature for detention storage capacity shall clearly identify the limits and depths of the expected detention pool.

7. **Stagnant Water:** Basin configurations which create stagnant water conditions shall be avoided.

8. **Discharge Velocities:** 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.

9. **Recovery Time:** The detention volume from all controls shall be drained from the structure within 72 hours.

10. **Infiltration:** Infiltration devices may be required on those sites which do not currently discharge stormwater runoff, have no existing outlet, or are in the Church Creek watershed and have limits on volume increases. In such cases, in the post-development condition, devices shall be designed to infiltrate the runoff volume equivalent to the 2-year 24-hour storm event in 24 hours. For evaluating the 10-year and 25-year 24-hour storm events, some discharge is allowed. However, the rate from the site shall not exceed that of a site of equivalent size and slope with a SCS Curve Number equal to 39. As with detention ponds, the response of the system to the 100-year 24-hour storm event shall be determined, 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. Areas draining to these devices shall be stabilized and vegetative filters established prior to runoff entering the system. Infiltration devices 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 20 foot length of vegetative filter prior to stormwater runoff entering the infiltration practice. Forebays or other engineered devices for sediment removal may be required;

    b. Each system shall be designed to prevent clogging by fine material and for ease of maintenance;

    c. The bottom of the infiltration device shall be at least 0.5 feet above the seasonal high water table, whether perched or regional, determined by direct piezometer measurements which can be demonstrated to be representative of the maximum height of the water table on an annual basis during years of normal precipitation, or by the depth in the soil at which mottling first occurs;

    d. The infiltration device shall be designed to completely drain of water within 72 hours;

    e. Soils shall have adequate permeability to allow water to infiltrate. Infiltration practices are limited to soils having an infiltration rate of at least 0.5 inches per hour. Initial consideration shall 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 shall be accomplished to verify the actual site and seasonal high water table conditions when infiltration is to be utilized;

    f. Infiltration devices greater than three feet deep shall be located at least 25 feet from basement walls;

g. Infiltration devices designed to handle runoff from any parking areas or commercial properties shall be a minimum of 150 feet from any public or private water supply well;

h. The design of an infiltration device 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 device shall not exceed five percent.

j. An infiltration device shall not be installed on or atop a slope whose natural or existing angle of incline exceeds 20 percent.

k. If an underdrain system is required, clean-outs shall be provided at a minimum, every 100 feet along the infiltration practice to allow for access and maintenance.

11. **Pond Requirements:**

a. Ponds with vegetated embankments shall be less than 15-feet in height and shall have side slopes (inside and outside) no steeper than 3H:1V. Embankments protected with Erosion Control Blankets or Turf Reinforcement Matting may be used but shall be no steeper than 2H:1V. Geotechnical slope stability analysis is required for slopes greater than 10-feet in height and embankments that have steeper slopes than those indicated above. Access inside a pond shall be provided with at least one side slope at 3H:1V or flatter for maintenance.

b. A minimum freeboard of ½-foot above the 100-year 24-hour design storm high water elevation shall be provided for all impoundments.

c. The bottom of detention structures shall be graded towards the outlet structure(s) to prevent standing water conditions. A minimum 0.5% bottom slope is required.

d. The maximum depth of permanent storage facilities with a permanent pool shall be determined by site conditions, design constraints, and environmental needs. The facility shall 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 depth of 3- to 8-feet is reasonable unless County Mosquito Control requirements dictate otherwise. Aeration or other means shall be used as necessary to prevent anaerobic conditions.

12. **Construction Specifications:** Construction specifications shall conform to the latest version of SCDOT's *Standard Specification Manual for Highway Construction*.

3.3.1 Accepted 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. Detention structural stormwater controls accepted by the City of Charleston are shown in Table 3.4.

Table 3.4: Accepted 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 release 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 Stormwater Detention Basins • 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 ≥ 3 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 areas 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. The underground storage utilizes tanks, vaults, and buried pipes to supply the required storage

General Structural Control	Description
	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.

3.3.2 Typical 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, 10, 25, 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 the stage-discharge relationship for 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, 10, 25, and 100-year 24-hour storm events. Calculations may be done by hand, or may be done by using a storage routing computer model.

5. For projects in the Church Creek watershed, determine the cumulative volume at the 24-hour point released from the facility. Compare the two volumes and two peak discharges. The volume released from the pond up to 24 hours shall be at or below that for pre-development conditions. The peak discharge rate from the pond shall be at or below the peak discharge rate for the pre-development conditions for the 2-, 10-, and 100-year storm events, and a maximum 110% of the pre-development peak discharge rate for the 25- and 50-year event. The discharge hydrograph from the 100-year storm event does shall not overtop the banks of the facility. The 24-hour storm event shall be used in all cases.

6. Evaluate the control structure outlet flow velocity and provide velocity control and channel stabilization. Drawings and details shall be provided for outlet structures and basin.

7. Repeat steps 1-6 for post-development condition until peak, volume, and velocity criteria are met.

8. All calculations shall be submitted in the application package in a cohesive, easy to follow format.

Stage-storage and stage-discharge calculations shall 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 adequate justification at the discretion of the Department of Public Service, Engineering Division.

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 engineer will be using one of the many computer software packages available to perform storage routing calculations. All models and methodologies used shall be approved by the City of Charleston. Currently, the City of Charleston has approved the below list of accepted computer models:

1. ICPR
2. Drain:Edge,
3. PondPack/Civil Storm,
4. HEC-1,
5. HYDRAFLOW
6. HydroCAD
7. SWWM (including commercial versions)

3.4 Water Quality Control Requirements

Water quality control is an integral and required component of an overall stormwater management system. Construction activities, development and re-development projects shall include controls that treat or otherwise limit the discharge of pollutants. These requirements have been added due to state and federal requirements, but also due to the need to improve and preserve the water resources in the City of Charleston.

3.4.1 Characterization of Urban Stormwater Runoff Quality

Table 3.5: Typical Stormwater Pollutants and Sources

Pollutant Source	Pollutants of Concern
Erosion	Sediments and attached soil nutrients, organic matter, and other adsorbed pollutants.

Pollutant Source	Pollutants of Concern
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, and metals.
Construction Sites	Sediment, metals, paint, and wood preservatives.
Manufactured Products (Industrial Land Uses)	Heavy metals, phenols, and oils from automobiles, and Zinc and Cadmium from tire wear.
Lawn and Landscape Maintenance	Fertilizer and pesticides.
Plants and Animals	Plant debris and animal excrement.
Septic Tanks	Coliform bacteria, nitrogen, and NO_3.
Non-Stormwater Connections	Sanitary sewage, industrial wastewater and commercial discharge.
Accidental Spills	Pollutants of concern depend on the nature of the spill.
Animal Waste Management	Coliform bacteria, nitrates, and phosphorus.
Pesticide Applications	Pollutants of concern depend on the pesticide being used and the type of crop or pest being treated.
Agricultural Land Disturbance	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. 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 energy 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. Models that do have capabilities that have been used for predicting urban clean sediment include SWMM, SEDPRO, SWAT, and SEDCAD models. For the models to be effectively utilized in sizing BMPs, predictions shall be made of time varying quantities as well as the size distribution. Those distributions shall 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 enters the stormwater drainage system typically from the washoff of animal feces and organic matter from the catchment's surface, through leaking sewer systems (lateral connections, manholes, and industrial or commercial drains, etc.), and malfunctioning septic system, all of which are termed illicit discharges and illegal by the City of Charleston Stormwater Management Ordinance. 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. The reduction of bacteria in waters of the State has been the focus of total maximum daily loading (TMDL) efforts by SCHDEC to date.

3.4.1.3 Nutrients

Nitrogen and phosphorus are plant nutrients that promote the growth of plants and protista such as algae, and are the second leading stressor of impaired rivers and streams and the leading stressor of impaired lakes (US EPA, 1997). Such nutrients contribute to the eutrophication of water bodies resulting in a list of associated liabilities such as 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 dry fall onto impervious surfaces that is later washed into stormwater. Nutrients can be removed from stormwater prior to discharge through biological uptake such as by plantings in stormwater quality control ponds.

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. BMPs treat nutrient rich runoff through settling (particulates), adsorption (to clay particles), uptake (by plants), and denitrification (nitrogen only).

3.4.2 Accepted Water Quality BMPs

The City of Charleston's current approved list of stormwater quality BMPs, listed in Table 3.7, is based on literature reviews and experience. Some references to BMP selection, effectiveness, and design can be found in SCDHEC (2005), ARC (2001), Schueler (1987), and WEF & ASCE (1998). Guidance on applying BMPs into LID approaches can be found in PGC (1999 a and 1999 b).

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

	Pollutant Concentrations (mg/l)											
Land Use	**BOD**	**COD**	**TSS**	**TDS**	**TP**	**DP**	**TKN**	**NO2 & NO3**	**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
NO_2/NO_3 = 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) shall be sought when estimating existing and post-development bacteria loads and the reduction requirements.

Table 3.7: Accepted 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.
Stormwater 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 exfiltrate 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 • Vortex Separator • Baffles • Cartridges • Skimmers • Bioretention units • Gravity Oil-Grit Separator • Filter Material	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

General Structural Control	Description
• Sedimentation • Inlet inserts	not limited to, Crystal Stream, Vortechnics, Aquashield, Filterra, Stormceptor, Stormfilter, CDS, BaySaver, and Downstream Defender[1]. This is by no means a complete list, and the Engineering Division of the Department of Public Service will evaluate any such device if included in designs, if evidence is provided as to it effectiveness. Such evidence shall include applicability and proof of third-party testing on trapping efficiency.

[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 shall 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 • 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 shall only be used in mid- to high- density environments where other structural controls will be utilized.
Small Sand Filters • 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.

Limited Structural Control	Description
Porous Pavement/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. Approval of these systems is subject to City review and will not be given within any right of way.

Regardless of the structural control utilized, maintenance schedules shall be included for each BMP proposed.

Listed below are some non-structural BMPs that shall be considered for use in larger construction activities, development 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 shall be avoided in high traffic and heavy load 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 HOAs to educate and train themselves and homeowners 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 Design Requirements

3.4.3.1 General requirements

The following design criteria are established for water quality controls and shall be incorporated in one or more BMPs for a given sub basin unless a specific quality variance is granted by the

Engineering Division of the Department of Public Service. Incorporation of these requirements shall constitute adequate control of the discharge of pollutants.

1. **Quality Control Threshold:** All sites which disturb one acre or greater shall have at least one permanent water quality structural BMP installed and require the execution of a Covenant for Permanent Maintenance of Stormwater Facilities (CPMSF).

2. **BMP Threshold:** All BMPs shall have a pretreatment device or forebay as described in Section 3.3 #4.

3. **Water Quality Volume**

   a. Permanent water quality ponds and water quality structures having a permanent pool elevation shall be designed to store and release a water quality volume (WQV) defined as the first ½-inch of runoff from the contributing area site over a minimum period of 24-hours.

   b. Permanent water quality structures not having a permanent pool elevation shall be designed to store and release the WQV, defined as the first 1-inch of runoff from the site over a minimum period of 24-hours.

   c. If the project is located within one thousand feet of shellfish beds, the water quality structure shall be designed to store and release the WQV, defined as the first one and one-half (1 ½) inches of runoff from the site over a minimum period of 24-hours.

   d. All projects 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.

   e. The storage volume of these water quality structures shall be designed to accommodate at least ½-inch of runoff from the entire site.

   f. The WQV requirement may be waived if treatment is instead provided by engineered devices. Applicability of such waivers shall be based on submitted information showing that an equivalent amount of runoff is captured by the device as captured by a “dry” pond with a WQV of 1-inch.

4. **Impaired Waters:** 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 latest 303(d) list, shall be required to reduce pollutant loads so as to meet applicable water quality standards. 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. An evaluation of the BMPs chosen to control the release of pollutants shall be provided. Such evaluations may reference published values on BMP effectiveness.

If more than 25 acres of planned development directly discharge to an impaired waterbody, a quantitative and qualitative analysis shall be provided and include at a minimum calculations that show:

a. A site pollutant load for all pollutants listed in Table 3.5;

b. The trapping effectiveness of the chosen BMPs; and

c. The runoff discharged through the last water quality BMP shall have a water quality level equal to or better than the in-stream standard or as required by an applicable TMDL.

The necessity to provide the quantitative and qualitative analysis shall apply to phased projects that are part of a larger common plan, even if a single phase will develop or otherwise disturb less than 25 acres.

5. **Maintenance Plan:** All BMPs shall have a maintenance plan. Suggested schedules and routine activities are provided in the BMP Manual (SCDHEC 2005).

6. **Effluent Limits:** The Engineering Division of the Department of Public Service 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 Design Procedures

1. Determine appropriate accepted BMPs needed for the site, considering the land use, pollutants of concern, soils, maintenance requirements, location in relation to receiving waters, and any impairments that may exist.

2. If the receiving water of the project is impaired or has an adopted TMDL, the applicant shall show that water quality standards are being met and designated uses are not impacted. This proof shall be quantitative and qualitative for sites which disturb greater than twenty five (25) acres. The appropriate steps include:

   a. Calculate the load for the pollutant(s) of concern. The IDEAL model may be used for all water quality calculations. The various versions of the SWMM model or HSPF may also be used. Other models may be allowed on a case-by-case basis as determined by the Department of Public Service. Another option is the Schuler Simple Method (Schueler 1987). This method is based on an extensive database developed in Washington,

D.C. for the National Urban Runoff Program (NURP). The Simple Method estimates pollutant loads from urban development by the following equation:

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

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 interval 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:

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

The rainfall depth, P, was chosen such that a large percentage of storm events shall be captured, with larger events only partially captured or bypassed. Greater than 85% of the average annual rainfall amount in the City of Charleston occurs from storm events with a total depth equal to or less 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 functions, 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 the Appendix G.

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. For ponds capturing runoff from 5 acres or more, a forebay or vault shall be provided at each inlet, unless the inlet provides less than 10% of the total design storm inflow to the pond.

4. Calculate the water quality volume using the following equation.

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

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 shall be captured in a water quality BMP.

5. Compute the inflow hydrograph for the structure for 1-inch or ½-inch, 24-hour storm event, as necessary, for the proposed condition. Note – this is the 1-inch **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 1-inch or ½-inch, 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 1-inch or ½-inch, 24-hour storm event was released before the 24-hour point. If it is, the outlet is too large. Resize outlet structure.

9. Repeat Steps 4-8 until entire volume is not released prior to 24-hours.

10. For engineered devices, alternative calculations other than detailed here shall be provided. SCDHEC has accepted some such devices as providing adequate treatment as compared to capturing and detaining the 1-inch storm event.

