CITY OF NEW BERN, NORTH CAROLINA

Stormwater Management Manual

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1. Introduction

1.1 Purpose of the City of New Bern (City) Stormwater Program

New Bern is an important regional center that offers a wide range of employment opportunities, business and professional services, and important historical, cultural, and recreational attractions. New Bern residents desire to maintain the character of their community and to sustain and improve the excellent quality of life that the area provides. Residents and City officials favor growth and development that is environmentally responsible, well designed and located, and respectful of the character of the City. Future development is expected to involve a mix of residential development with varying densities and building styles, as well as new business, industrial, and institutional land uses. It is the purpose of the New Bern Stormwater Program to meet the current and anticipated needs for stormwater services and to protect public and private properties, the Neuse River, the Neuse Estuary, and all other streams, water bodies, and wetlands from unnecessary damage due to stormwater releases and non-point source pollution. The provision of those services will be based upon compatibility with the City's development plans, the City's taxpayers and developers financial capacities, and upon compliance with applicable Federal and State laws and regulations.

1.2 Summary of Goals and Elements of the New Bern Stormwater Program

The goals of the New Bern Stormwater Program are:

- Minimize the public's risk of injury and death and limit damages to private and public property caused by stormwater runoff within the City's jurisdiction.
- Maintain and increase the riparian buffers along the streams and waterbodies within the City's jurisdiction.
- Provide for the public's health, safety and welfare by protecting the water quality of the Neuse River, Neuse Estuary and other streams.
- Ensure City of New Bern compliance with all applicable Federal and State regulations.

In order to meet these goals, the City will require anyone proposing new developments within a 50-foot riparian buffer around all intermittent and perennical streams and other water bodies and anyone proposing new development that will result in disturbance of greater than ½ acre of land to obtain a Stormwater Permit. Obtaining a New Bern Stormwater Permit requires property owners and developers to address five topics:

1.2.1 Protecting and Enhancing Riparian Areas

The Neuse Riparian Buffer Rule (NRBR) requires that the City protect riparian buffers on new developments. The New Bern Stormwater Program will ensure that a 50-foot riparian buffer will be maintained on all sides of intermittent and perennial streams and other water bodies within the City's jurisdiction. The program also will seek restoration and enhancement of impaired buffers within the City's jurisdiction. The City seeks to cooperate with other communities and

with the North Carolina Wetlands Restoration Program to ensure that available funds are best used to protect water quality and provide attractive green space.

1.2.2 Controlling Peak Stormwater Discharges

Controlling the peak discharge rate of water leaving a developed area is one of the key factors in managing the impact of new development on the property of downstream landowners, on the City's roads, buildings, and stormwater facilities, and on local streams and other natural waterbodies.

The City's Stormwater Program requires that all new development within the jurisdictional limits of the City control water runoff so that there is no net increase in the peak discharge from the predevelopment conditions for the 1-year, 24-hour storm as defined in this Manual. Where this requirement places an undue hardship upon a property owner, variances from the requirement may be granted by the Stormwater Administrator to developments that meet one or both of the following requirements:

- The increase in peak flow for pre- and post-development conditions does not exceed 10 percent and it is demonstrated, to the satisfaction of the Stormwater Administrator, that no damage to public or private properties, including to the City's stormwater facilities and to the quality of the public waters, will be caused by granting of the variance.
- The proposed new development does not cause the development parcel's total impervious area to exceed 15 percent, the remaining pervious portions of the site are utilized to the extent practical to convey and control the stormwater runoff, and it is demonstrated, to the satisfaction of the Stormwater Administrator, that no damage to public or private properties, including to the City's stormwater facilities and to the quality of the public waters, will be caused by granting of the variance.

The City's Stormwater Program also requires that all new development within the jurisdictional limits of the City control water runoff so that there is no net increase in the peak discharge from the predevelopment conditions for the 10-year, 24-hour storm as defined in this Manual. Where this requirement places an undue hardship upon a property owner, variances from the requirement may be granted by the Stormwater Administrator to developments that meet the following requirement:

- The proposed new development appropriately uses the parcel's total remaining impervious area the extent practical to convey and control the stormwater runoff, and it is demonstrated, to the satisfaction of the Stormwater Administrator, that no damage to public or private properties, including to the City's stormwater facilities and to the quality of the public waters, will be caused by granting of the variance.

