City of Rocky Mount, North Carolina
Stormwater Design Manual

Chapter 1: General Design Criteria

December 2006

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Disclaimer

To the best of their ability, the authors have insured that material presented in this manual is accurate and reliable. The design of engineered facilities, however, requires considerable judgment on the part of designer. It is the responsibility of the designer to insure that techniques utilized are appropriate for a given situation. The City of Rocky Mount therefore accepts no responsibility for any loss, damage, or injury as a result of the use of this manual.

Chapter 1: General Design Criteria

1.1 Introduction

The intent of this manual is to serve as a reference for City staff and practicing professionals in designing storm drainage facilities within the City of Rocky Mount (the City) and its extraterritorial jurisdiction. It is primarily a compilation of the City's accepted design procedures and practices. Design criteria listed herein are the general policy of the City of Rocky Mount and may not be applicable in every situation. Where the designer determines that conformance with this manual would create an unreasonable hardship or where an alternative design may be more appropriate, alternative designs may be accepted upon written authorization from the Director of Engineering or his designee. In order to insure good engineering design, the City staff may occasionally require more stringent standards than those presented here. This manual may also be subject to periodic change by the City staff. When changes are required, revisions will be made available via the City of Rocky Mount website.

Engineering construction specifications are contained in a separate manual entitled "City of Rocky Mount Department of Engineering Manual of Specifications", which can be obtained from the City Engineering Department.

Engineering standard details are available via the City of Rocky Mount website at http://www.ci.rocky-mount.nc.us/engineering/main.html.

The City of Rocky Mount Stormwater Design Manual consists of 3 Chapters. Chapter 1 – General Design Criteria discusses the overall minimum design criteria for storm drainage systems within the City's jurisdiction and the stormwater management criteria for new development. Chapter 2 – Structural Best Management Practices presents the acceptable structural measures that can be used to control stormwater along with minimum design and maintenance criteria. Chapter 3 – Design Calculations presents the acceptable hydrologic and hydraulic methodologies, parameters, and in some cases, equations that are required to demonstrate compliance with the minimum design criteria.

1.2 Stormwater Management Overview

Stormwater management in the City of Rocky Mount addresses issues related to the proper control of stormwater runoff in both quantity (site and roadway drainage and flood conveyance) and quality (nutrients and suspended solids). The City has adopted a variety of regulations, ordinances and policies that serve as the

foundation of the City's design standards for the management of the quantity and quality of stormwater runoff. These standards are designed to protect the health and welfare of the residents of Rocky Mount, to protect the environment, and to protect those who live downstream from Rocky Mount. The following sections of this chapter present the minimum standards related to stormwater management within the City of Rocky Mount.

1.3 Plan Submittal Requirements

The City of Rocky Mount requires a separate site stormwater management plan submittal for all developments greater than ½ acre. The stormwater management plan submittal shall include the complete storm drainage system and all of the supporting calculations for review. All stormwater management plans shall include a completed City of Rocky Mount Stormwater Management Summary Sheet, unless the project is exempt or receives a written exemption from the Director of Engineering, and all of the relevant calculation forms provided in this stormwater design manual.

The stormwater management plan supporting information shall include the following:

- Location map.
- Overall site map showing the proposed site, surrounding properties, and zoning information.
- Existing condition drainage area map showing the existing stormwater outfall locations and existing land use. The drainage area map shall be the City topographic map unless more detailed topography is available. The existing drainage area map shall be large enough to show portions of the upstream and downstream drainage areas. Soil survey information shall be shown, including boundaries and hydrologic classification as identified by the NRCS
- Existing storm drainage pipes including offsite storm drainage pipes that either discharge onto the site, run parallel to the site, or will receive stormwater runoff from the site.
- Seasonal high water table, as needed for BMP design.
- Proposed condition drainage area map showing the proposed site improvements and the stormwater outfall locations. The proposed drainage area map shall be consistent with the catchment and outfall areas identified in the Stormwater Management Summary Sheet.
- All storm drainage catch basins, drop inlets, junction boxes and pipe locations and sizes along with the supporting inlet design chart, pipe design chart, and hydraulic grade line calculations as provided in Chapter 3 – Calculations.