11. All calculations shall be provided in the submittal package in a cohesive and easy-to-follow manner.

3.5 Erosion Prevention and Sediment Control Requirements

The City of Charleston requires that an erosion prevention and sediment control (EPSC) plan be submitted and approved prior to initiating construction, development, or re-development

activities. This plan describes the practices and controls that shall be used during and after construction to meet the following goals:

1. Minimize the extent and duration of disturbed soil exposure;

2. Protect off-site and downstream locations, drainage systems and natural waterways from the impacts of erosion and sedimentation;

3. Limit the exit velocities of the flow leaving the site to non-erosive or pre-development conditions; and,

4. Design and implement an ongoing inspection and maintenance plan.

3.5.1 Allowed EPSC BMPs

The various types of EPSC BMPs that are acceptable for use in the City of Charleston are presented below. These generally fall into three categories: erosion prevention measures, temporary sediment controls, and runoff controls and conveyance measures. Runoff from sites shall contain controls that fall into each 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. Guidance documents that shall 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, may be approved by the Department of Public Service. To use an alternative measure, the design engineer shall submit substantial supporting documentation that the proposed measure shall perform at least equivalent to the currently approved erosion privation measures approved and contained in this Manual.

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	X	X	X			X	

BMP	Slope Protection	Waterway Protection	Surface Protection	Enclosed Drainage	Large Flat Areas	Borrow Areas	Adjacent Properties
Turf Reinforcement Mats (TRM)							
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

The City of Charleston emphasizes preventative measures as the main control to protect against erosion, both during and following construction. However, there are instances where erosion prevention measures alone do not provide sufficient control. For these instances, temporary sediment controls shall be implemented to control the migration of eroded sediment off site. These temporary sediment control measures are typically only applicable as practices for use during construction. One or more of the measures shall 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 can be found in Haan, Barfield, and Hayes (1995) and Appendix B in SCDHEC (2003). To use an alternative measure, the design engineer shall submit substantial supporting documentation that the proposed measure shall perform at least equivalent to the currently approved temporary sediment control measures approved and contained in this Manual.

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 Controls and Conveyance Measures

This category of EPSC BMPs shall 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 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 and Permanent Vegetation

Information regarding temporary and permanent vegetation for construction and post-construction activities can be found in the South Carolina DHEC Stormwater Management BMP Handbook.

3.5.2 Design Requirements

3.5.2.1 General Requirements

1. **Removal Efficiency:** EPSC plans shall be developed to achieve an 80 percent design removal efficiency goal. Simply applied, when a site is completely denuded of vegetation, the structural and nonstructural EPSC measures are designed to trap 80 percent of the total suspended solids (TSS) or 0.5 mg/L peak settable solids concentration, which ever is greater, 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.

2. **SCS Procedures:** SCS procedures shall 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 shall have a greater trapping efficiency for more frequent events such as the 2-year 24-hour storm event.

3. **Sediment Basin Threshold:** A sediment detention basin is required when 10 or more acres of disturbed land area drain to a single outlet point. Such basins shall be designed to have a design effluent concentration of 0.5 mg/L peak suspended solid concentration (SSC) or 80 percent trapping efficiency, whichever is less, and control the 10-year 24-hour storm event to pre-development conditions and successfully pass the 100-year 24-hour storm event. A single sediment basin shall be limited to controlling runoff for 20 acres. Sediment trap(s) shall not have more than 5 acres draining to it.

   Activities that disturb between 1 and 5 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.

4. **Silt Fence:** Silt fencing shall be placed at the toe of all fill slopes and soil berms and below disturbed areas where the size of the disturbed area is no more than ¼ acre per 100 feet of silt fence length. The maximum slope length behind the fence shall be 100 feet and the maximum gradient behind the fence is 2H:1V. Specification of silt fence shall be that of the SCDOT as amended from time to time;

5. **Non-Structural Site Management Practices:** The following non-structural 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. Maintenance schedules are provided in SCDHEC (2005).

6. **Sediment Storage Volumes:** 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) or other acceptable methods that determine sediment yield may be used to predict the required sediment storage volumes for specific sediment control structures.

7. **Alternative EPSC Controls:** 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 Engineering Division. To use an alternative BMP, the design engineer shall submit substantial supporting documentation that the proposed measure shall perform at least equivalent to currently approved BMPs contained in the Manual. Documentation shall include, but is not limited to, the following:

a. Supporting hydraulic and trapping efficiency calculations;

b. Peer-review by a panel of licensed professional engineers;

c. Research results as reported in professional journals; and,

d. Manufacturer literature.

8. **Alternative BMP Documentation:** To use an alternative measure, the design engineer shall submit substantial supporting documentation demonstrating that the proposed measure shall perform at least equivalent to the currently approved erosion prevention measures approved and contained in this Manual.

9. **EPSC Plans**

a. Detailed EPSC plans shall comply to the maximum extent practicable with the following specific standards and review criteria:

i. Sediment Tracking Control shall be implemented using stabilized construction entrances that are to be located and utilized at all points of ingress and egress on a construction site. The transfer of soil, mud, and dust onto roads shall be prevented;

ii. Crossings of waterways during construction shall be minimized and shall be approved by the Engineering Division of the Department of Public Service and possibly the US Army Corps of Engineers (USACE). Encroachment into stream buffers riparian areas and wetlands shall be avoided;

iii. Topsoil shall be stockpiled and preserved from erosion or dispersal during and after site grading operations;

iv. Where construction activities, development, or re-development will or has temporarily ceased on any portion of a site, temporary site stabilization measures shall be required as soon as practicable, but no later than 14 calendar days after the activity has ceased. Hydroseeding shall be done as often as necessary to avoid bare areas of soil. Stabilization of disturbed areas is one of the best approaches for erosion prevention and sediment control;

v. All slopes shall be stabilized through grassing, hydroseeding, synthetic or vegetative matting, diversion berms, temporary slope drains, etc. and shall be performed within 2 working days after the necessary grading (temporary or permanent) has been achieved;

vi. Final stabilization of the site shall be required within 14 calendar days of construction completion;

vii. 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 permit application and engineering calculations. All temporary structural controls shall be designed to control the peak runoff resulting from the 10-year 24-hour storm event;

viii. All permanent structural controls, including drainage facilities such as channels, stormwater inlets, and detention basins shall be cleaned out as part of the project closeout and NOT processes; and,

ix. 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 shall not be performed without approval from USACE. In addition, such work shall be coordinated with the installation of erosion prevention and sediment control measures so that disruption is minimized. Every effort shall be made to install utilities during the initial construction phases. Trench sharing is encouraged to the extent practicable.

b. EPSC plan shall contain the following information in a cohesive and easy-to-follow manner:

i. Location of all erosion and sediment control structures on construction documents;

ii. Delineation of all sensitive features (wetlands, streams, ponds, existing stormwater structures, etc.) and potential sediment sources;

iii. Installation sequencing and maintenance schedules for all EPSC BMPs during and after construction;

iv. Provisions to preserve topsoil and limit the amount of total disturbed area;

v. Details of site grading;

vi. Design details and computations for all EPSC structures;

vii. Protection of all storm drain inlets and outlets;

viii. For sites which disturb greater than 5 acres, a list or calculation of the trapping efficiency for all EPSC BMPs;

ix. For sites which disturb greater than 5 acres, calculations of required sediment storage volumes for all EPSC BMPs;

x. Explanation of any computer models or software used with highlights of and/or notes on the output data;

xi. Location of temporary and permanent soil disposal areas, haul roads, and construction staging areas to minimize erosion, sediment transport, and disturbance to existing vegetation; and,

xii. All necessary certifications by the person responsible for the activity. This includes the Construction Activity Application, the maintenance agreement(s), and operating permit(s). The EPSC Plan and the SWPPP shall be properly prepared and signed by a registered engineer, landscape architect, Tier B land surveyor, or other qualified Federal Government employee.

10. **Grading Plan:** The grading plan shall include the following general measures at a minimum:

a. The finished cut and fill slopes to be vegetated shall not be steeper than 3H:1V. The finished grades of cut and fill slopes to be vegetated with vines and/or groundcovers shall not be steeper than 1H:1V;

b. Cuts or fills shall 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 damage;

c. Subsurface drainage shall be provided in areas having a high water table to intercept seepage that would affect slope stability, bearing strength or create undesirable wetness;

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 shall be included as part of the grading plan;

g. Adequate channels and floodways shall 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; and,

h. The site shall be graded to direct flows to appropriate controls.

3.5.2.2 Typical Design Procedures

The design procedures will vary depending on the EPSC BMP. Many of the BMPs listed in Tables 3.9 – 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 the EPSC BMPs listed in Tables 3.9 – 3.16. Example problems are given for most types. As with the design of any BMP, engineering judgment is necessary on all applications. Proper design shall be complemented with proper installation and routine maintenance in order for BMPs to be effective and adherence to the provisions of Section 3.5 to be met.

3.6 Stormwater System Design

This section provides the design requirements for various stormwater drainage and 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 under roadways. These standards are required for all publicly maintained drainage systems and are recommended for privately maintained 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;

   b. The **minimum size** storm drainage pipe allowable in the right-of-way shall be fifteen (15) inches in diameter. The minimum size pipe allowable outside the right-of-way shall be ten (10) inches in diameter;

   c. The **minimum slope** for storm drainage pipe shall be three tenths of on (1) percent [0.003 ft/ft] where possible. The **minimum flow velocity** shall be three (3) feet per second for pipes flowing full or half full. The controlling factor is velocity rather than grade. Pipes that have the purpose of equalization between two or more ponds do not have to meet this requirement. Maximum allowable flow velocity shall be 10 feet per second under any flow condition;

   d. Drainage system installation shall be such that stormwater discharge is **not concentrated** on adjacent property 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 or articulating concrete mat (preferred) for a minimum distance equal to or greater than six (6) pipe diameters. To use an alternative measure, the design engineer shall submit substantial supporting documentation that the proposed measure shall perform at least equivalent to the currently approved erosion prevention measures approved and contained in this Manual;

   e. **Submerged conveyances** shall not be used due to maintenance difficulties. However, conduits used for equalization may be submerged if isolator boxes are installed at both ends of the conduit to facilitate draining for maintenance purposes. If the distance of the conduit exceeds 200 feet, additional isolator boxes shall be installed such that the maximum distance between isolator boxes shall be 200 feet.

   f. **Type and class** of storm drainage pipe and the installation of pipes shall be in accordance with Sections 714 and 715 of the latest SCDOT specifications. The use of any storm drain pipe other than RCP shall be approved in writing by the Director of Public Service;

   g. All **joints** shall be wrapped in a non-woven filter fabric of at least 6 ounces. All pipes and boxes (catch basins, drop inlets, manholes, junction boxes, etc.) shall have **stone bedding** made of 6 inches of #57 stone. **Backfill** shall consist of suitable material and compaction requirements per latest SCDOT specifications;

h. A minimum of one (1) foot of **cover** shall be provided for all storm drainage pipes unless otherwise specified. RCP Class IV or V pipe may be requested by the Public Service Director in special conditions (e.g. deep installation, excessive surface loads, etc.);

i. Storm drainage pipe shall be placed to **minimize the length running under pavement**. Where it is necessary for 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 6-inch lifts to 95% Standard Proctor maximum density and to 98% Standard on the last 6 inches;

j. Any "open" storm drainage cross line pipe shall extend out beyond the toe of the roadway **embankment**. In no case shall the end of the pipe be within the five foot **roadway shoulder**;

k. 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 less than or at most equal to ninety (90) degrees. Rip-rap (grouted), articulating concrete matting, or other suitable protection is required from the top of the pipe at the outlet point to the bottom of the channel and on the opposite channel bank to prevent scour and erosion.

l. Storm drainage pipe shall have the **discharge invert above the permanent pool elevation or above Mean Higher Water, which ever is higher.** Rip-rap (grouted), concrete matting, or other energy dissipation structures shall be placed from the bottom of the outlet to two feet below the normal permanent pool level when discharging into a wet pond or lake. When submerged outlets are approved through a variance, they will be allowed with the inclusion of isolator boxes and shall incorporate measures to prevent sedimentation and the need for frequent maintenance;

m. Any connections to existing **brick arch** drainage systems shall be coordinated with the Engineering Division during initial planning stages. Failure to communicate early in the design process will delay processing;

n. A **maintenance access point** shall be available at a minimum within every 200 feet. In addition, junction boxes with manholes shall be placed at all pipe intersections, grade changes, alignment changes, and pipe size or geometry changes;

o. The **100-year 24-hour storm event** shall be used to check all drainage designs for local flooding and possible flood hazards at adjacent structures and/or property;

p. **Hydraulic grade line** and head loss calculations for determining water surface elevations shall be performed for all system connections;

q. Calculations shall be performed for the appropriate **design storm event**;

r. For storm drainage systems with less than 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, should be employed in larger design situations;

s. **Storm drain profile plots** shall be included in the set of construction plans and shall show the **hydraulic grade line** for the required design storm;

t. Storm drainage systems shall be designed to convey stormwater runoff by **gravity flow** unless otherwise approved;

u. For very flat flow lines, **flow velocities** shall increase progressively throughout the system. The upper reaches of the pipe system may have flatter slopes than the lower end of the system;

v. It shall be unlawful for any person to uncover any component of the public stormwater system or connection branches thereof, for any purpose or to make connection therewith, unless and except with the **approval and inspection** of the Department of Public Service;

w. No person shall lay any pipe or conduit for any purpose whatsoever in any street within **five (5) feet** on either side of the public stormwater system in such street;

x. In **opening trenches** in any street or public way, the paving or ballast shall be removed in a manner directed by the Department of Public Service. The sides of the trench shall be sheeted or braced in accordance with current OSHA standards. The earth thrown from the trench shall be placed so as not to obstruct the gutters and so as to cause the least obstruction to public travel. Gas and water pipes shall be protected from injury, the trench enclosed and lighted at night, and every precaution taken to prevent injury to person or property during the progress of the work; and,

y. Notice shall be left at the engineering division **two (2) working days** prior to the beginning of any work laying a storm drain. No material shall be used or work covered until inspected and approved by the engineering division.

z. At the end of all projects in which pipes were installed, the entire closed system (pipes, boxes, etc.) shall be **video inspected** and sent to the Engineering Division as part of the closeout procedure. Pipes shall be video inspected again at the end of the 2-year warranty period. See Chapter 2.8 for video specifications.

2. **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 shall properly account for water, bed-load, and floating debris at all stages of flow;

c. There shall be no unnecessary or excessive cause of property damage;

d. The **outlet** shall be designed to prevent 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 shall be approved by the Engineering Division of the Department of Public Service. Designs shall be based upon SCDOT requirements where applicable;

f. Culverts under City roadways shall be designed such that the water elevation does not come within **12-inches** of the highest point of the roadway at the crossing for the following roadway types and storms:

1. Residential roads – 10-year 24-hour storm
2. Secondary roads – 25-year 24-hour storm
3. Primary roads and interstates – 50-year 24-hour storm

g. Culverts under residential City roadways shall be designed to prevent overtopping using the **25-year 24-hour storm event** at a minimum, regardless of contributing area. Ponding or backwater effects shall not impact new or existing structures beyond existing conditions and shall recede in a maximum time of 24 hours.

h. The 25-year 24-hour storm event **hydraulic grade lines** shall be shown on all profile sheets;

i. **Additional hydraulic capacity** shall be required as necessary to prevent backwater effects that may adversely impact upstream property or structures;

j. Acceptable models for designing culverts include, but are not limited to, the following:

   i. ICPR;
   ii. HY8;
   iii. Pond Pack;
   iv. HEC-RAS; and,
   v. Flow Master.

k. A complete study of culverts and design considerations is provided in USDOT 2001a.