1.2.3 Controlling Nitrogen Export

Owners and developers of all new developments that disturb an area greater than one-half acre in order to establish, expand or modify a residential, commercial, industrial, or institutional facility obtain a Stormwater Permit before any land disturbing activities occur. A Stormwater Permit requires each development to meet a nitrogen export performance standard of less than or equal to 3.6 pounds total nitrogen (TN) per acre per year (#/ac/yr). Where that standard cannot be reasonably achieved, there are provisions for variance and mitigation offsets. Except where there are substantial vested rights in place before the final enactment of the City Stormwater Ordinance, no new residential development will be permitted to export more than 6 #/ac/yr and no new non-residential development will be permitted to export more than 10 #/ac/yr. All applications for a Stormwater Permit must include calculations of the total nitrogen export from the proposed disturbance or development consistent with the methods specified in this Manual.

1.2.4 Use of Best Management Practices (BMPs)

The New Bern Stormwater Program seeks to encourage the use of modern design principles and management practices that will allow the community to grow and prosper while reducing the pollution of our land and water. The program encourages, and in some cases requires, the use of Best Management Practices (BMPs) from the conceptual design of a new development project through the project's construction and operation. Chapter 7 of this manual describes some of the project design BMPs that can be used to minimize the negative impacts of development. Chapter 8 describes some of the structural BMPs that can be used to reduce the remaining impacts.

1.2.5 Maintaining BMPs

In order to be effective, BMPs for stormwater control must be appropriately maintained. The New Bern Stormwater Program includes an annual inspection program under which City staff, or others working in their behalf, will inspect all BMPs and their maintenance records. The program provides procedures under which the City will accept the responsibility to maintain BMPs servicing residential properties and establishes the requirement that BMPs servicing non-residential properties be maintained by their owners. The City will have the authority and capacity to perform necessary maintenance of all BMPs and will charge delinquent owners for maintenance services that the City performs.

1.3 Disclaimer

This Manual is established to provide the City's Stormwater Administrator, property owners, developers, engineers, surveyors, and builders a better understanding of acceptable methods to meet the intent of the City's Stormwater Quality Management

and Discharge Control Ordinance. Design of stormwater management for development requires experienced judgment by the designer. The City accepts no responsibility for any loss, damage, or injury as a result of the use of this manual.

2. Definitions

The terms used in this Manual shall have the following meanings:

(a) Applicant: An owner or developer of a site who executes the Stormwater Permit Application pursuant to the City's Stormwater Quality Management and Discharge Control Ordinance (hereinafter "Stormwater Ordinance").

(b) Best Management Practices: An activity, procedure, or structural or nonstructural management-based practice used singularly or in combination to prevent or reduce the discharge of pollutants directly or indirectly to the stormwater system and waters of the United States in order to achieve water quality protection goals. Best Management Practices include but are not limited to: treatment facilities to remove pollutants from stormwater; operating and maintenance procedures; facility management practices to control runoff, spillage or leaks of non-stormwater, waste disposal, and drainage from materials storage; erosion and sediment control practices; and the prohibition of specific activities, practices, and procedures and such other provisions as the City determines appropriate for the control of pollutants. Please refer to the City of New Bern Stormwater Management Manual, as discussed further under Section 1-16(c) herein, for specific requirements.

(c) Bona Fide Farm: Tract or tracts of land used for the production of plants and animals useful to man.

(d) Built-upon area: Built-upon areas shall include that portion of a development project that is covered by impervious or partially impervious cover including buildings, pavement, gravel roads, and recreation facilities.

(e) Channel Bank: The location of the upper edge of the active channel above which the water spreads into the overbanks on either side of the channel or the elevation of the two-year frequency storm. Where the channel bank is not well defined, the channel bank shall be considered the edge of the waterline during a two-year frequency storm.

(f) City: City of New Bern, North Carolina.

(g) Clean Water Act: The federal Water Pollution Control Act (33 U.S.C. § 1251 et seq.), and any subsequent amendments thereto.

(h) Cluster Developments: Grouping of buildings in order to conserve land resources and provide for innovation in the design of the project including minimizing stormwater runoff impacts. This term includes nonresidential development, Planned Unit Developments (PUDs), and single-family residential and multi-family developments.

(i) **Construction Activity**: Activities subject to NPDES Construction Permits. These include construction projects resulting in land disturbance of one-half acre or more. Such activities include, but are not limited to, clearing and grubbing, grading, excavating, and demolition.

(j) **Design Storm**: The specific frequency and, if necessary, duration of the rainfall event to be used in design to meet the criteria established in the Stormwater Management Manual.