- Profiles of all storm drainage pipe systems. The profiles shall show existing and proposed utility crossings.
- All open channel locations including vegetated swales, trapezoidal ditches, intermittent streams and perennial streams along with supporting design calculations.
- All culvert crossings locations and sizes with the supporting culvert calculation sheets.
- All structural BMPs and supporting calculations including hydrograph routings, water quality volumes, spillway and volume rating curves, outlet protection and other calculations identified in Chapter 2 – Structural BMP Design Criteria.
- Structural BMP operation and maintenance plan.
- All flood zones including those calculated as required by this manual. The floodplain and floodway boundaries shall be clearly labeled to identify the boundary source such as FEMA 100-year floodplain or calculated 100-year floodplain.
- All wooded pervious areas clearly identified with a metes and bounds description. A written conservation easement for the wooded pervious area must be executed prior to plan approval
- All proposed Finish Floor Elevations of buildings.
- All riparian or vegetated buffers shall be shown and clearly labeled.
- All existing and proposed drainage and utility easements.
- All existing wetlands, perennial and intermittent streams.
- All proposed site utilities in plan view.
- If the project is phased, a schedule for implementation of all proposed water quality BMPs that specifies when the BMP(s) will be on-line with respect to the development schedule for the drainage area serviced by the BMP.
- Certification by a North Carolina registered professional engineer, registered landscape architect, or registered land surveyor who is qualified in hydrology and hydraulics, stating that the plans comply with the standards in the City of Rocky Mount Stormwater Design Manual.
- Peak runoff calculations to each outfall leaving a site and any required BMP's to meet peak runoff control requirements.

1.3.1 Record Drawings

Upon completion of the new construction, the developer is required to provide "record drawings", certified by a NC registered professional engineer, landscape architect, or land surveyor, prior to receiving an occupancy permit for the property.

1.4 General Design Criteria

New construction within the Rocky Mount jurisdictional area is subject to various City requirements. The following general requirements apply to both private development as well as City projects, unless the designer requests and receives approval for alternative designs from the Director of Engineering or his designee.

The City of Rocky Mount must approve all new or revised stormwater discharges from private property to a publicly maintained storm drainage system. The owner of the property or the developer may make written application to the City for stormwater discharge or may submit a stormwater management plan for City staff review under the terms of the Zoning Ordinance or General Plan Project Submittal Policy.

For all non-single family residential projects that are ½ acre or larger and single family residential projects that are 1 acre or larger, the owner or developer shall provide a stormwater management plan and supporting calculations to the City for review. The City reserves the right to require a drainage plan and calculations for projects less than a ½ acre if deemed necessary by the Director of Engineering.

A conveyance system shall be properly designed and installed when stormwater runoff is equal to or greater than 5 cubic feet per second (cfs) for the 10-year storm. A properly designed conveyance system may include a vegetated swale, open channel, catch basin with pipe, stream and floodplain, culvert or structural Best Management Practice (BMP).

When development of an area changes the flow regime from sheet flow to concentrated flow, the drainage system shall be designed to minimize impacts of the concentrated flow on adjoining properties by tying into existing drainage systems using multiple outlets, through agreements with adjacent owners, or other appropriate means.

No concentrated flow shall be discharged across walkways. Provisions are to be made through piping or other means to carry the flow under the walkway.

All stormwater drainage systems that will be maintained by the City of Rocky Mount and convey between 5 and 50 cfs shall be piped, unless those systems are Structural BMPs, intermittent or perennial streams.

No stormwater drainage shall be discharged into a sanitary sewer.

No utilities (sewers, power lines, water lines, etc.) shall be located within or under any stormwater management facility.

No utilities (sewers, power lines, water lines, etc.) shall be located over a storm drain line and along the same alignment unless approved by the Director of Engineering.

In no case shall a building be located within an impoundment area or over a storm drain line.

Where storm drainage lines cross or parallel other utility lines, appropriate clearances shall be provided according to the City of Rocky Mount Department of Engineering Manual of Specifications.

1.4.1 Easements

Drainage easements are required for all public and private drainage systems. This includes commercial developments with out-parcels, phased development and other developments with surrounding land under the same ownership as the tract being developed.