3. **Headwalls and Outlets**:

a. 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**:

   i. A headwall constructed of concrete or brick plastered with non-shrink grout is preferred; it is required on culverts located in major defined drainage channels; and

   ii. A rip-rap headwall is acceptable for pipes 24" or less in a number of situations. Note that this technique requires the use of both filter fabric and grout.

b. Storm drainage or pond outfalls shall be carried to an existing drainage outfall such as a pipe, ditch, etc.;

c. No new point discharge onto adjacent property where there was not an existing point discharge shall be permitted without the adjacent property owner's **written consent**. Discharge points created by construction, development and re-development shall connect to an existing drainage system, whether natural or man-made. The new outlet shall not cause flooding or in any way degrade the existing stormwater drainage system and proof of such shall be provided. In some cases, conveyances shall be constructed from the project to a point of discharge into the existing stormwater drainage system and this shall be done at the owner's expense. In these cases, the owner shall be responsible for obtaining all necessary easements and agreements to construct such;

d. The **inverts of all discharge pipes and channels** shall not be less than 4.5' NGVD 29 or below Mean Higher High Water (MHHW), whichever

is greater. Any outlet below 5.0' NGVD or not more than 0.5 feet above MHHW, whichever is greater, shall incorporate measures to prevent sedimentation and the need for frequent maintenance; and,

e. Outlets shall not discharge on **fill slopes**.

4. **Energy Dissipation Structures**:

a. All outlets shall 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 and **grout** shall be used to hold the riprap in place; and,

c. Level spreaders, plunge pools, etc. shall be properly designed and installed at the proposed outlet(s).

5. **Catch basins, inlets, manholes, and junction boxes**:

a. Materials and construction shall be as specified in **Section 719** of the latest SCDOT specifications;

b. Side inlet catch basins or junction boxes with concrete covers shall have a metal ring and **manhole lid** cast within the top for easy access. All manhole lids and catch basins shall contain a label identifying the system as stormwater and marked with an appropriate stormwater awareness message such as 'No Dumping – Drains to Waterways'. Contact the Engineering Division for more information.

c. When the **depth of a catch basin or junction box** exceeds four (4) feet, rungs or steps shall be provided for ascent and descent. Steps shall be ASTM-C-478, or equivalent;

d. The **box top** shall be a minimum of three (3) feet by three (3) feet. Sides shall be plastered with non-shrink grout;

e. All pipes entering or leaving shall not **protrude** more than six (6) inches into the box;

f. All roadway catch basins shall comply with **latest SCDOT standard specifications** and details;

g. Maximum roadway **catch basin inlet capacity** for an inlet shall be determined based on the following:

i. For inlets at sags, capacity shall be based on either weir flow (unsubmerged) or orifice flow (submerged). The depth of flow

shall be limited to the curb depth, but may be further limited by the allowed spread. In sag conditions, a 15% factor of safety shall be used to account for debris and clogging if an open throat inlet is proposed. A 50% factor shall be used if a grate is proposed; and

ii. For inlets on grades, theoretical capacity shall consider in the design the longitudinal and cross slopes, and gutter depression. The length of the gutter opening shall be such that the gutter efficiency is 80% of the theoretical capacity. Maximum flow depth shall be limited to the depth of curb.

h. SCDOT **Type 9 inlets** shall be designed to accommodate a given flow based on road type and so as not to cause flooding on adjacent property;

i. It is desirable to **locate catch basins outside curve radii**. If this is not reasonably possible, the catch basin shall be set back an extra foot and the face of the catch basin shall be parallel to a chord joining the two points on the curve radius located by projecting lines from the sides of the catch basin box;

j. Junction boxes and catch basins shall contain a **minimum drop** of 0.1 feet from invert in to invert out;

k. **Waffle and knockout boxes** shall be prohibited. Boxes with pre-cast openings shall be used;

l. All inlet catch basins shall have a **1-foot sump** at the bottom to contain sediment and debris;

m. Within a catch basin, inlet, manhole, or junction box, the **elevation at the crown** of any inlet pipe shall be equal to or greater than the crown of the outlet pipe; where crowns do not match the engineer must demonstrate that the unmatched crowns do not adversely affect the capacity or functionality of the system.

n. Catch basins shall be **field staked** to ensure proper catch basin inlet alignment with the street gutter line.

o. **Rubber gaskets** and resilient flexible type connections conforming to ASTM C923 shall be used for all pipe-to-box connections, including road subgrade connections. Pipes shall enter perpendicularly to the face of the box. Pipe may extend into the box such that it breaks the plane of the inside wall, but by no more than 6 inches. If pipes must enter structure at an angle, circular junctions shall be used. Use of an approved alternative detail will be allowed for non-perpendicular pipe connections where circular boxes cannot be used.

p. **Subgrade drains** connected to catch basins, manholes, or junction boxes shall be required for the length of all roads unless a geotechnical report shows less is necessary;

q. All stormwater structures under this heading shall be **backfilled in 6" lifts** compacted to **95% Standard Proctor maximum density**;

r. **Inlet protection** shall be provided at all inlets into the stormwater system during the project until the closure procedures have been completed or notification from the Engineering Division of the Department of Public Service 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 the latest SCDOT specification.

s. **Inlet spacing** shall be based partly on the maximum spread of water into the travel lane. Allowable gutter spread is limited to ½ of the travel lane for the appropriate design storm listed in SCDOT Requirements for Hydraulic Design Studies, 2009. Inlet spacing for alleys shall be based on a 2 year storm event, limited to ½ of the travel lane.

t. **Inlets upgrade of a road intersection**, sag inlets, or the last inlet for a given system shall be designed with sufficient capacity to handle the entire flow, such that there is no flow through or bypass. Provide spread calculations for review by the Engineering Division;

u. **Maximum depth** in which the water may **pond** above or around an inlet shall not threaten surrounding permanent structures or facilities including vehicular or pedestrian traffic;

v. In-depth design procedures for inlet and stormwater facility design may be referenced in AASHTO (1999), USDOT (2001b), Mays, L., (2001), and Yen (2001). Culvert design guidance is found in USDOT (2001a).

3.7 Open Channel Hydraulics

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

1. All open channels shall **fully contain** all stormwater from the appropriate design storm with no overtopping of the bank along the channel's entire length;

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 design storm shall be less than five (5) fps (2.5 fps in bare sandy soils) or the channel surfaces shall be adequately lined (e.g., rip-rap, concrete matting);

3. The **minimum channel grade** shall be 0.003 ft/ft and shall be designed to accommodate flows resulting from the appropriate design frequency storm;

4. Design conditions can be assumed to be **steady, uniform flow**;

5. **Roadside channels** shall meet the definition of a **swale**;

6. Channels may be designed with **multiple stage levels** with a low flow section to carry the 2-year 24-hour storm event and a high flow section to carry storms of larger frequencies;

7. The City of Charleston allows **vegetated channels**. Guidance on the design of these types of 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 properties or structures;

9. The side slopes of **grassed lined channels** without Erosion Control Blankets or Turf Reinforcement Matting shall be no steeper than 3H:1V;

10. All **open channels** shall be **uniform** and shall be **stabilized** to prevent erosion in a manner approved by the Engineering Division of the Department of Public Service. Acceptable techniques are shown in the SCDHEC (2005);

11. **Permissible velocities** for channels shall be established and not exceeded during the design storm(s) used to size the conveyance. In the case of an existing conveyance, permissible velocities shall not be exceeded during the design storm(s) used to size the outlet. See Table 3.12 for vegetated channels. For bare soils, permissible velocities will depend on the nature of the soil (cohesiveness and void ratio) and runoff (sediment concentration). Mays, L., (2001) provides graphs to select the permissible velocity. For typical soils in the City, the maximum permissible velocity of less than 3.5 ft./sec; and,

12. Acceptable models for designing open channels include, but are not limited to, the following:

    a. ICPR;
    b. HY8;
    c. Pond Pack;
    d. HEC-RAS; and,
    e. Flow Master.

Table 3.12 Maximum Permissible Velocities for Channels

	Permissible Velocity (ft./sec.)*					
	Erosion Resistant Soils % Slope			Easily Eroded Soils % Slope		
Cover	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 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 Easements

The following section provides the required easement widths for various components of the stormwater system. In all cases, there will be an allowance for offset easements, in which the pipe, channel, or other stormwater system components do 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 Department of Public Service.

3.8.1 Stormwater 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 3.13-Storm drain pipe easements

Pipe size (in)	Maximum depth to invert (ft)	Width of drainage easement (ft)
15 - 18	3.5	16
21 - 24	5.0	16
27 - 42	7.0	20
48 - 54	7.0	24
60 - 72	9.0	30

Notes: (1) For depths greater than shown, add two feet for each additional foot to the invert.
(2) For pipe sizes not specifically listed above, the easement width and depth to invert shall be that of the next larger size.
(3) For larger pipe sizes and/or multiple lines of pipe easement width shall be as determined by the Director of Public Service or his designee.

3.8.2 Open Conveyances

A minimum easement width for any open conveyance is twenty-four (24) feet. For open conveyances greater than four feet wide and/or greater than four feet deep, the drainage easement width shall be increased by two feet for each additional foot of width and/or depth. The open conveyance shall be placed within an easement in such a way as to expedite maintenance activities.

3.8.3 Detention and Retention Ponds

An access easement with a width of twenty feet, minimum, shall be provided from the right-of-way to the pond. In addition, the entire pond and sufficient access room on the perimeter shall also be included as part of the drainage easement that will include a minimum width of 10 feet outward from the top of the bank. The perimeter easement around the top of the bank of a pond shall have a maximum cross slope of 10H:1V.

3.8.4 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 ten (10) feet beyond the boundary of any such structure. The Department of Public Service may require or allow other easement widths on a case-by-case basis given site constraints or special conditions.

3.8.5 Offsite Easements

Any required off-site easements shall be obtained prior to construction activity approval which would impact upon that area. Any work done without proper and adequate easements shall be at the owner's own risk. Non-subdivision projects shall provide validation of necessary easements before a construction activity application approval will be given.

3.9 Special Protection Areas

In an effort to address some of the most critical water resource problems that exist in the City, 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 ecosystems or maintain a designated use(s).

3.9.1 Areas Associated With Flooding

Flooding exists in many locations around the City where development densities have increased to the point that stormwater controls have become overwhelmed. These areas are expected to change with time; however, it is the intent of the Engineering Division that these areas do not increase. The following design criteria shall be used for projects discharging to receiving waters within these areas:

1. The post-development, peak discharge rates is restricted to ½ the pre-development rates for the 2 and 10-year 24-hour storm event or to the downstream system capacity, whichever is less; and,

2. 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.

Additional criteria may be established by the Department of Public Service.

3.9.2 Areas Associated With TMDLs and Impaired Waters

In conjunction with the NPDES permitting program, SCDHEC, through delegated responsibility from the 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. 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). An established TMDL in the City of Charleston will require that the owner implement a plan that uses structural and nonstructural BMPs to reduce the current loading to either a certain total load or by a certain percentage. The plans to address the TMDLs shall

contain provisions for both existing and future land uses. In an effort to counter the potential reduction of water quality with new development, the following list of design criteria shall be followed for all projects within Special Protection Areas associated with TMDLs. Those areas affected will change and additional TMDLs will be adopted.

The following design criteria shall be used for projects occurring within or discharging to these areas:

1. BMP and water quality analysis – see Section 3.4.3.1 for the list of design procedures to follow.

2. Buffers are required along perennial and intermittent streams adjacent to the project within a watershed where there is an established TMDL. Buffers shall be required on other waters as dictated by the City of Charleston. Within buffer areas, all significant sources of aquatic contamination and degradation shall be excluded including construction resulting in land disturbance, impervious surfaces, logging roads, mining, septic tank drain fields, agricultural fields, waste disposal sites, stormwater BMPs (except those designed as wetlands), access of livestock, clear cutting, and application of pesticides and fertilizers. The width of buffers shall be as follows:

    a. Base width is 50 feet plus 2 feet per 1 percent of slope of the stream valley;

    b. Existing impervious surfaces in the riparian zone as well as wetlands, do not count toward buffer width (i.e., the width is extended by the width of the impervious surface, just as for wetlands); and,

    c. Slopes over 25 percent do not count toward the width.

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CHAPTER 4 INSPECTIONS & ENFORCEMENT

4.1 City of Charleston Stormwater Management Inspections

The City shall inspect, at its discretion, applicable construction, development and re-development project sites for the purposes of verifying compliance with and enforcement of the City's Stormwater Management Plan, Stormwater Management Ordinance, and Stormwater Design Standards Manual. Additionally, maintenance inspections, at the City's discretion, will also be performed on stormwater management systems and facilities throughout their useful life to confirm adherence to their submitted maintenance plans. In addition to City inspections, owners/operators shall conduct self-inspections in accordance with any applicable local, state, or federal stormwater requirements.

4.1.1 City of Charleston Stormwater Management Inspection Duties and Responsibilities

Inspections for the purposes of ensuring compliance and the enforcement of the City's Stormwater Management Plan and Ordinance shall include the following:

1. Ensuring that the approved City construction activity application, stormwater management plan, the SWPPP, and the construction, development and re-development plans are on the project site and are being followed and implemented;

2. Conducting post-construction, post development and post re-development inspections to ensure that permanent maintenance is being performed in accordance with the maintenance schedules for the various stormwater management facilities;

3. Providing the owner/operator of the property with a written report within seven (7) days after the site inspection as necessary;

4. Taking enforcement actions, as necessary, when any portion of the construction, development and re-development and post construction, post development and post re-development activity does not comply with the approved City construction activity application and/or stormwater management plan or work is occurring without appropriate approvals;

5. Performing a final inspection upon the completion of the stormwater system to determine if the system is constructed in accordance with the approved City construction activity application and stormwater management plan. The Project Operator/Owner shall furnish Stormwater Record Drawings in accordance with Section 2.8.2 of this manual to the City of Charleston Engineering Department for use prior to final inspection.

6. Taking immediate action, if necessary, if the owner/operator fails to comply with the approved City construction activity application or the approved stormwater management plan and an imminent hazard exists along with notifying any applicable local, state and federal agencies; and,

7. Maintaining accurate and comprehensive project inspection files ensuring all relevant information is entered in the files which are to be maintained by the Department of Public Service.