(k) Development: Means any of the following actions taken by a public or private individual or entity:

i. The division of a lot, tract, or parcel of land into two (2) or more lots, plots, sites, tracts, parcels or other divisions by plat or deed, or

ii. Any land change, including, without limitation, clearing, tree removal, grubbing, stripping, dredging, grading, excavating, transporting and filling of land.

(l) **Drainage Structures**: Shall include swales, channels, storm sewers, curb inlets, yard inlets, culverts, and other structures designed or used to convey stormwater.

(m) Hazardous Materials: Any material, including any substance, waste, or combination thereof, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause, or significantly contribute to, a substantial present or potential hazard to human health, safety, property, or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

(n) **Illegal Discharge**: Any unlawful disposal, placement, emptying, dumping, spillage, leakage, pumping, pouring, or other discharge of any substance other than stormwater into a stormwater conveyance system, the waters of the State or upon the land such that the substance is likely to reach a stormwater conveyance system or waters of the State constitutes an illegal discharge, except as exempted in Division II, Section 2.1 of the City of New Bern Stormwater Ordinance.

(o) **Illicit Connections**: An illicit connection is defined as either of the following:

i. Any drain or conveyance, whether on the surface or subsurface, which allows an illegal discharge to enter the stormwater system including but not limited to any conveyances which allow any non-stormwater discharge including sewage, process wastewater, and wash water to enter the stormwater system and any connections to the stormwater system from indoor drains and sinks, regardless of whether said drain or connection

had been previously allowed, permitted, or approved by a government agency; or

ii. Any drain or conveyance connected from a commercial or industrial land use to the stormwater system, which has not been documented in plans, maps, or equivalent records and approved by the City.

(p) Industrial Activity: Activities subject to NPDES Industrial Permits as defined in U.S. 40 CFR, Section 122.26 (b)(14).

(q) Impervious Surface: A surface composed of any material that impedes natural infiltration of water into the soil. Gravel areas shall be considered impervious.

(r) Intermittent Streams: A natural drainage way, which shows up as a blue line on the USGS 7.5-minute quadrangle maps and has a contributing drainage area of 300 acres or less, shall be considered an intermittent stream for the purposes of this Ordinance.

(s) Land Disturbing Activities: The use of land by any person that results in a change in the natural cover or topography that may contribute to or alter the quantity and or quality of stormwater runoff.

(t) Major Subdivision: The development or subdivision of a tract of land that:

i. Requires the development of public or private streets or right-of-ways; and/or

ii. Requires or includes the extension of public utilities or the recording of access easements; and/or

iii. Disturbs or subdivides an area of five (5) acres or more; and/or

iv. Results in the creation of five (5) or more lots.

(u) Major Variance: A variance issued by the City of New Bern that results in any one or more of the following:

i. The complete waiver of a management requirement;

ii. Any variance for which the City of New Bern must prepare documentation for, and receive approval from, the NC DENR/DWQ and/or the NC Environmental Management Commission before it may legally issue the requested variance.

(v) Minor Subdivision: Any development or subdivision of land that does not meet the description of a Major Subdivision.

(w) Minor Variance: A variance that does not qualify as a major variance.

(x) National Pollutant Discharge Elimination System (NPDES) Stormwater Discharge Permits: General, group, and individual stormwater discharge permits that regulate facilities defined in federal NPDES regulations pursuant to the Clean Water Act.

(y) Natural Drainageway: Shall mean an incised channel with a defined channel bed and banks that are part of the natural topography. Construction channels such as drainage ditches shall not be considered a natural drainage way unless the constructed channel was a natural drainage way that has been relocated, widened, or otherwise modified.

(z) Non-residential Development: All development other than residential development, agriculture, and silviculture.

(aa) Non-Stormwater Discharge: Any discharge to the stormwater system that is not composed entirely of stormwater.

(bb) Perennial Stream: Perennial streams are streams that have essentially continuous flows and are shown on the United States Geological Survey 24,000 (7.5 min.) scale topographic maps.

(cc) Plat: A map or plan of a parcel of land, which is to be, or has been subdivided or developed.

(dd) Pollutant: Anything, which causes or contributes to pollution. Pollutants may include, but are not limited to: paints, varnishes, and solvents; oil and other automotive fluids; non-hazardous liquid and solid wastes and yard wastes; refuse, rubbish, garbage, litter, or other discarded or abandoned objects, articles, and accumulations, so that same may cause or contribute to pollution; floatables; pesticides, herbicides, and fertilizers; hazardous substances and wastes; untreated commercial car wash water and industrial discharges, contaminated fountain drains, and cooling waters; sewage, fecal coliform and pathogens; dissolved and particulate metals; animal wastes; wastes and residues that result from constructing a building or structure (including but not limited to sediments, slurries, and concrete rinsates); and noxious or offensive matter of any kind.