Drainage easements shall be provided:

- For all culverts, all new or existing open channels or watercourses that carry water from public rights-of-way or convey water from adjoining property across the developing property. Width of the easements shall be per the most recent City of Rocky Mount Standard Detail.

- For all stormwater BMPs, the BMP shall be located in a stormwater BMP easement with a minimum width of 15 feet beyond the top of bank or toe of slope and as necessary to provide access for maintenance.

- For all new or existing open channels or watercourses with peak flows of 15 cubic feet per second or more for the 10 year storm;

- At other locations deemed appropriate by the Director of Engineering or Engineering Department staff.

In addition:
Appropriate drainage easements must be secured prior to the submission of the construction plat if the easement(s) is entirely or partially located offsite.

Access easements, dedicated to the City of Rocky Mount, shall be provided for access and repair of velocity dissipaters, headwalls, and other structural portions of the drainage system located outside of the right-of-way (ROW) which are immediately adjacent to and directly associated with the City owned portion of the drainage system. These easements are requested to allow City staff access to repair and maintain those drainage facilities located immediately adjacent to the right-of-way which would endanger the roadway should they fail.

Adequate easements shall be provided to allow access of construction equipment, taking into consideration the limitations that may be imposed by embankment slopes or other obstacles.

Drainage easements containing only storm drainage facilities should be centered over the culvert or watercourse.

All drainage easements should be recorded based on field surveys, following construction, to insure that the drainage structure or watercourse is centered within the easement (unless specifically offset). Where this is not possible, a note shall be added to recorded plats establishing that easements are to be centered over the pipe or channel.

All drainage easements shall be designed to tie into existing easements, existing watercourses or to other appropriate locations when possible.

When other easements are not present along the property line, 5-foot easements for drainage and other general amenities are required around the entire perimeter of each lot adjacent to the lot property line.

1.4.2 Streets and Gutters

Gutters shall be designed in such a way that the spread of water during the 2-year storm does not exceed 6 feet into the travel lane. The travel lane does not include the gutter section.

When the street typical section includes a full shoulder or parking lane, no encroachment into the travel lane will be allowed.

For new streets located within or near a floodplain, the 100-year water surface elevation shall be no more than 2 feet above the low point of the road unless written approval is provided by the Director of Engineering.

No peak flow greater than 3 cfs during the 10-year storm may run down a driveway and into the street without the placement of a catch basin to intercept the flow.

Driveways that discharge 3 cfs or more during the 10-year storm into a roadside ditch shall provide outlet protection to prevent erosion of the ditch.

A minimum longitudinal slope of 0.4% shall be utilized unless approved otherwise by the Director of Engineering. When lesser slopes are encountered, the gutter shall be warped to provide the minimum slope.

New street crossings in the Tar-Pamlico riparian buffer areas shall be as close to a perpendicular angle as possible to minimize buffer disturbance.

No public or private roads are to be constructed on dams without the approval of the Director of Engineering.

1.4.3 Catch Basins, Drop Inlets and Junction Boxes

Catch basins shall be provided at street sags, up-grade of intersections, up-grade of super-elevation crossovers, and where driveways would discharge more than 3 cfs into a street for the 10-year storm.

Catch basins shall be provided in streets to intercept flow such that the spread conditions defined in 1.4.2 are not exceeded for the peak flow during the 2-year storm event.

Catch basin capacity and bypass shall be designed for the peak flow during the 2-year storm event with a 5 minute time of concentration.

Inlet capacity at sags, where relief by curb overflow is not provided, shall allow for debris blockage by providing twice the required computed opening for the 2-year storm.

No grate only type inlets are allowed in city streets.

Inlets are required on drainage systems discharging to a public street (including sheet flow) where the stormwater discharge is more than 3 cfs for the 10-year storm.

For combination grates and curb openings, ignore the curb opening on continuous grades to determine bypass and ignore the grate opening at the sag.

Limit the depth of ponding to 1 foot above the drop inlet grates located outside of the ROW during the inlet design storm.

A structure (catch basin, drop inlet or junction box) is required at all changes in grade or direction or at any pipe junction. Details shall be provided on the plans for all such structures.