4.1.2 Inspection Reports

Upon completion of a construction, development, or re-development site inspection, the City should include the following in the inspection report to be provided to the owner/operator:

1. Date and location of the site inspection;

2. Whether the approved City construction activity application or stormwater management plan, SWPPP, and construction plans have been properly implemented and maintained;

3. Identification of any approved plan or BMP deficiencies;

4. Any corrective actions needed; and,

5. The time period for correcting the deficiencies.

Upon completion of a post-construction, post development, or post re-development maintenance inspection, the City should include the following in the inspection report to be provided to the owner/operator as necessary:

1. Date and location of the site inspection;

2. Whether the activities identified in the approved maintenance schedule have been properly implemented and completed;

3. Identification of any maintenance deficiencies;

4. Any corrective actions needed; and,

5. The time period for correcting the deficiencies.

4.2 Construction Activity Applicant, Owner, and Operator 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 construction, development and re-development and post-construction, post-development and post re-development site inspections. Records of such inspections shall be kept for a minimum of five (5) years and shall be made available to the City of Charleston upon reasonable request.

4.3 Enforcement

If the City determines that a project is in non-compliance with the City's Stormwater Management Ordinance, the City may direct conformity by proceeding with the appropriate enforcement action. The types of enforcement tools available to the City include a Correction Order, Notice of Violation (NOV), Stop Work Order and other Civil and Criminal Penalties. The enforcement mechanism to be utilized will be at the City's discretion.

4.3.1 Correction Orders

The Public Service Director or his designee may issue a written Correction Order for offenses of non-compliance with the City's Stormwater Management Ordinance, the approved City construction activity application, or the approved stormwater management plan. Correction Orders shall be made in writing, but a verbal notice may be given if the deficiency needs immediate correction to prevent offsite or downstream impacts. All Correction Orders, verbal or written, shall be noted in the project file.

A Correction Order should include the following:

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

4.3.2 Notices of Violation (NOV)

The Public Service Director or his designee may issue a Notice of Violation (NOV) for offenses of non-compliance with the City's Stormwater Management Ordinance, the approved City construction activity application, or the approved stormwater management plan. 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, a Notice of Violation may be issued.

A Notice of Violation (NOV) shall include the following:

1. Nature of the violation(s);
2. Proposed penalty;
3. Notification that a Stop Work Order may be issued or that approvals for the site may be suspended or revoked if there is continued non-compliance;
4. Required corrective actions; and
5. The time period for correcting the violation(s).

4.3.3 Stop Work Order

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

1. Construction, development, re-development activities occurring without an approved City construction activity application and/or a City approved stormwater plan;
2. Past enforcement actions taken by the City to remedy a situation(s) which have not been properly addressed with appropriate and prompt action to the satisfaction of the Public Service Director or his designee;
3. A health or safety issue resulting from the failure to comply with the City's Stormwater Management Ordinance, an approved City construction activity application and/or an approved stormwater plan;
4. Offsite sedimentation resulting from non-compliance with the approved stormwater plan which has eliminated or degraded a use in a downstream waterbody or that such degradation is imminent; and,
5. Offsite sedimentation resulting from non-compliance with the approved stormwater plan which has caused damage to adjacent land

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 City approvals for development activities and criminal and/or civil penalties.

4.3.4 Uniform Ordinance Summons

A Code Enforcement Officer may issue a Uniform Ordinance Summons (UOS) for offenses of non-compliance with the City's Stormwater Management Ordinance or this Stormwater Design Standards Manual. This UOS may result in the offending individual having to appear before the Magistrate in the Livability Court of the City of Charleston. These violations can result in a fine and/or time in jail.

Appendix A

Application Forms

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CITY OF CHARLESTON, SOUTH CAROLINA

Department of Public Service
Engineering Division

Erosion Protection & Sediment Control Certification
ALL REQUESTED INFORMATION MUST BE PROVIDED ON THIS FORM

For Single Family Residential, Small Construction Projects, and Utility/Linear Projects

Applicant Information

OWNER: _____
ADDRESS: _____
CITY:_____ **STATE:** _____ **ZIP CODE:** _____
PHONE: _____ **FAX:** _____ **E-MAIL:**_____

Property Information

PARCEL/TMS #(S): _____ **LOT NUMBER(S):** _____
DEVELPOMENT NAME/PHASE:_____
CITY:_____ **ZIP CODE:**_____
TOTAL ACRES:_____ **DISTURBED ACRES:**_____
LOTS APPLIED FOR:_____

Contractor Information (if applicable)

COMPANY: _____
OPERATOR NAME: _____
LICENSE #: _____
ADDRESS: _____
CITY:_____ **STATE:** _____ **ZIP CODE:** _____
PHONE: _____ **FAX:** _____ **EMAIL:** _____

1. Is your site part of a larger common development? ( ) yes ( ) no

If yes you must sign the certification below. If no proceed to question 2.

I certify by my signature below that:

I certify under penalty of law that I understand and will implement the City's construction, development, and redevelopment activity management requirements specified in the construction activity application issued to the owner of the development and those listed in this Erosion Protection & Sediment Control Certification. I will ensure that all stormwater control measures are maintained. I further certify that City of Charleston inspectors may enter the property as necessary to ensure compliance with all related requirements.

OPERATOR SIGNATURE:_____**DATE:** _____

OWNER SIGNATURE: _____**DATE:** _____

2. If not part of a larger common development, you must sign the certification below.

I certify under penalty of law that I understand and will implement the City's construction activity management requirements specified in this Erosion Protection & Sediment Control Certification. I will ensure that the stormwater control measures are maintained. I further certify that City of Charleston inspectors may enter the property as necessary to ensure compliance with all related requirements.

OPERATOR SIGNATURE:_____**DATE:** _____

OWNER SIGNATURE: _____**DATE:** _____

Construction Activity Management Requirements for Single Family Residential structures and Small Construction Projects disturbing less than 1 acre, and Utility/Linear Projects

1. The lot/area shall have protection around the entire boundary with allowances for no more than two entrance/exits. This protection may be silt fencing or earthen or man-made berms or dikes. These measures shall be installed prior to land disturbance and maintained until the project is stabilized as detailed below. The following guidelines shall be followed:

The maximum length from the crest of a hill to the 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 (normal [perpendicular] to fence line) is 2H:1V. When exceeded, slope drains shall be employed.

A maximum of ¼ acre drainage per 100 linear feet of silt fence shall be used. When this area is exceeded, an intermediate row of silt fence shall be used or another control measure shall be employed.

Sediment accumulated along the fence shall be removed when it reaches 1/3 the height of the fence.

Proper construction of these measures can be found in South Carolina Department of Health and Environmental Control's (SC DHEC's) BMP Manual. Manufacturers recommended installation and maintenance procedures shall be followed.

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 shall be maintained throughout the construction process until the site is stabilized as detailed below.

3. A maximum of two (2) construction entrances shall be provided at all times. The entrances shall contain washed stone that is at least 6-inches deep, 20-feet wide, and 75-feet long. The stone shall be maintained throughout the construction process until the site is stabilized as detailed below. Sediment tracked onto streets shall be removed daily. More information on the installation and maintenance of the construction entrances can be obtained from the Public Service Department.

4. All sediment and erosion control devices shall be inspected every seven (7) days. If site inspections identify BMPs that are damaged or are not operating effectively, maintenance must be performed as soon as practical or as reasonably possible and before the next storm event whenever practicable.
<u>OR</u>
All sediment and erosion control devices shall be inspected at least once every fourteen (14) calendar days and within 24 hours of the end of a storm event of 0.5 inches or greater. If site inspections identify BMPs that are damaged or are not operating effectively, maintenance must be performed as soon as practical or as reasonably possible and before the next storm event whenever practicable.

5. Construction debris and other waste shall be contained in a dumpster or covered with plastic. Chemicals, paints, solvents and other materials shall be stored such that exposure risk to precipitation and stormwater run-on is low. 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 cement shall be disposed of in a dumpster or otherwise removed from the site. Be aware that this water can kill vegetation. De-watering water shall be disposed of in a pervious area and shall be contained completely within that area. Discharge of sediment from de-watering operations shall be prevented from entering into stormwater facilities and surface waters.

6. Areas not used during construction shall be vegetated with sod or grass seed. Existing/natural vegetation shall be preserved as much as possible. Grass specifications are available from SCDHEC.

7. A site is considered stabilized once the entire area other the buildings, driveways, and walkways, has a vegetative cover with a density of 70%. Seeding shall be accompanied or replaced with erosion control mats as necessary to achieve this density.

8. After final stabilization is achieved, all temporary control measures shall be removed from the site.

_____ _____

APPLICANT'S SIGNATURE **DATE**

_____ _____

CONTRACTOR'S SIGNATURE **DATE**

CITY OF CHARLESTON, SOUTH CAROLINA

Department of Public Service

Engineering Division

Application for Small Construction Activities and Utility/Linear Projects (TYPE I)

ALL REQUESTED INFORMATION MUST BE PROVIDED ON THIS FORM

Applicable for sites that disturb ½ to one acre or between 0 and ½ acre and within ½ mile of receiving water body and Utility Projects as deemed necessary by the City of Charleston.

A. Name of Activity: _____

B. Applicant Name: _____

Address: _____

City: _____, State: _____

Zip: _____

Phone: _ _ _ - _ _ _ - _ _ _ _ Mobile: _ _ _ - _ _ _ - _ _ _ _ Fax: _ _ _ - _ _ _ - _ _ _ _

Email Address (optional):

_____

C. Property Info: ☐ Check Box if same as above

Address:_____

City: _____, South Carolina

Zip: _____

Tax Map Number(s): _____

D. Disturbed area to the nearest tenth of an acre: _____

E. Is this project a part of a larger common plan for development or sale? YES _____ NO _____

F. Is this a linear construction project that disturbs less than one acre? YES _____ NO _____

G. Are there any wetlands/Waters of the State that will be disturbed? YES _____ NO _____

H. Are there any flooding problems on or adjacent to this site? YES _____ NO _____

I. Where does the stormwater discharge? _____

General Narrative: Please give a general site narrative explaining the purposes of the land disturbance, existing and proposed stormwater runoff patterns, offsite stormwater runoff and potential problems with adjacent properties. Also, if applicable, wetland and waterbody disturbance issues must be discussed along with the proof of permit coverage by the US Army Corps of Engineers and SC DHEC, if applicable.

_____

_____

_____

_____

_____

_____

Project Sketch: (Draw To Scale)

Attach to this application a project sketch that includes **all of the following**: Location of all proposed disturbance; an outline of the limits of the disturbed area; location of existing and proposed stormwater management control outfalls; location of 100-year flood plain; necessary measures for energy dissipation; property lines; location of all sediment and erosion control measures (silt fence, riprap, inlet protection, etc.).

ATTATCH CHECKS HERE

Stormwater Plan Review Fee:

$100.00 per disturbed acre rounded up to the next whole acre (up to $2,000 maximum)

Applicant's Certification:

I hereby certify that all land disturbance, construction, development, and/or re-development activities will be done pursuant to this plan. I am responsible for the land disturbance and related maintenance thereof. The City of Charleston authorities will be allowed to enter the project site for the purpose of on-site inspections. I realize that if approved, a permit fee may be required. **I also realize that the City of Charleston may deny this application and require the submittal and approval of a Type II or III application**.

_____	_____	_____
Applicant's Printed Name	Applicant's Signature	Date

CITY OF CHARLESTON, SOUTH CAROLINA
Department of Public Service
Engineering Division

Application for Medium and Large Construction Activities
(TYPE II and TYPE III)

ALL REQUESTED INFORMATION MUST BE PROVIDED ON THIS FORM.

(Only applicable for sites that disturb **one or more** acre**s** or **½ or more** acre**s** within ½ mile of receiving water)

Date: __ __/__ __/__ __ __ __
Project/ Site Name: _____ **County:** _____

I. Project Information
Project Owner/ Operator (Company or person):_____
Permit Contact (if owner is company): _____ Company EIN: __ __ - __ __ __ __ __ __ __
Mailing Address: _____ City: _____ State: __ __ Zip: __ __ __ __ __
Phone: (Day) __ __ __-__ __ __-__ __ __ __ (Mobile) __ __ __-__ __ __-__ __ __ __ (Fax) __ __ __-__ __ __-__ __ __ __
Email address (optional): _____

Person Financially Responsible: _____
(If different than above)
Mailing Address: _____ City: _____ State: __ __ Zip: __ __ __ __ __
Phone: (Day) __ __ __-__ __ __-__ __ __ __ (Mobile) __ __ __-__ __ __-__ __ __ __ (Fax) __ __ __-__ __ __-__ __ __ __
Email address (optional): _____

Agent or Contact Person (if applicable): _____
Mailing Address: _____ City: _____ State: __ __ Zip: __ __ __ __ __
Phone: (Day) __ __ __-__ __ __-__ __ __ __ (Mobile) __ __ __-__ __ __-__ __ __ __ (Fax) __ __ __-__ __ __-__ __ __ __
Email address (optional): _____

Engineer, Technical Representative or Firm _____
Mailing Address: _____ City: _____ State: __ __ Zip: __ __ __ __ __
Phone: (Day) __ __ __-__ __ __-__ __ __ __ (Mobile) __ __ __-__ __ __-__ __ __ __ (Fax) __ __ __-__ __ __-__ __ __ __
Email address (optional): _____

II. Property Information
A. Site Location (street address, nearest intersection, etc.):
_____
City/ Town): _____ Latitude: __ __°__ __'__ __" N Longitude: -__ __°__ __'__ __" W
Tax map # (list all): _____
B. Property Owner (if different from section I above):_____
Mailing Address: _____ City: _____ State: __ __ Zip: __ __ __ __ __
Phone: (Day) __ __ __-__ __ __-__ __ __ __ (Mobile) __ __ __-__ __ __-__ __ __ __ (Fax) __ __ __-__ __ __-__ __ __ __
Email address (optional): _____

III. Site Information
A. Disturbed area (to the nearest tenth of an acre): __ __ __ __ __. __ Total area: __ __ __ __ __. __
B. Is this project part of a Larger Common Plan for Development or Sale (LCP)? ☐ Yes ☐ No
If yes, what is the previous state permit no.? __ __-__ __-__ __-__ __ __ Previous NPDES number: SCR10 __ __ __ __
LCP/ Overall Development Name: _____
C. Start Date (MM/DD/YYYY): __ __/__ __/__ __ __ __ Completion Date: __ __/__ __/__ __ __ __

D. Type of Activity (check all that apply):
☐Commercial ☐Residential: Single-family ☐Linear (Roads, utility lines, etc.) ☐Other:
☐Institutional ☐Residential: Multi-family ☐Site Preparation (No new impervious) _____