(ee) Pollution: The human-made or human-induced alteration of the quality of waters by waste to a degree which unreasonably affects, or has the potential to unreasonably affect, either the waters for beneficial uses or the facilities which serve these beneficial uses.

(ff) Premises: Any building, lot, parcel of land, or portion of land whether improved or unimproved including adjacent sidewalks and parking strips.

(gg) **Riparian Buffer**: An area of trees, shrubs, or other vegetation, that is adjacent to a natural drainage way through which stormwater runoff flows in a diffuse manner so that the runoff does not become channelized and which provides for infiltration of the runoff and filtering of pollutants. Riparian buffers reduce the impact of upland sources by trapping, filtering, and converting nutrients, sediments, and other chemicals and maintain the integrity of the natural drainage way. For the purposes of this Ordinance, surface water shall be present if the feature is approximately shown on the most recent version of the 1:24,000 (7.5 min.) quadrangle topographic maps prepared by the United States Geological Survey or on the most recent version of the soil survey map prepared by the Natural Resources Conservation Service of the United States Department of Agriculture. The buffer shall be measured landward from the normal pool elevation of impounded structures and from the bank of each side of streams or rivers

(hh) **Stormwater system**: Publicly-owned facilities operated by the City by which Stormwater is collected and/or conveyed, including but not limited to any roads with drainage systems, streets, gutters, curbs, inlets, piped storm drains, pumping facilities, retention and detention basins, natural and human-made or altered drainage channels, reservoirs, and other drainage structures which are within the City and are not part of a publicly owned treatment works as defined at U.S. 40 CFR Section 122.2.

(ii) **Stormwater**: Any surface flow, runoff, and drainage consisting entirely of water from rainstorm events.

(jj) **Stormwater Administrator**: The person designated by the City Manager of the City of New Bern to have authority to review and approve Stormwater Permits and Stormwater Management Plans. The Stormwater Administrator shall also be responsible for inspecting development and making sure the provisions of this Ordinance are being followed and for reporting from time to time to the City Manager and to the Board of Aldermen on the progress, plans, and expectations of the City's stormwater program.

(kk) **Stormwater Management Manual**: The manual of design, performance, and review criteria adopted by Aldermen of the City of New Bern for the administration of the Stormwater Program.

(ll) **Stormwater Facilities**: Shall include devices designed specifically to detain or retain Stormwater for water quantity or water quality control. These devices shall not include those drainage structures that provide incidental water quantity or water quality control. These devices include but are not limited to wet ponds, dry ponds, bioretention areas, filter strips, infiltration trenches.

(mm) **Stormwater Management Plans**: A document, submitted as part of an application for a Stormwater Permit, which presents the design, operation,

and maintenance specifications for one or more Drainage Structures, Best Management Practices, or other facilities and practices to be implemented for the management of stormwater quality and/or discharge control.

(nn) Variance: A permission to develop or use property granted by the City of New Bern relaxing or waiving a management requirement where that permission is granted at the discretion of the City under:

i. authority that it solely owns,

ii. authority delegated to it by the State of North Carolina and specifically the Environmental Management Commission, or

iii. the City's authority because of a direct action by the State of North Carolina and its Environmental Management Commission.

(oo) **Vegetative Buffer**: An area that has any combination of trees, samplings, shrubs, vines, and herbaceous plants that grow together in disturbed or undisturbed conditions, which provides for diffusion and infiltration of runoff and filtering of pollutants. This includes mature and successional forests as well as cutover stands.

(pp) **Vested Rights**: Vested right shall be based upon the following criteria:

i. Having an outstanding valid building permit in compliance with GS 153A-344.1 or GS 160A-385.1, or

ii. Having an approved site specific or phased development plan in compliance with GS 153A-344.1 or GS 160A-385.1.

iii. Projects that require a state permit, such as landfills, NPDES wastewater discharges, land application or residuals and road construction activities, shall be considered to have vested rights if a state permit was issued prior to the effective date of the adoption of the Stormwater Ordinance.