Yard inlets that collect site stormwater runoff and convey the stormwater to the stormwater drainage system within the right of way shall be located outside of the right of way unless site conditions warrant otherwise.

Junction Boxes shall allow for access to the storm drainage system with a grate, manhole ring and cover, or a lid capable of being removed. No "blind boxes" are permitted.

Catch basins, drop inlets and junctions boxes shall have minimum drops between the upstream and downstream openings as provided in Table 1.1 below.

Table 1.1 - Minimum Structure Invert Drops

Change in Alignment	Drop*
0 - 45 degrees	0.1 ft
45 – 90 degrees	0.2 ft
> 90 degrees (reverse flow conditions)	Only with detailed study and drop equal to or greater than the diameter of the pipe out
Change in Pipe Size	**Drop***
Increase in pipe size	Match the crown elevations
Decrease in pipe size	Only with a detailed study and special provisions for maintenance

* Structure invert drops that are less than the required minimum may be approved at the discretion of the Director of Engineering.

1.4.4 Storm Drainage Pipes

Storm drainage pipes convey stormwater runoff from areas such as streets, parking lots and grass areas underground to a receiving channel, stream or structural BMP. When stormwater runoff is conveyed from one side of a roadway to the other and flooding or failure can cause flow across the roadway then the conveyance system shall be designed as a culvert.

Storm drainage pipes shall be designed, at a minimum, to convey the future conditions peak flow during the 10-year storm event.

The design of storm drainage pipe systems shall consider where water flows when the storm drainage system cannot handle the stormwater runoff, such as storm events greater than the design storm. Section 1.5.2 identifies when floodplain boundaries shall be determined and shown on the plans.

For design of the storm drainage pipe it shall be assumed that the catch basin or drop inlet captures 100% of the peak flow during the 10-year storm event.

Minimum slopes for pipes 36 inches in diameter or less shall be 0.5%.

Minimum slopes for pipes greater than 36 inches in diameter shall be 0.3%
Minimum flow velocity in storm drainage pipes during the design storm event shall be 2.5 feet per second (fps).

All storm drainage pipes within the street ROW shall be reinforced concrete pipe Class III or higher.

All new pipes within easements that are to be maintained by the City shall be a minimum of 15 inches in diameter or equivalent. Privately maintained pipes within easements shall be a minimum of 12 inches in diameter or equivalent.

Maximum slope for reinforced concrete pipes is 12.0%. The Director of Engineering may approve greater slopes with the submittal of appropriate detailed structural designs and other supporting documentation.

Storm drainage pipes shall be designed such that the hydraulic grade line calculations demonstrate that when all tailwater conditions, pipe friction loss and all minor structure losses are considered, the hydraulic grade line remains at least 6-inches below the grate or gutter line.

Flared end sections are required at the inlet and outlet on all pipes 48 inches or less.

For multiple pipes 48-inches in diameter or less, a headwall may be used in lieu of multiple flared end sections.

Inlet and outlet headwalls are required on pipes larger than 48 inches in diameter.

If a pipe is located within the ROW, the minimum distance between the outside wall of the pipe and the ROW is 5 feet

Cover for pipes within the ROW shall be provided based on the following table:

Table 1.2 - Minimum Pipe Clearance

Pipe Size (in.)	Clearance Distance (ft) From Pipe Invert to Subgrade
15	2.4
18	2.7
24	3.3
30	3.8
36	4.4
42	4.9
48	5.4
54	6.0
60	6.5
66	7.0
72	7.6

Minimum cover for pipes outside of the ROW is 1 foot.

1.4.5 Open Channels

Open channels shall be designed to convey the future conditions peak flow during the 10-year storm event. The future condition land use shall be obtained from the City Planning Department.

New and existing open channels, with a 100-year discharge equal to or greater than 50 cfs and which are impacted by the proposed development, shall be designed to pass the 100-year storm unless the following criteria are met:

- The developer demonstrates that the 100-year discharge will not flood habitable structures or increase flood elevations on adjacent properties and the limits of the 100-year floodplain are determined and recorded.

- Existing natural channels serving do not have to be improved to carry the 10-year design flow but the limits of the 100-year floodplain must be established and recorded on the plat.