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

F. Are any portions of the site located in an designated floodplain? ☐Yes ☐No
If yes, what are the FIRM Numbers? _____

IV. Waterbody Information

A. Nearest receiving waterbody(s): _____Distance to this waterbody (feet): _____
Next/Nearest named receiving waterbody(s): _____

B. Wetlands/ Waters of the State

	On the site?	If yes, delineated/ identified?	Impacts?	Amount of impacts
1. Receiving Waters	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No	_____ Ac _____ Feet
a. Perennial stream(s)	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No	_____ Ac _____ Feet
b. Intermittent stream(s)	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No	_____ Ac _____ Feet
c. Ephemeral stream(s)	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No	_____ Ac _____ Feet
d. Jurisdictional wetlands	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No	_____ Ac _____ Feet
e. Non-jurisdictional wetlands	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No	_____ Ac _____ Feet
f. Other (List):_____	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No	_____ Ac _____ Feet

2. If yes for delineation in item B.1, has documentation of the delineation from the USACOE been provided?
☐ Yes ☐ No ☐ N/A

3. If yes for impacts in item B.1, has a U.S. Army Corps of Engineers (USACOE) permit been applied for or obtained for those impacts?
☐ Yes ☐ No ☐ N/A If yes, list the permit/ application number. _____

C. Impaired Waterbodies

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

1. Is the WQMS(s) listed on the most current 303(d) List for Impaired Waters? ☐ Yes ☐ No

a. If yes for 1, list the impairment(s):_____

b. If yes for 1, will the site's construction SW discharges contain any pollutants causing the impairment(s)? ☐ Yes ☐ No

c. If yes for b. list the impairment(s) affected by the pollutant(s) referenced in b. _____

d. If yes for (c), 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

2. Has a TMDL(s) been developed for this WQMS(s)? ☐Yes ☐ No

a. If yes for (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 construction 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

D. Are S.C. Navigable Waters (SCNW) on the site? ☐Yes ☐No If yes, list the SCNW:_____
Will any construction activities cross over or occur in, under, or through the SCNW? ☐ Yes ☐No
If yes, then describe activity (e.g., road crossing, sub aqueous utility line). _____
Has an SCNW permit been issued for this site? ☐ Yes, for all activities ☐ Yes, for some activities ☐No
If yes, list permit number and corresponding activities. _____

V. Operator Information

A. SWPPP Preparer: _____ S.C. Registration #: __ __ __ __ __
Company/ Firm: _____ S.C. COA #: __ __ __ __
Mailing Address: _____ City: _____ State: __ __ Zip: __ __ __ __ __
Phone: (Day) __ __ __-__ __ __-__ __ __ __ (Mobile) __ __ __-__ __ __-__ __ __ __ (Fax) __ __ __-__ __ __-__ __ __ __
Email address (optional): _____
B. Operator of Day-to-Day Site Activities [ODSA] (Company or person): _____
Site Contact (if ODSA is company): _____
Mailing Address: _____ City: _____ State: __ __ Zip: __ __ __ __ __
Phone: (Day) __ __ __-__ __ __-__ __ __ __ (Mobile) __ __ __-__ __ __-__ __ __ __ (Fax) __ __ __-__ __ __-__ __ __ __

VI. Signatures and Certifications

A. Three copies of the SWPPP, 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 Title 48, Chapter 14 of the Code of Laws of SC, 1976 as amended, pursuant to Regulation 72-300 et seq., and in accordance with the terms and conditions of SCR100000. (This should be person identified in Section V.A.)
Please check one. ☐ Engineer ☐ Tier B Land Surveyor ☐ Landscape Architect

_____	_____	_____
Printed name of SWPPP Preparer	**Signature of SWPPP 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 land-disturbing construction, development, and re-development activities and associated activities pertaining to this site shall be accomplished pursuant to and in keeping with the terms and conditions of the approved plans and SCR100000. I also certify that a responsible person will be assigned to the project for day-to-day control. I hereby grant authorization to the Department of Health and Environmental Control and/or the local implementing agency 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. (See Section 122.22 of S.C. Reg. 61-9 for signatory authority information.)

_____	_____	_____
Printed name of Project Owner/Operator	**Signature of Project Owner/ Operator**	**Title/ Position**

C. Designer Certification-One copy of the plans, all specifications and supporting calculations, forms, and reports are herewith submitted and made a part of this application. Three copies of the plans, all specifications and supporting calculations, forms, and reports shall be submitted upon approval. 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 that the design is consistent with the City of Charleston Stormwater Management Ordinance and the requirements of Title 48, Chapter 14 of the Code of Laws of SC, 1976 as amended, and pursuant Regulation 72-300.

_____	_____
SIGNATURE	S.C. REGISTRATION NUMBER

☐ Engineer ☐ Tier B Land Surveyor ☐ Landscape Architect

ATTATCH CHECKS HERE

Stormwater Plan Review Fee:
$100.00 per disturbed acre rounded up to the next whole acre (up to $2,000 maximum)

Instructions

Completing the Application:

You must type or print legibly. You must include the original, signed application form, required fees and appropriate fees), one copy of the Stormwater Pollution Prevention Plan (SWPPP), and three copies of all other supporting documentation with the initial submittal.

Who Must File a Construction Activity Application:

- The Owner/ operator of a single project or larger common plan for development or sale that will ultimately disturb 1 acre or more or that is within ½ mile of a receiving waterbody (RWB) and will ultimately disturb 0.5 acre or more. Submittal of this application may not be required for projects disturbing 0.5 acre or less, but may require the submittal of a Small Construction Activity Application.

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

County: Enter either Charleston or Berkeley.

I. Project Information

- The official or legal name of the Project Owner/ Operator should be listed. If the Project Owner/ Operator is a company, then a Permit Contact person should 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.
- The Company EIN is the Employer Identification Number as established by the U.S. Internal Revenue Service.
- NPDES coverage under SCR100000 will be issued to the Project Owner/ Operator. If an email address is entered, the Department may contact the Project Owner/ Operator via email.
- The Project Owner/ Operator is responsible for all portions of the site until a Notice of Termination (NOT) or Transfer of Ownership form is submitted. See our website for additional information on NOTs and transfers of permit coverage and ownership.

II. Property Information

A. List a city/town only if the site is within the city/ town limits. See the following website for assistance in obtaining latitude/ longitude coordinates: http://www.epa.gov/tri/report/siting_tool/index.htm. Latitude (from

32° to 35°) and longitude (78° to 83°) should be for the center of the site to the nearest 15". Minutes (') should be from 0 to 59, and seconds (") should be 0, 15, 30, or 45.

B. If the Project Owner/ Operator does not own the project site, then list the official or legal name of the current Property Owner of the site. NPDES coverage will be issued to the Project Owner/ Operator (Section I), not the Property Owner, unless same entity.

III. Site Information

A. 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 Department must be notified if the actual disturbed area is greater than the disturbed area listed on the application.

B. The plan in LCP is "broadly defined as any announcement or piece of documentation (including a sign, public notice or hearing, sales pitch, advertisement, drawing, permit application, zoning request, computer design, etc.) or physical demarcation (including boundary signs, lot stakes, surveyor markings, etc.) indicating construction activities may occur on a specific plot." [63 Federal Register No. 128, July 6, 1998, p. 36491] For example, if master calculations have been prepared and/ or submitted for an entire site, then all phases and parcels at that site would be considered part of a LCP. If this is the first phase of an LCP, then this item should be answered yes and the LCP/ Overall Development name should be listed. This LCP/ Overall Development name should also be listed on all applications for future projects that are part of this LCP, including subsequent phases. If the project is part of an LCP, then list the previous state permit number and previous NPDES coverage number (not SCR100000).

C. List the estimated start and completion dates of the construction activity.

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

F. If yes, then the extent of the flooding problems and the effect of this project on those problems must be explained in the project narrative.

IV. Waterbody Information

A. The nearest receiving waterbody is the nearest waters of the State (see definition in S.C. Regulation 61-9—http://www.scdhec.gov/environment/water/regs/r61-9.pdf) 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. See the following website for information about identifying and classifying ephemeral, intermittent, and perennial streams:
http://h2o.enr.state.nc.us/ncwetlands/documents/NC_Stream_ID_Manual.pdf.

B. 1. If there are other waters of the U.S./ State on the site not listed in items a-e (e.g., lake, pond), then list those in item f. Delineation means identification by USACOE. If there are waters of the State (WoS) located within 100' of the disturbed area, then the WoS must be delineated. The surveyed delineation and boundaries of the WoS must be shown and labeled on the plans. For an ephemeral stream, the centerline of the stream must be shown and labeled on the plans. If WoS will be impacted, then provide an additional, separate plan sheet that shows all WoS on the site and the impacted areas. Provide a description of the activity(s), whether it is permanent or temporary, and any other relevant information. If there are proposed impacts to WoS, then it is advised that you contact USACOE (866-329-8187) and/ or S.C. DHEC Water Quality Certification, Standards & Wetlands Programs Section (803-898-4300) to determine additional requirements before submitting this NOI. Please note that it is Project Owner/ Operator's responsibility to ensure that all WoS are shown and identified in the SWPPP.
2. You must provide a copy of the letter from the USACOE and map showing the boundaries of the delineated area.

3. If a USACOE permit has been applied for or issued for impacts to waters of the U.S. and State listed in item B.1, then list the permit/ application number. Provide a copy of that permit. If a USACOE permit has been applied for, then provide a copy of associated correspondence. Make sure to include all plats referenced in the permit or correspondence.

C. See the following website for the most current 303(d) List for Impaired Waters, Approved TMDLs, and related information: http://www.scdhec.gov/environment/water/tmdl/. Maps showing WQMS locations are available at the following website for each watershed by clicking the appropriate basin on the S.C. map: http://www.scdhec.gov/environment/water/tmdl/. Determine which WQMS are in the watershed in which your site is located and check the 303(d) List and Approved TMDLs to see if any of the WQMS are listed as impaired. If item 1.c is answered yes and the disturbed area is less than 25 acres, then provide an evaluation of the selected BMPs described in section 3.4C.2(c) of the Construction General Permit (CGP). If item 1.c is answered yes and the disturbed area is greater than or equal to 25 acres, then provide the written quantitative and qualitative assessment described in section 3.4C.2(c) of the CGP.

D. See http://www.scdhec.gov/environment/water/navwater.htm for the definition of S.C. Navigable Water(s) [SCNW] and other information related to SCNW. Or, contact S.C. DHEC Water Quality Certification, Standards & Wetlands Programs Section at (803) 898-4300 for assistance determining the navigability of the waters on your site or with questions related to SCNW. If an SCNW will be crossed (under, over, or through) during construction, then provide an additional plan sheet that shows plan and profile views of the SCNW and associated activities; include a description of the proposed activities on this plan sheet. If the SCNW is not named, then provide a description that references the nearest, named waterbody (e.g., tributary to Grove Creek). If an SCNW permit has already been issued for all or some of the activities at this site, then provide a copy of that permit and list the permit number.

V. Operator Information

A. SWPPP is the Stormwater Pollution Prevention Plan. Enter N/A for the S.C. Registration # if the SWPPP preparer is not a registered professional in S.C. (engineer, Tier B land surveyor, or landscape architect). For projects disturbing more than 2 acres, the SWPPP preparer must be one of the listed professionals or federal government employee as described in Title 40, Chapter 22. S.C. COA is S.C. Certificate of Authorization. Enter N/A for S.C. COA if the firm does not have a COA. If an email address is entered, the Department may contact the SWPPP Preparer via email.

B. If the Project Owner/ Operator will not be the ODSA, then complete this section. See Appendix A of the CGP for the definition of Operator. If the ODSA is a company, then a person should be listed as the Site Contact. If there are multiple ODSAs, then attach additional sheets with all information in Section V.B of this application listed. ODSA must be co-permittees with the Project Owner/ Operator or have their own separate NPDES coverage under the CGP.

VI. Certifications

A. The same registered professional must sign and seal the application, SWPPP, calculations, and supporting documentation.

B. A person with signatory authority for the Project Owner/ Operator must sign the application. The SWPPP Preparer cannot sign the application for the Project Owner/ Operator. The SWPPP, all reports, including monthly reports, and any information requested by the Department must be signed by a person with signatory authority for the Project Owner/ Operator or a duly authorized representative. See Section 122.22 of S.C. Reg. 61-9 (Appendix C of the CGP) for complete information about signatory authority requirements.

- 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 Central Office files (hard copy or digitized copy) or by the City's Records Retention Department in accordance with the City's Retention Schedule.

CITY OF CHARLESTON, SOUTH CAROLINA

Department of Public Service
Engineering Division

Close-Out Application Form
ALL REQUESTED INFORMATION MUST BE PROVIDED ON THIS FORM

CLOSE-OUT APPLICATION MUST BE ACCOMPANIED BY A FULLY COMPLETED AND CORRECT *COVENANTS FOR PERMANENT MAINTENANCE OF STORMWATER FACILITIES*

J. Name of Project: _____

K. Engineering Division Permit Number: __ __ - __ __ __

L. NPDES Permit Coverage Number (if applicable): SCR10 __ __ __ __

M. Owner Name: _____
Address: _____
City: _____, State: _____
Zip: _____
Phone: _ _ _ - _ _ _ - _ _ _ _ Mobile: _ _ _ - _ _ _ - _ _ _ _ Fax: _ _ _ - _ _ _ - _ _ _ _
Email Address (optional): _____

N. Property Info: ☐ Check Box if same as above
Address:_____
City: _____, South Carolina
Zip: _____
Tax Map Number(s): _____

O. Previous Owner Name: _____
Address: _____
City: _____, State: _____
Zip: _____
Phone: _ _ _ - _ _ _ - _ _ _ _ Mobile: _ _ _ - _ _ _ - _ _ _ _ Fax: _ _ _ - _ _ _ - _ _ _ _
Email Address (optional): _____

P. Closeout Information: Date Construction completed (MM/DD/YYYY): __ __/__ __/__ __ __ __
a. Is the entire site sufficiently stabilized? ☐Yes ☐No
b. Are all stormwater facilities working properly and ready for long-term functioning? ☐Yes ☐No

Owner Certification
"I hereby certify that all construction, development, and/or re-development has been completed in accordance with the City requirements and the City-approved project application and all information is truthful to the best of my knowledge. I realize that I am now responsible for the long-term maintenance of all stormwater management facilities until a transfer of ownership has been approved by the Public Service Department in accordance with the Stormwater Management Ordinance."