Private V-swales are acceptable for design discharges between 0 and 10 cfs. The swale shall be properly protected from erosion during the design event.

Trapezoidal swales are acceptable between 0-50 cfs. The trapezoidal swale shall be graded to a minimum of 3 feet bottom width with 3:1 side slopes and properly protected from erosion during the design event.

Open channels that convey more than 50 cfs during the 10-year design storm shall be designed as a combination channel. A combination channel shall have a separate low flow channel designed to adequately convey the 2-year storm event, without erosion, and a larger channel that can convey the 10-year design storm.

The minimum slope of soil ditches shall be 0.5%.

For open channels, gradual changes in alignment, not to exceed a minimum radius of 4 times the top width of the channel, is recommended. Where no other options are available, sharper changes in alignment may be allowed under the following conditions:

Table 1.3 – Open Channel Alignment

Open Channel Bend	Requirements
20 - 45 degrees	Bank stabilization must be provided according to tractive force analysis
>45 degrees	Same as for above but in addition, freeboard superelevation shall be calculated to demonstrate adequate channel depth on the outside bank.

Side slopes for vegetated open channels in residential areas should be no greater than 3 to 1 for stability, safety, and ease of maintenance. Where the channel width must be limited, side slopes may be increased if suitable vegetative or structural stabilization techniques (see following table) and safety measures are utilized. Aesthetics and ease of maintenance should also be considered in the design.

Table 1.4 – Maximum Side Slopes

Stabilization Type	Maximum Side Slopes
Vegetative*	2:1
Stone	1.5:1
Grid Pavers	1.5:1
Paving**	1:1
Retaining Walls	Vertical
Bioengineering	Varies
Other Methods	Approved by Director of Engineering

**Note: Special consideration must be given to the use of vegetative linings in channels. In some cases, structural stabilization is required along the lower portions of the channel bank where continuous or frequent water contact weakens the soil structure and may impede the growth of vegetation (recommend protection to a point 2' above the bottom of the channel or the high water mark for the 2-year storm, which ever is greater). The designer is directed to the State of North Carolina "Erosion and Sediment Control Planning and Design Manual" for the selection of appropriate vegetation based on soil types and flow velocities.*

***Note: Asphalt channel linings are not allowed in the City right-of-way.*

In the interest of preserving existing vegetation (which helps to stabilize stream banks and provides shade thereby reducing temperature extremes) and in order to preserve the aesthetics of natural channels, not all streams have to be altered to protect them from erosion. However, existing channels which are an integral part of the development and which may endanger new or existing structures or other improvements (such as parking lots and tennis courts) as the result of future stream bank erosion, should be evaluated for the need for additional erosion protection. In addition, those existing channels which will be subject to peak flow increases of 100% or more as the result of complete build-out of the contributing watershed and those existing channels with sharp bends should also be evaluated for the need for additional erosion protection.

Vegetation and other bioengineering measures are the preferred method of stabilizing channels. However, calculations must

demonstrate that design storm velocities do not exceed those acceptable for the measure.

1.4.6 Culverts

Culverts are structures, such as pipes or boxes, which convey surface water and/or stormwater runoff from one side of a roadway to the other and when the culvert can not handle all of the stormwater runoff, flooding will occur across the roadway.

Culverts shall be designed to meet the following requirements unless the Director of Engineering requires more stringent conditions or waives the minimum requirements identified below.

- **Residential Local –** Designed to convey the 25-year design storm with a 1 foot freeboard and a HW/D<1.2
- **Residential Collector –** Designed to convey the 25-year design storm with a 1 foot freeboard and a HW/D<1.2
- **Commercial Local –** Designed to convey the 50-year design storm with a 0.5 foot freeboard and a HW/D<1.2
- **Commercial Collector –** Designed to convey the 50-year design storm with a 0.5 foot freeboard and a HW/D<1.2
- **Industrial Local –** Designed to convey the 50-year design storm with a 0.5 foot freeboard and a HW/D<1.2
- **Industrial Collector –** Designed to convey the 50-year design storm with a 0.5 foot freeboard and a HW/D<1.2
- **Minor Arterial –** Designed to convey the 50-year design storm with a 0.5 foot freeboard and a HW/D<1.2
- **Major Arterial –** Designed to convey the 50-year design storm with a 0.5 foot freeboard and a HW/D<1.2

Minimum size of culvert shall be 18-inches in diameter.