_____ _____ _____
Owner's Printed Name Owner's Signature Date

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APPENDIX B

SCDHEC BMP HANDBOOK

As of the date of this Manual, the SCDHEC BMP Handbook can be found at the website address below or by contacting SCDHEC directly.

http://www.scdhec.gov/environment/ocrm/bmp_docs.htm

APPENDIX C

NPDES PERMITS

As the date of this Manual, the NPDES General Permit for Stormwater Discharges from Large and Small Construction Activities can be found at the website address below or by contacting SCDHEC directly.

http://www.scdhec.gov/environment/water/swater/construction.htm

APPENDIX D

COVENANTS & TRANSFER OF OWNERSHIP

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CITY OF CHARLESTON, SOUTH CAROLINA

Department of Public Service
Engineering Division

COVENANTS FOR PERMANENT MAINTENANCE OF STORMWATER FACILITIES

THIS MAINTENANCE COVENANT AND ACCESS EASEMENT ("Covenant Agreement") is made this ____ day of _____, 20___, between _____ ("Property Owner") and the CITY OF CHARLESTON, a municipal corporation organized under the laws of the State of South Carolina (the "City").

RECITALS

A. Property Owner is the owner of certain real property located in the City of Charleston, Charleston County, South Carolina, legally described on Exhibit A attached hereto and commonly known as _____ (the "Property").

B. The City has approved the Construction Activity Application submitted by the Property Owner for Development, Re-Development, or other Construction Activities. This Covenant Agreement applies to all Best Management Practices (BMPs) used by the Property Owner for the control of stormwater, including detention and retention ponds. This Covenant Agreement applies to all BMPs as described in the approved construction plans and any other BMPs that may hereafter be constructed on the Property.

C. To protect subsequent owners of the Property and owners of neighboring property, the City is requiring that Property Owner enter into this Covenant Agreement as a condition to the City's approval of the Construction Activity Application and approval of the final plat for the Property.

D. This Covenant Agreement is intended to protect the value and desirability of the real property described above, and shall inure to the benefit of all citizens of the City of Charleston and their successors and assigns.

COVENANT AGREEMENT

NOW, THEREFORE, for good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the City and Property Owner agree as follows:

A. The above stated recitals are incorporated herein by reference as if fully restated verbatim.

B. Definitions.

The following words and terms when used in this Article shall have the meaning respectively ascribed to them in this Section.

"Best Management Practices (BMPs)" are any structural or non-structural measure including, but not limited to stormwater detention and retention ponds or facility used for the control of stormwater runoff, be it for quantity or quality control. BMPs also include 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 measures that otherwise prevent or reduce the pollutant loading of receiving waters.

"Forebay" is a settling basin, engineered structure, or plunge pool constructed at the incoming discharge points of a stormwater BMP which helps to isolate the sediment deposition in an accessible area.

C. Covenant to Maintain and Repair.

Property Owner shall at all times maintain the BMPs in good working order, condition, and repair, clear of all debris, and in compliance with all applicable federal, state and municipal laws, rules, regulations, and guidelines (including those adopted from time to time by the City, including but not limited to, the City's Stormwater Design Standards Manual), and in accordance with the Property Owner Responsibilities set forth in this Covenant Agreement.

D. Property Owner Responsibilities.

1. Regular Inspections: Inspections shall be performed at least twice a year or more regularly as listed below. In the event of a sale or a transfer of property, the original set of inspection records or a copy of the original inspection records shall be provided to the new property owner. BMP Inspection reports shall be generated and kept on file for five (5) years. BMP Reports shall be made available to the City of Charleston within seven (7) business days upon written request. If such reports are generated by a third party, the reports shall remain the owner's (or owners') responsibility to maintain.
2. Routine Maintenance: Maintenance activities needed on a routine basis are listed below. All activities listed below shall be performed at the frequency specified below or more frequently as needed.
    a. Vegetation Management: If applicable, grass shall be mowed every two (2) weeks or more frequently as needed during the growing season.
    b. Inlet and Outlet Structures: Any blockage of inlet and outlet structures shall be removed immediately. Inlet and outlet protection shall be repaired or replaced as needed.
    c. Debris and Litter: Trash and other debris that collects in stormwater detention and retention ponds shall be removed immediately. Trash and other debris that collects in other BMPs shall be removed as recommended by the manufacturer or at a frequency such that the function of the BMP is not adversely affected.
3. Sediment Removal: BMPs will trap sediments and other material over time and shall be maintained in accordance with the submitted and City-approved post-construction maintenance plan. Removal of the sediment shall occur no less frequently than once per year for manufactured BMPs, or once every five years for stormwater detention and retention ponds, or as specified by the BMP manufacturer, whichever is more frequent.

If a Forebay exists, any trash or other debris shall be completely removed as discovered through routine maintenance activities or inspections.

4. Slope Stabilization/Structural Integrity: Slope erosion, sink holes, or other slope structural deficiencies shall be repaired upon discovery through routine maintenance activities or inspections.
5. The City of Charleston reserves the right to alter the maintenance schedule and required activity(ies) as necessary to ensure the proper function of a BMP.

E. Additional Responsibilities.

Additional routine or long-term maintenance activities to be performed on the BMPs. This section may also be used to replace the list of maintenance activities listed above or to list manufacturer requirements.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

F. Failure to Perform Covenant Agreement

If the City determines that Property Owner is not in compliance with the requirements contained in this Covenant Agreement, except in the case of emergency, the City or its designee shall give the Property Owner written notice to perform the maintenance and/or repair work specified in the notice. If such work is not performed to the City's satisfaction within seven (7) days after the date of such notice, Property Owner hereby grants to the City, its employees, independent contractors and designees the right to enter the Property to perform any and all work required to bring the BMPs into compliance with the requirements contained in this Covenant Agreement. The scope of work required shall be determined by the City at its sole discretion.

If the City determines that the Property Owner is not in compliance with the requirements contained in this Covenant Agreement and determines that there exists or will likely exist an emergency on or about the Property with respect to the BMPs, Property Owner hereby grants to the City, its employees, independent contractors and designees the right to enter the Property to perform any and all work required to bring the BMPs into compliance with the requirements contained in this Covenant Agreement, and in such case the City shall use reasonable efforts to notify the Property Owner prior to entering the Property.

G. Reimbursement.

If the City exercises its right to enter the Property under the authority granted to it by this Covenant Agreement (to include inspection, sampling, repairing, maintaining, and monitoring), Property Owner shall reimburse the City for all of its costs and expenses incurred in connection

therewith within thirty (30) days after receipt of an invoice from the City for such work. If Property Owner fails to pay the invoiced amount within such period, such amount shall thereafter accrue interest at a per annum rate equal to the prime rate being the rate from time to time publicly announced and published daily in the Wall Street Journal plus three percent (3%). Such amount, together with interest, shall be a lien on the Property (and each of the lots contained therein) which may be foreclosed in accordance with the law, as amended from time to time. If the Property is owned by more than one person (i.e., multiple lot owners), each such owner shall be jointly and severally liable for payment of the amounts provided for under the requirements contained in this Covenant Agreement.

H. Indemnification.

Property Owner agrees to indemnify, defend, and hold harmless the City, its employees, independent contractors and designees harmless from and against any liability, losses, costs, expenses (including reasonable attorneys' fees), claims or suits arising from Property Owner's failure to perform its obligations under this Covenant Agreement or any exercise of the City, its employees, independent contractors or designees of their rights under this Covenant Agreement.

I. Access Easement.

Property Owner hereby grants the City, its employees, independent contractors and designees a nonexclusive easement for ingress and egress over, across and under the Property for the purposes described in this Covenant Agreement and from time to time at the City's sole discretion to inspect, sample, and monitor components of the BMPs and discharges there from.

PROPERTY OWNER, FOR ITSELF AND ITS SUCCESSORS AND ASSIGNS (INCLUDING ALL OWNERS OF LOTS IN THE PROPERTY), AGREES THAT THE CITY, ITS EMPLOYEES, INDEPENDENT CONTRACTORS AND/OR DESIGNEES SHALL NOT HAVE ANY OBLIGATION TO EXERCISE THEIR RIGHTS UNDER THIS COVENANT AGREEMENT OR TO PERFORM ANY MAINTENANCE OR REPAIR OF THE BMPS, AND THAT THE CITY, ITS EMPLOYEES, INDEPENDENT CONTRACTORS AND/OR DESIGNEES SHALL NOT HAVE ANY LIABILITY TO PROPERTY OWNER OR ANY OF PROPERTY OWNER'S SUCCESSORS OR ASSIGNS (INCLUDING OWNERS OF LOTS IN THE PROPERTY) IN CONNECTION WITH THE EXERCISE OR NONEXERCISE OF SUCH RIGHTS, THE MAINTENANCE OR REPAIR OF THE BMPS, OR THE FAILURE TO PERFORM THE SAME.

J. This Covenant Agreement Runs with the Land.

The parties' rights and obligations contained herein shall run with the land and inure to the benefit of, and shall be binding upon, the City and Property Owner and their respective successors and assigns including, without limitation, subsequent owners of the Property and any homeowner's association owning common areas on the Property.

K. Assignment.

The obligations of the Property Owner (and subsequent owners of the Property) under this Covenant Agreement shall not be assigned except (a) in connection with the sale of the

property owned by such person (in which case the transferee shall assume such obligations), or (b) with the prior written consent of the City.

L. Authority.

By executing this Covenant Agreement, the Property Owner represents and warrants to the City that he or she has the full power and authority to do so and that the Property Owner has full right and authority to enter into this Covenant Agreement and perform its obligations under this Covenant Agreement.

M. Entire Covenant Agreement.

This Covenant Agreement constitutes the entire Covenant Agreement between the parties, and supersedes all prior discussion, negotiations, and all agreements whatsoever whether oral or written.

N. Governing Laws.

The laws of South Carolina shall govern this Covenant Agreement. Any and all litigation arising under or as a result of said Covenant Agreement shall be litigated in the Circuit Court in the Ninth Judicial Circuit of Charleston County, South Carolina.

PROPERTY AND BMP DESCRIPTIONS

PARCEL/TMS#:_____

NAME & TYPE OF BMP(S):

_____
_____
_____
_____
_____
_____
_____

LOCATION OF BMP(S):

_____
_____
_____
_____
_____
_____
_____

PROPERTY DEED RECORDED DATE:

_____

TITLE OF SITE PLAN:

_____
(Shall exactly match the title given on application for a land disturbance permit)

PROJECT ENGINEERING FIRM:

_____

PROJECT CONSTRUCTION FIRM:

_____

NUMBER & DATE OF LAND DISTURBANCE PERMIT:

_____

ENGINEERING DIVISION APPROVAL OF MAINTENANCE CONVENANTS

_____
Plan Review Engineer or Public Service Department Designee Date

PROPERTY OWNERS

NAME : _____

ADDRESS: _____

CITY: _____ **STATE:** _____ **ZIP CODE:** _____

PHONE: _____ **FAX:** _____

E-MAIL: _____

NAME : _____

ADDRESS: _____

CITY: _____ **STATE:** _____ **ZIP CODE:** _____

PHONE: _____ **FAX:** _____

E-MAIL: _____

NAME : _____

ADDRESS: _____

CITY: _____ **STATE:** _____ **ZIP CODE:** _____

PHONE: _____ **FAX:** _____

E-MAIL: _____

IN WITNESS WHEREOF, the Property Owner and the City have executed this Covenant Agreement on the date first written above.

PROPERTY OWNER: _____

BY: _____ ITS: _____

Witness: _____Printed Name_____

Witness: _____Printed Name_____

STATE OF SOUTH CAROLINA) ss
County of Charleston)

This instrument was acknowledged before me on _____, by _____ as _____.

_____
Notary Public for South Carolina
My Commission Expires_____

THE CITY OF CHARLESTON, SOUTH CAROLINA

BY: _____ ITS: _____

Witness: _____Printed Name_____

Witness: _____Printed Name_____

STATE OF SOUTH CAROLINA) ss
County of Charleston)

This instrument was acknowledged before me on _____, by _____ as _____ of the City of Charleston.

_____
Notary Public for South Carolina
My Commission Expires_____

CITY OF CHARLESTON, SOUTH CAROLINA

Department of Public Service
Engineering Division

TRANSFER OF CONSTRUCTION ACTIVITY APPLICATION
City of Charleston

A. Name of Activity:
_____

B. City of Charleston Application 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: Requested Transfer Date (MM/DD/YYYY): __ __/__ __/__ __ __ __
   a. Is the entire permit being transferred to a new Permit Holder? 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 (By TMS# or Lot #).
   _____

H. Other Information:
   a. If there are no modifications being made to the plans, include one (1) set 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 clearly identifying the lot or group of lots that are being transferred.
   c. Include a transfer of ownership fee of $100.00 with the plans.
   d. YOU MUST ATTACH TO THIS APPLICATION A LEGAL DESCRIPTION OF THE PROPERTY BEING TRANSFERRED.
   e. By signing this application, the new applicant is certifying that he/she has read through the existing maintenance agreement, fully understands the maintenance responsibilities, and fully accepts the maintenance responsibilities.

Original Applicant's Certification

"I hereby am requesting that the responsibility and ownership of the City Permit listed in Item B above be transferred to the individual/entity listed in Item D above. I hereby agree that the responsibility and ownership of the City Permit listed in Item B above will continue to be my responsibility until such time as this application is signed and filed at the office of the Register Mesne Conveyance for Charleston County, South Carolina by the City of Charleston.

_____ _____ _____

Applicant's Printed Name Applicant's Signature Date

NEW APPLICANT'S CERTIFICATION

"I hereby agree to accept the responsibility and ownership of the City Permit listed in Item B above. I further certify that all construction and/or development shall be done pursuant to this Permit and I am responsible for the construction activities and related maintenance thereof once this application is signed and filed at the office of the Register Mesne Conveyance for Charleston County, South Carolina by the City of Charleston. I authorize the City of Charleston and its designees to enter the property for the purpose of on-site inspections at any time.

_____ _____ _____

Applicant's Printed Name Applicant's Signature Date

This Application has been approved by the City of Charleston.