Headwater elevations for all roads crossing watercourses for the peak flows during the design storm and 100-year storms, including weir calculations, shall be provided for those situations where overtopping is allowed.

Culverts on intermittent and perennial streams shall be designed to maintain the integrity of the stream channel. If the 10-year peak discharge is greater than 50 cfs then the culvert shall be designed to handle the 2-year storm event within a lower section set at the stream invert and the design storm in a larger section set at a higher elevation such that the larger section is utilized when water elevations exceed the water elevations during the 2-year storm event.

Flared end sections are required at the inlet and outlet on all culverts 48 inches or less.

Inlet and outlet headwalls are required on culverts larger than 48 inches in diameter.

1.4.7 Energy Dissipation Design

Energy dissipators shall be employed whenever the velocity of the flow leaving a storm drainage pipe or culvert exceeds the erosive velocity of the receiving channel.

Energy dissipators shall be designed per the North Carolina Erosion and Sediment Control Planning and Design Manual or Hydraulic Engineering Circular No. 14 “Hydraulic Design of Energy Dissipators for Culverts and Channels”.

1.5 Stormwater Quantity Control

Stormwater quantity control, for purposes of this manual, refers to the management of the impact new development has on downstream drainage systems and properties and the management of potential flooding within the development site. In order to manage the downstream impact, new development must control the peak flow rates that leave the site. This control is referred to as stormwater detention. In order to manage the potential flooding within the development, the potential floodplain boundaries must be identified. This is referred to as floodplain management.

1.5.1 Stormwater Detention

New development shall not result in an increase in the peak stormwater runoff leaving the site from the pre-development conditions for the following storm events unless the development is demonstrated to be exempt:

- **1-year, 24 hour storm event** – To reduce downstream channel degradation
- **10-year, 24-hour storm event** – To protect downstream drainage system capacity.
- **25-year, 24-hour storm event** – To protect downstream properties.

A development is exempt from the above control requirements if:

- The overall impervious surface is less than 15 percent of the total site and the pervious portions of the site are used to the maximum extent practical to convey and control the stormwater runoff, or;
- The increase in peak flow between the pre-development and post-development conditions does not exceed 10 percent, or;
- The Director of Engineering makes a determination that peak stormwater control at this particular location will increase flooding,

accelerate erosion or negatively impact existing storm drainage problems in the area. In such cases, an alternate method of stormwater quantity control may be required.

The designer shall demonstrate quantity control requirements are satisfied by routing hydrographs using the acceptable methods presented in Chapter 3 – Calculations.

If an impoundment is used to control the peak flow, it is the responsibility of the designer to verify the whether the impoundment is regulated by the Division of Land Resources under the jurisdiction of the Dam Safety Act NCAC T15A 02K.0100. An impoundment that is 15 feet high or more and has 10-acre-feet of storage or more must comply with the North Carolina Dam Safety Act which has specific spillway and embankment design standards and requires a separate submission to the Division of Land Resources for review and approval. Impoundments below the established threshold can be classified as high hazard by the Division of Land Resources and also be required to satisfy the rules of the Dam Safety Act.

1.5.2 Floodplain Management

Chapter 9 of the City's Land Development Code identifies the allowable activities and procedures for any activities within the flood zones.

In general, drainage systems are not designed to convey all potential storm events or quantity of stormwater runoff nor is it possible to guarantee that the system will never experience a debris blockage or other unpredictable event. For this reason, the designer shall always take into consideration where the water would flow in the event the system capacity is exceeded or the system is blocked or failed.

For storm drainage pipe systems and open channels that convey a peak flow of more than 50-cfs during the 100-year storm event, the 100-year floodplain boundary shall be calculated and shown on the development plans. When the drainage system includes a watercourse, the Subdistrict C flood zone shall be shall be shown as defined in Chapter 9 of the Land Development Code unless calculations demonstrate otherwise.