_____ _____ _____

Printed Name & Title Signature Date

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APPENDIX E

TMDLS AND IMPAIRED WATERS

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As the date of this Manual, a list of adopted TMDLs, as well as other impaired waters can be found at the website address below or by contacting SCDHEC directly.

http://www.scdhec.net/environment/water/tmdl/index.htm

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APPENDIX F

CONSTRUCTION APPLICATION APPROVAL PROCESS FLOWCHARTS

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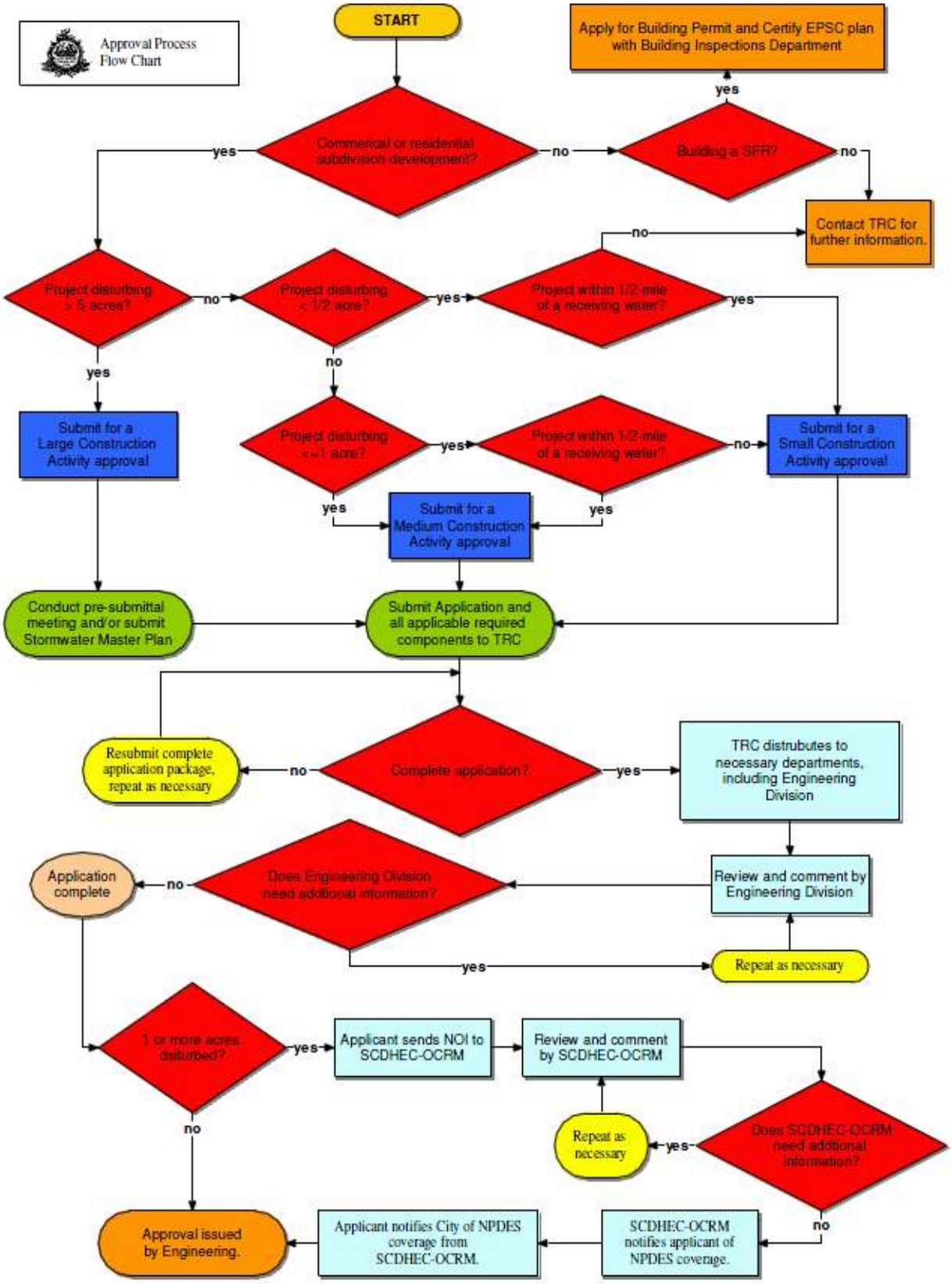
Approval Process Flow Chart
START
Apply for Building Permit and Certify EPSC plan with Building Inspections Department
yes
Commerical or residential subdivision development?
yes
no
Building a SFR?
no
Contact TRC for further information.
no
Project disturbing > 5 acres?
no
Project disturbing < 1/2 acre?
yes
Project within 1/2 mile of a receiving water?
yes
yes
no
Submit for a Large Construction Activity approval
Project disturbing <=1 acre?
yes
Project within 1/2 mile of a receiving water?
no
Submit for a Small Construction Activity approval
yes
Submit for a Medium Construction Activity approval
yes
Conduct pre-submittal meeting and/or submit Stormwater Master Plan
Submit Application and all applicable required components to TRC
Resubmit complete application package, repeat as necessary
no
Complete application?
yes
TRC distrubutes to necessary departments, including Engineering Division
Application complete
no
Does Engineering Division need additional information?
Review and comment by Engineering Division
yes
Repeat as necessary
1 or more acres disturbed?
yes
Applicant sends NOI to SCDHEC-OCRM
Review and comment by SCDHEC-OCRM
no
Repeat as necessary
yes
Does SCDHEC-OCRM need additional information?
no
Approval issued by Engineering.
Applicant notifies City of NPDES coverage from SCDHEC-OCRM.
SCDHEC-OCRM notifies applicant of NPDES coverage.

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APPENDIX G

TABLES 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 HSG B SOILS MAY REQUIRE INFILTRATION TESTING
Wet Extended Pond with Aquatic Bench	LOW	LOW	X	X	10 MIN 25 PREFERRED	
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
Sand Filtration Facilities	HIGH	HIGH			5 MAX 2 PREFFERED	REQUIRE PRETREATMENT
Infiltration Trenches	HIGH	HIGH			5 MAX	INFILTRATION RATE > 0.5 IN/HR
Enhanced Dry Swales	LOW	MODERATE			5 MAX	PERMEABLE SOIL
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

	Pollutant Removal Efficiency %					
BMP	**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

STORMWATER REVIEW CHECKLISTS

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City of Charleston Guide for Design of Development and Re-Development Activities

This checklist will be used by the City of Charleston in reviewing proposed construction, development, or re-development activity applications. This guide shows the components for the activity types (Single Family Residential [SFR], Small Construction Activity, Medium Construction Activity, Large Construction Activity, and Utility/Linear). In the event there is a conflict between this guide and the Stormwater Management Ordinance or the Stormwater Design Manual, the Stormwater Management Ordinance and Stormwater Design Manual shall prevail.

The submitted information shall include three parts: the application, the technical engineering calculations and discussions, and the construction documents (plans, details, specifications, Stormwater Pollution Prevention Plan [SWPPP]).

Please indicate the location and/or page number(s) where each item below can be found in your SWPPP or supporting calculations. If an item is not applicable, put N/A. The City of Charleston reserves the right to modify this checklist at any time.

Project Name:_____

Checklist Completed by:

Printed name: _____ Signature: _____ Date:_____

I. APPLICATION FORM **Application Types: ALL**

- All applications shall be completed in full
- Signatory authority (original signatures) shall be provided

II. TECHNICAL REPORT/ENGINEERING CALCULATIONS

1**. REPORT COMPOSITION:** **Application Types: II and III**

- Table of Contents.
- A summary table shall include the following at a minimum:
    a. All hydrologic results (design storms and distribution type, peak discharges, pre- and post-development, CN, T_c, Peak Rate Factor [PRF]),
    b. Results of hydraulic calculations (road overtopping, velocities, 100-yr event analysis) and methodologies,
    c. Methodology/models used,
    d. Tidal considerations,
    e. Documentation showing that post-development peak stages are below minimum finished floor elevation, that the ponds accommodate the 100 year storm event without exceeding 1 foot of freeboard, and that the system will not cause increased frequency of dwelling flooding, property damage, or public access and/or utility interruption, and
    f. Results of water quality calculations
- Report shall be put together in a manner that facilitates review
- Report shall be prepared by Tier A licensed professional engineer
- Two copies shall be submitted

2. **MAP(S):** **Application Types: ALL**

All shall include:

- North arrow and scale
- Outlined activity location
- Labeled road names

- Nearest labeled water bodies, discharge points, and Receiving Waters
- Location of any nearby protected areas (waters, wetlands, etc.)
- Topographic information showing runoff patterns/overland flow paths
- Soil types
- 100-year floodplain contours
- Wetlands

Note: Simple sketches will suffice for SFR, Utility, and Type 1 applications at the discretion of the Director of Public Service

3. **PROJECT NARRATIVE:** **Application Types: ALL**

- A general description of the site, purpose of the activity, any conflicts or special considerations with adjacent properties and owners, water bodies receiving stormwater runoff, any potential problems with site soils, existing water quality and flooding considerations, anticipated impacts (quality, downstream structures, etc.) and benefits (open space, treatment, maintenance, etc.) of the activity
- A summary table of existing and proposed runoff flows, volumes, and pollutant loads
- A discussion of issues relating to other State and Federal permits needed or regulations to be followed
- A summary of the maintenance of the stormwater system and arrangements for post-construction maintenance responsibility. Maintenance agreements and/or operating permits must be provided in the application or otherwise addressed
- Simple narratives will suffice for SFR, Utility, and Type I activity applications at the discretion of the Director of Public Service
- Increased level of detail is required for Type II and Type III activity applications

4. **HYDROLOGIC ANALYSIS:** **Application Types: II and III**

- Proper delineation of the site shown on maps or construction plans on D-size sheets or larger
- Pre- and post- development hydrologic analysis calculations for the 2-, 10-, 25-, 50-, and 100-year storm events, as necessary, at each outfall point. Analysis should be performed at the same points and with the same drainage area for both pre- and post-development conditions and correspond to the delineation. Hydrograph calculations should be provided as needed.
- Analysis performed using SCS methodology. Rational method is not acceptable for Type II and Type III activities.
- Use rainfall data in accordance with Chapter 3

5. **DETENTION ANALYSIS/DESIGN:** **Application Types: II and III**

Analysis

- Pond routing using a volume based hydrograph for the 2-, 10-, 25-, 50- and 100-year SCS Type III 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)
- 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 in item 10].)
- Inputs and outputs from analysis program
- Summary table of the peak inflows, peak outflows, and maximum water surface elevations (WSE) for the 2-, 5-, 10-, 25- and 100-year storm events for each pond
- Stage-storage-discharge relationship for the outlet structure of each detention structure
- If a rating curve for the outlet structure must be generated externally from the analysis program (Drain:Edge, HEC-1, HydroCAD), include data and equations used to rate the outlet structure

Design

- Detail of the outlet structure and cross-section of the dam, including elevations and dimensions that correspond to the calculations
- Orifice constructability considerations (do not specify orifice diameters with increments of less than ¼")
- Maximum WSE for the 100-year storm event below the embankment with a minimum of 0.5-ft of freeboard
- The volume within any structure used for water quantity control shall be drained from the structure within 72 hours
- Bottom of all detention and retention ponds graded shall have a slope of not less than 0.5% toward the outlet structure(s) and side slopes no steeper than 3:1 unless adequately protected
- If the pond is to be used for sediment control during construction, outlet structure shall be sufficiently protected. Adequate access and maintenance shelf for routine dredging shall be present.
- Permanent maintenance access to all permanent detention structures (easements may be needed for structures surrounded by lots)
- Infiltration and underground detention systems designed in accordance with Chapter 3.
- Emergency spillways shall not be built on fill slopes
- If pond is to be used to meet water quality requirements, a forebay, designed in accordance with this manual, is required
- Installation of a trash rack or other debris-screening device is recommended on all pond risers

6. **HYDRAULIC DESIGN:** **Application Types: II and III**

- Design calculations for all conveyances, inlets, and outlets shall be based on the contributing area, allowable velocities, and upstream and downstream conditions
- Upstream and downstream analysis shall demonstrate that the activity will not impact new and existing structures or reduce downstream system capacity
- Engineer shall ensure the proper design storms were used at the appropriate design points

7. **WATER QUALITY REQUIREMENTS:** **Application Types: II and III**

- Permanent water quality shall be addressed (all activities or Larger Common Plans that disturb 1 or more acres)
- Wet ponds designed to catch the first ½" of runoff from the entire area draining to the pond and then release the captured volume in a minimum of 24 hours
- Dry ponds designed to catch the first 1" of runoff from the entire area draining to the pond and then release the captured volume in a minimum of 24 hours
- All projects 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.
- For areas not draining to a pond, demonstrate how permanent water quality requirements shall be addressed
- Receiving waters shall not be used for permanent water quality control. Alternative means of treatment shall be used if an existing pond is to be used for water quantity control.

Note: Other non-traditional stormwater controls such as Bioretention areas, constructed wetlands, etc may be used.

Note: Pre-fabricated or proprietary treatment devices are approved on a case-by-case basis if adequate removal efficiency can be demonstrated. Provide pollutant removal efficiency data from a third-party testing company. Type of system to be used shall be based on the ability to remove the pollutants of concern in that area/situation (i.e. bacteria, hydrocarbons, etc.).

8. **INLET PROTECTION:** **Application Types: II and III**

- Shall be provided at all inlets (no hay bales)
- Steel posts and buried wire-reinforced fabric shall be used for filter fabric inlet protection
- Inlet protection details shall be provided for pre-paving and post-paving of roadways

9. **DISCHARGE POINTS:** **Application Types: II and III**

- The post-development discharge rates shall be less than pre-development discharge rates for each discharge point for the 2-, 10, and 25-year storm events.
- Storm drainage or pond outfalls shall be connected to an existing drainage outfall such as a pipe, ditch, easement, etc
- New point discharges shall not discharge onto adjacent property where there was not a point discharge previously without providing the adjacent property owner's written consent
- A 20-foot minimum buffer between the property line and the end of all pipes shall be provided or energy dissipation measures shall be installed
- Outlets shall not discharge on fill slopes.
- Headwall with wings shall be required for discharge pipes greater than 24-inches
- Headwalls shall be required in major drainage channels
- All outlets shall be stabilized
- Riprap aprons shall be sized appropriately
- Riprap details shall show apron dimensions and stone sizes
- Filter fabric shall be installed beneath all riprap

10. **SLOPE AND/OR CHANNEL STABILIZATION:** **Application Types: II and III**

- All slopes shall be designed and stabilized properly
- All channels and diversion ditches shall be able to accommodate the 10-year storm event with non-erosive velocities during construction and post-construction.
- Rock check dams shall be provided in temporary diversion
- Include installation detail for erosion control blanket (ECB) or turn reinforcement matting (TRM) if ECBs or TRMs to be used
- For all slopes steeper than 1.5:1, stabilization practices shall be identified (e.g., ECB, TRM)
  Note: Measures, in addition to grassing or hydroseeding, include synthetic or vegetative matting, diversion berms, temporary slope drains, etc.
  Note: If retaining walls or fill slopes are to be constructed at the downstream property line, a 10' buffer is required for construction and maintenance.

11. **UTILITY/LINEAR LINES:** **Application Types: II, III, and Utility**

- Ensure limits of disturbance only include areas disturbed for water, sewer, gas, and electric line installation
- Ensure the utility company is covered by the SCDHEC General Stormwater Permit

12. **SEDIMENTOLOGY:** **Application Types: II and III**

- BMPs shall be properly placed (silt fence, inlet protection, construction entrance, rip-rap at outfalls, check dams etc.)
- Trapping efficiency calculations demonstrating that all sediment basins/ traps or other BMPs are capable of achieving a sediment trapping efficiency of 80 percent for suspended solids or 0.5 ML/L peak settable solids concentration, which ever is less, shall be required. The efficiency shall be calculated for disturbed conditions for the 10-year, 24-hour design event.
- Sediment basins shall provide storage for the 10-year, 24-hour storm event for disturbed conditions if 10 acres or more drain to a common point (stream, lake, property line, etc.).
- Sediment traps shall be used only for drainage areas of less than 5 acres
- Trapping efficiency calculations shall be complete, specifying methods, assumptions, and results
- Sediment basins and traps shall be designed for total area draining to them

- Drainage area map shall outline the area draining to each basin/trap
- Copies of any figures used to determine V_{15} and trapping efficiencies shall be included. The Design Aids in SCDHEC (2003) may be used for these calculations.
- Silt fence shall be used only in areas with drainage areas of less than ¼ acre per 100 LF of fence and shall not be used in areas with concentrated flows
- Clean-out stake, marked at ½ the designed sediment storage depth, shall be provided in all sediment basins/sediment traps
- Clear cutting (including tree stump removal) shall be limited to 10 acres
- Construction schedule with timeline for each activity shall be included

  Note: SCDHEC (2003) and SCDHEC (2005) provide information on the design of these and other devices.