For storm drainage pipe systems and open channels that convey a peak flow of less than 50-cfs during the 100-year storm event, the design shall consider where water will flow if the system overflows. The Director of Engineering may require calculation of the 100-year floodplain boundary if there is concern that system overflows may cause structural flooding or unsafe roadway or driveway flooding.

All drainage systems and site development shall consider the effects of the FEMA Floodplain as shown on the most recent Flood Insurance Rate maps and floodplains defined by the City of Rocky Mount. The

floodway and flood plain boundaries must be shown for any mapped stream.

The designer shall determine floodplain boundaries using acceptable step backwater calculations as presented in Chapter 3 – Calculations unless FEMA or the City has developed an existing floodplain boundary.

1.6 Stormwater Quality Control

These policies implement citywide measurable performance goals for control of nutrients, total nitrogen and total phosphorous in stormwater runoff as required by the Tar-Pamlico Rules, NPDES regulations and others. The control of sediment is also required for construction site runoff as part of the City's Erosion Control Program, and specific restrictions and performance-based criteria for controlling total suspended solids in stormwater runoff exist in the water supply watershed protection area. This section summarizes the City's nutrient and total suspended solids control requirements to satisfy the Tar-Pamlico Nutrient Sensitive Waters and Water Supply Watershed Protection Rules. Guidelines and design requirements for the City's Sediment and Erosion Control Program can be found in Chapter 8, section 802 of the City's Land Development Code.

The City of Rocky Mount encourages satisfying these stormwater quality requirements through onsite land planning measures to reduce the disturbed and impervious areas to the maximum extent practical, as well as the design and installation of as few structural BMPs as practical.

The City also strongly encourages the use of onsite structural BMPs to provide both stormwater quantity and quality control.

Garbage dumpsters and apartment or condominium car washing areas must be located such that runoff from these areas sheet flows across a densely vegetated area. These facilities cannot be located in close proximity to streams or other watercourses.

1.6.1 Tar-Pamlico Nutrient Sensitive Waters

Chapter 8, Section 802 of the City's Land Development Code describes the requirements for the Tar-Pamlico Nutrient Sensitive Waters in detail. This section provides a brief summary of those requirements. Nutrient offset payment can be made in lieu of onsite land planning and/or structural control measures. Any nutrient offset payments must be in accordance with North Carolina Administrative Code 15A NCAC 02B .0240 and subsequent amendments.

1.6.2 Nutrient Control – One Acre Disturbance (Single-Family Residential)

New single-family residential development that disturbs greater than **1** (one) acre of land to establish, expand, or replace a single family residential development or recreational facility shall demonstrate the following nutrient loading requirements are met:

- **Total Nitrogen (TN) Export is reduced to 4.0 pounds per acre per year (lbs/ac/yr).**
  - If the nitrogen reduction can not be obtained through onsite land planning measures and/or structural BMPs then an equivalent mass load reduction shall be obtained through the treatment of existing offsite areas either in the site structural BMP, separate offsite structural BMP or regional structural BMP as long as the Total Nitrogen Export from the site does not exceed **6.0 lbs/ac/yr** and the offsite facility is located within the same classified surface water as defined in Chapter 8 of the City's Land Development Code.

- **Total Phosphorous (TP) Export is reduced to 0.4 lbs/ac/yr.**
  - If the phosphorous reduction can not be obtained through onsite land planning measures and/or structural BMPs then an equivalent mass load reduction shall be obtained through the treatment of existing offsite areas either in the site structural BMP(s), separate offsite structural BMP(s) or regional structural BMP located within the same classified surface water as defined in Chapter 8 of the City's Land Development Code.

Nutrient offset payment for both nitrogen and phosphorous can be made in lieu of onsite land planning and/or structural control measures. Any nutrient offset payments must be in accordance with North Carolina Administrative Code 15A NCAC 02B .0240 and subsequent amendments.