  Note: The Design Aids in SCDHEC (2003) shall not be used to determine trapping efficiencies for structures in series. If the flow for the10-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.

13. **RECEIVING WATERS, INCLUDING WETLANDS:** **Application Types: ALL**

- Delineation of all Receiving Waters located on the site, including wetlands, shall be shown and labeled on plans
- If impacts to Receiving Waters, areas of impact shall be outlined and labeled such that no work can begin in this area until all necessary USACE permits and SCDHEC 401 certifications have been obtained
- Double row of silt fence shall be provided in all areas where a 50' undisturbed buffer cannot be maintained between the disturbed area and the Receiving Waters
- Minimum 10' maintenance buffer shall be provided between last row of silt fence and Receiving Waters; or, if buffer not provided, then a statement from Tier A professional engineer on plans indicating how silt fence will be installed and maintained without impacts to Receiving Waters shall be included on the plans.

  Note: If there are proposed impacts to Receiving Waters, then applicant shall contact the USACE (866-329-8187) and/or SCDHEC Water Quality Certification, Standards & Wetlands Programs Section (803-898-4300) to determine additional requirements before submitting the application to the City.

  Note: If Receiving Waters are to be impacted, work shall not be performed in these designated areas until all necessary permits have been acquired.

  Note: If USACE permit is required for construction of a permanent stormwater management structure, the City's final approval shall not be granted until all applicable State and Federal permits have been obtained. A preliminary approval is issued instead.

14. **SPECIAL PROTECTION AREAS:** **Application Types: II and III**

- 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
- If nearest WQMS is listed on the latest 303(d) List of Impaired Waters and if site's stormwater construction discharges contain the pollutant of impairment and if the project disturbs 25 or more acres, then qualitative and quantitative assessment is required (described in Section 3.4C of SCR100000)
- Evaluate selected BMPs if nearest WQMS is listed on the latest 303(d) List of Impaired Waters and if site's stormwater construction discharges contain the pollutant of impairment and if site disturbs less than 25 acres

- If an Approved 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 on the SWPPP meet assumptions and requirements of TMDL (may need to contact DHEC Watershed Manager for assistance)

15. **POST-CONSTRUCTION MAINTENANCE PLAN:** **Application Types: ALL**
- Submit a signed agreement accepting ownership and maintenance of the stormwater management structures (Covenant Agreement)
- Provide a description of maintenance plan to be used
- Provide a schedule of maintenance procedures, including time to replacement
- Provide a detailed, manufacturer-specific maintenance plan for proprietary control devices (oil-water separators, etc.), underground detention structures, and non-traditional stormwater controls (constructed wetlands, bioretention, etc.)
- Typical maintenance items to be addressed include:
    - Grass to be mowed
    - Trees to be maintained
    - Trash to be removed from within and around the pond outlet structure and outlet pipes to be cleaned, inspected, and repaired, sediment accumulation to be removed from pond(s)
    - Energy dissipater to be cleaned and repaired
    - Pond bottom to be regraded to provide proper drainage towards the outlet discharge point and/or energy dissipater to be cleaned and repaired
    - Emergency spillway, if applicable, to be inspected and erosion repaired on side slopes, if present
    - A Transfer of Ownership application shall be approved by the Director of Public Service before ownership and maintenance responsibilities of the stormwater BMP are transferred
    - Specific maintenance items particular to more complex structures

16. **ACCESS:** **Application Types: ALL**
- Demonstrate that project layout has considered access for maintenance and inspection during and after construction

17. **DETENTION VARIANCE:** **Application Types: II and III**
- If the 2- and 10-year post development flow rates exceed the pre-development rates, variances for detention may be granted in accordance with Chapter 2
- Justification shall be provided in a separate written request and demonstrate that:
    - The proposed activity will have no significant adverse impact on the receiving natural waterway or downstream properties; or
    - The imposition of peak control requirement for rates of stormwater runoff would aggravate downstream flooding
- Variance application shall be signed by the project's Professional Engineer
- Variance from water quality criteria is not allowed, however, another equivalent method or criteria may be considered for water quantity

Standard Notes

1. If necessary, slopes that exceed eight (8) vertical feet shall 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.

2. 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 (14) days after work has ceased, except as stated below:
   - Where stabilization by the 14th day is precluded by snow cover or frozen ground conditions, stabilization measures shall be initiated as soon as practicable.
   - Where construction activity on a portion of the Site is temporarily ceased and earth-disturbing activities will be resumed within 14 days, temporary stabilization measures do not have to be initiated on that portion of the Site.

3. All sediment and erosion control devices shall be inspected every seven (7) days. If site inspections identify BMPs that are damaged or are not operating effectively, maintenance must be performed as soon as practical or as reasonably possible and before the next storm event whenever practicable.

4. 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 immediately after the utility installation. Fill, cover, and temporary seeding at the end of each day are recommended. If water is encountered while trenching, the water shall be filtered to remove any sediments before being pumped back into any waters of the State.

5. 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 fully stabilized.

6. The contractor shall take necessary action to minimize the tracking of mud onto paved roadway(s) from construction areas and the generation of dust. The contractor shall daily remove mud/soil from pavement, as may be required.

7. Residential subdivisions require erosion control features for infrastructure as well as for individual lot construction. Individual property owners shall follow these plans during construction or obtain approval of an individual plan in accordance with S.C Reg. 72-300 et seq. and SCR100000.

8. 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.

9. All Waters of the State (WoS), including wetlands, shall be flagged or otherwise clearly marked in the field. A double row of silt fence shall be installed in all areas where a 50-foot buffer cannot be maintained between the disturbed area and all WoS. A 10-foot buffer shall be maintained between the last row of silt fence and all WoS.

10. Litter, construction debris, oils, fuels, building products with significant potential for impact (such as stockpiles of freshly treated lumber), and construction chemicals that could be exposed to storm water shall be prevented from becoming a pollutant source in storm water discharges.

APPENDIX I

INSPECTION CHECKLIST

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Items Engineering Inspectors may address during each site inspection will include, but shall not be limited to, are as follows:

1. Description of current weather
2. Description of last precipitation event
3. Are contractor's maintenance logs available?
4. Are contractor's set of plans available on-site?
5. What is the current status of construction? (Beginning, middle, nearing completion, complete)
6. Have areas been cleared and if so, does the total area exceed the 25-acre limit?
7. Are there any waterbody impacts (sediment, oil, grease, etc)?
8. Are there any roadway impacts (sediments, damaged asphalt, etc.)?
9. Have any adjacent properties been negatively impacted?
10. If yes to questions 7-9, description of the extent of the impacts
11. Are there any air/dust impacts?
12. Description of air/dust impacts.
13. Are all structural EPSC/BMPs working, properly installed, and in good condition?
14. Are the EPSC/BMP devices providing adequate protection?
15. Do any EPSC/BMP devices need to be removed or additional BMPs added?
16. Is pollution leaving the site?
17. Are there any instances of erosion across the site?
18. Is any enforcement action necessary?
19. Possible re-inspection date:
20. Record any additional comments as necessary

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APPENDIX J

ENFORCEMENT FORMS

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CITY OF CHARLESTON, SOUTH CAROLINA

Department of Public Service

Engineering Division

CORRECTION ORDER

Date:

Name:
Address:
City, State Zip code:

Project:_____
Project Address: _____
TMS No.:_____
NPDES Permit Coverage No.:_____

You are hereby served notice that you are in violation of City of Charleston's Stormwater Management Ordinance at the above mentioned site.

This warning is based on items of non-compliance noted on a City of Charleston inspection on _____. A verbal warning was also given to _____ at the time of the inspection. A copy of the inspection report detailing the deficiencies is enclosed with this correction order.

The deficiencies noted on the inspection report must be corrected by _____. At that time our inspector will re-visit your site. Failure to comply with this warning is considered a violation of the City of Charleston 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 843-724-3761 (Engineering Division).

Signed by: _____

Printed Name: _____

Additional Notes:

CITY OF CHARLESTON, SOUTH CAROLINA

Department of Public Service

Engineering Division

NOTICE OF VIOLATION

Date:

Name
Address
City, State Zip code

Project:_____
Project Address: _____
TMS No.:_____
NPDES Permit Coverage No.:_____

You are hereby served notice that you are in violation of City of Charleston's Stormwater Management Ordinance at the above mentioned site.

This violation is due to:

[ ] failure to comply with a Correction Order issued on _____.
[ ] non-compliance issues noted during a City of Charleston inspection completed on _____.
(check one or both)

A copy of the inspection report detailing the deficiencies is enclosed with this Notice of Violation.

The deficiencies noted on the inspection report must be corrected within **3 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 **criminal citation.**

If you have any questions concerning this violation you, can contact our office at 843-724-3761 (Engineering Division).

Signed by: _____

Printed Name: _____

Additional Notes:

CITY OF CHARLESTON, SOUTH CAROLINA

Department of Public Service

Engineering Division

STOP WORK ORDER

Date:

Name
Address
City, State Zip code

Project:_____
Project Address: _____
TMS No.:_____
NPDES Permit Coverage No.:_____

You are hereby served notice that you are in violation of the City of Charleston's Stormwater Management Ordinance at the above mentioned site. A **STOP WORK ORDER** is being posted on this property effective **IMMEDIATELY.**

[ ] failure to comply with a Notice of Violation issued on _____.
[ ] non-compliance issues noted during a City of Charleston inspection completed on _____.
(check one or both)

A copy of the inspection report detailing the deficiencies is enclosed with this Stop Work Order.

Your site must be inspected by a City of Charleston 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 criminal citation.

If you have any questions concerning this violation you, can contact our office at 843-724-3761 (Engineering Division).

Signed by: _____

Printed Name: _____

Additional Notes:

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APPENDIX K

CHURCH CREEK BASIN MAP

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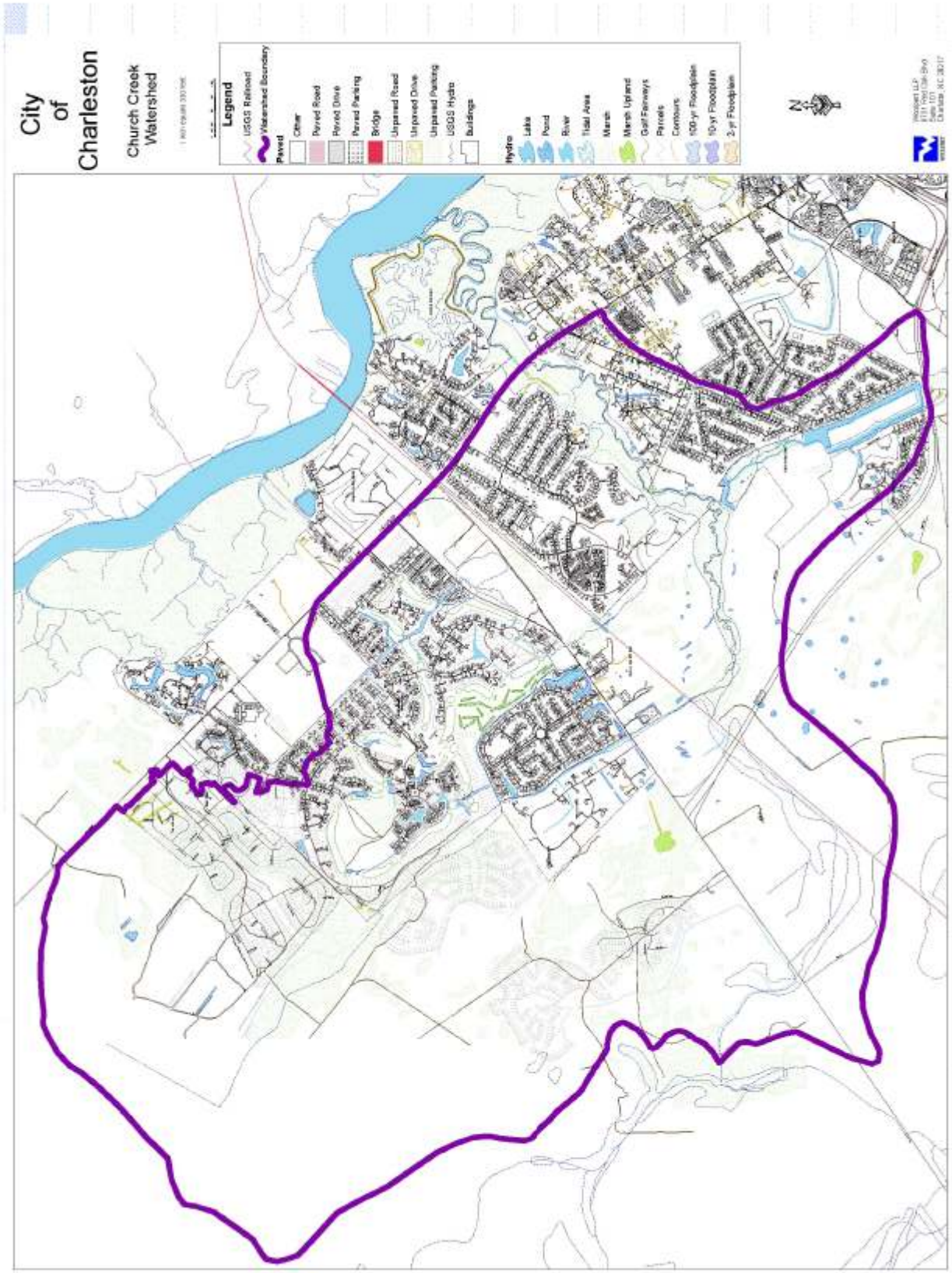
City of Charleston
Church Creek Watershed
Legend
USGS Railroad
Watershed Boundary
Paved
Other
Paved Road
Paved Drive
Paved Parking
Bridge
Unpaved Road
Unpaved Drive
Unpaved Parking
USGS Hydro
Buildings
Hydro
Lake
Pond
River
Tidal Area
Marsh
Marsh Upland
Golf Fairways
Parcels
Contours
100-yr Floodplain
10-yr Floodplain
2-yr Floodplain
N

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