1.6.3 Nutrient Control – One Half Acre Disturbance (All Other Projects)

New development that disturbs greater than **1/2** (one-half) acre of land to establish, expand, or replace a multi-family residential development, commercial, industrial, institutional or any other non-residential development shall demonstrate the following nutrient loading requirements are met:

- **Total Nitrogen Export is reduced to 4.0 Lbs/acre/year.**
  - If the nitrogen reduction can not be obtained through land planning measures and/or structural BMPs then an equivalent mass load reduction shall be obtained through the treatment of existing offsite areas either in the site structural BMP, separate

offsite structural BMP or regional structural BMP as long as the Total Nitrogen Export from the site does not exceed **10.0 lbs/ac/yr** and the offsite facility is located within the same classified surface water as defined in Chapter 8 of the City's Land Development Code.

- **Total Phosphorous (TP) Export is reduced to 0.4 lbs/ac/yr.**
  - If the phosphorous reduction can not be obtained through onsite land planning measures and/or structural BMPs then an equivalent mass load reduction shall be obtained through the treatment of existing offsite areas either in the site structural BMP(s), separate offsite structural BMP(s) or regional structural BMP located within the same classified surface water as defined in Chapter 8 of the City's Land Development Code.

Nutrient offset payment can be made in lieu of onsite land planning and/or structural control measures. Any nutrient offset payments must be in accordance with North Carolina Administrative Code 15A NCAC 02B .0240 and subsequent amendments.

The City strongly encourages onsite structural BMPs be designed for existing offsite development in order to achieve offsite nutrient load reductions.

When offsite load reduction is provided in a separate structural BMP, the structural BMP shall be reviewed and approved by the City of Rocky Mount and all of the necessary offsite easements and maintenance agreements shall be in place prior to receiving approval to begin land development activities.

Offsite facilities shall meet the conditions outlined in Chapter 8 of the City's Land Development Code.

Nutrient Loading Calculations are presented in Chapter 3 – Calculations. These calculations have been incorporated into a spreadsheet that must be completed with each development.

1.6.4 Riparian Buffers

The Tar-Pamlico Nutrient Sensitive Waters Rule established a 50 foot wide riparian buffer on all sides of intermittent and perennial streams, ponds and lakes shown on the most recent version of either the Natural Resources Conservation Service Soil Survey or a 1:24,000 scale (7.5 minute quadrangle) topographic map prepared by the U.S. Geological Survey (USGS) as appropriate. The buffer is measured from the top of bank or normal pool of an impoundment. The City will not approve new development plans that include land area within the riparian buffer unless the development receives approval from DWQ.

1.6.5 Water Supply Watershed Protection

Chapter 8, Section 803 of the City's Land Development Code describes the City's requirements for development within the designated Watershed Protection Areas. This section briefly summarizes those requirements.

New development that disturbs more than 1 acre of land located within the WS-IV-CA or WS-IV-PA as shown on the City 's watershed map, which is available on the City's website, shall meet the following conditions in addition to satisfying the stormwater quantity and quality control identified in earlier sections:

- WS-IV-CA (Critical Area)
  - Maintain the following low density and built upon limits
    - Single family residential developments shall not exceed 2 dwelling units per acre.
    - All other residential and non residential shall not exceed 24 percent built upon area.
    - Maintain a minimum of a 30 foot wide vegetative buffer along perennial streams.
  - Limit the percent imperviousness to 50 percent and construct structural BMPs that control the runoff from the first 1-inch of rainfall runoff such that 85% TSS is achieved, and maintain a 100 foot wide vegetative buffer along perennial waters. The buffer is measured from the top of bank or normal pool of impoundment.

- WS-IV-PA (Protected Area)
  - Maintain the following low density and built upon limits
    - Single family residential developments with a curb and gutter street system shall not exceed 2 dwelling units per acre.
    - Single-family residential developments without a curb and gutter street system shall not exceed 3 dwelling units per acre.
    - All other residential and non residential with a curb and gutter street system shall not exceed 24 percent built upon area.
    - All other residential and non residential without a curb and gutter street system shall not exceed 36 percent built upon area.
    - Maintain a minimum of a 30 feet wide vegetative buffer on perennial streams.
  - Limit the percent imperviousness to 70 percent and construct structural BMPs that control the runoff from the first 1-inch of rainfall runoff such that 85% TSS is achieved, and maintain a 100 foot wide vegetative buffer along perennial waters. The buffer is measured from the top of bank or normal pool of impoundment.