(qq) Water Dependent Structures: Those structures which require the access or proximity to, or sitting within surface waters to fulfill its basic purpose, such as boat ramps, boat houses, docks, and bulkheads. Ancillary facilities such as restaurants, outlets for boat supplies, parking lots, and commercial boat storage areas are not considered water-dependent structures.

(rr) Waters of the United States: Surface watercourses and water bodies as defined at U.S. 40 CFR § 122.2, including all natural waterways and definite channels and depressions in the earth that may carry water, even though such waterways may only carry water during rains and storms and may not carry Stormwater at and during all times and seasons.

3. Stormwater Permits

3.1 Stormwater Management and Site Plans

Persons proposing to conduct land disturbing activities that require a Stormwater Permit as identified in the City of New Bern Stormwater Ordinance shall submit a stormwater management plan that includes a site plan with the stormwater permit application.

3.1.1 Site Plan Requirements

The City may request all application documents (calculations, narrative, and drawings) be submitted digitally for archival and database entry. If requested, this information is to be submitted on a compact disc prior to final approval of the project. For the purpose of applying for a Stormwater Permit, the Site Plan shall include at minimum the following information:

- Address or Vicinity Map showing the location of the activity.
- Subdivision Name and the date of the approved subdivision plat, if applicable.
- The date of the subdivision's approved Stormwater Permit, if applicable.
- The site boundaries.
- Street Right-of-Way.
- Street Name and State Road Number.
- Existing roadway width and pavement type.
- Existing and proposed structures and finish floor elevations.
- Existing and proposed driveway locations and types (gravel, asphalt, concrete, etc.)
- Existing and proposed stormwater facilities (swales, pipes, inlets, etc.)
- Indicate the general drainage patterns and provide a topographic map showing 1-foot (or smaller) contour intervals.
- Show any easements and identify type of easement.
- Show any natural drainage ways and direction of flow.
- Show the location and extent and label the name of any waterbody that is shown on the most recent revision of either the 7.5-minute USGS topographic map or the NRCS Soil Survey map.
- Show any flood boundaries and/or elevations.
- Show any phasing of land disturbing activities. If needed, a separate drawing can be provided for each phase.
- Other information that may be necessary to develop an understanding of the project.

A complete list of the drawing requirements is included on a reproducible sheet included in Appendix A. No text presented on the drawings and documents shall be in a font smaller than a 10-point type. The Stormwater Administrator may waive any of the format specifications and required items that are deemed not to be necessary for the review, reproduction, and storage of the documents.

All drawings and specifications that include Structural Best Management Practices such as stormwater detention ponds, sand filters, and other constructed elements must present the seal and signature of a registered professional engineer.

3.1.2 BMP Design and Operation Specifications

Each structural and non-structural BMP included in an applicant's stormwater management plan must be designed and operated according to appropriate, documented principles and practices. Specific design and operation details, to the satisfaction of the Stormwater Administrator, must be presented in the stormwater management plan. The nature of those details will vary with the type of BMP proposed. For example, for a Wet Detention Pond, details of the containment berm, outlet structures, sediment forebay, maintenance access area and safety features and facilities (e.g. side slopes, fencing) must be described in the plan. Additional necessary items may include plant species to be introduced and maintained. Soil and hydrologic calculations that verify maintenance of the depth of surface water necessary for the proper operation of the BMP also must be presented.

Each applicable BMP has a specific set of design, operation and maintenance principles and practices that must be followed. Appendix C of this manual provides many of these details for a range of BMPs. It is the applicant's responsibility to provide the Stormwater Administrator with sufficient documentation on the principles and practices of a proposed BMP to ensure the Administrator that the BMP will be constructed and will operate sufficient to provide the benefits claimed in the applicant's Stormwater Management Plan.

3.1.3 Supporting Calculations

The owner shall provide formulas, tables, and other forms of supporting calculations in hardcopy or electronic forms as may be required by the Stormwater Administrator to determine the accuracy of any of the items described in the Stormwater Management Plan, shown on the Site Plan, or otherwise represented in the application for a Stormwater Permit. There are specific requirements for the documentation of the control of peak discharges and for the calculation of nitrogen exports from developments. The acceptable methods of performing those calculations are outlined in Sections 5 and 6 of this manual.

3.1.4 Maintenance Plans

The effectiveness of each of the BMPs described in the previous section depends upon appropriate maintenance. Also, many of the health and safety concerns that arise when the BMPs are installed can be significantly reduced by a program of planned, regular maintenance. For those reasons, the applicant's Stormwater Management Plan must contain a maintenance plan, including schedule, for each of the BMPs incorporated into the stormwater system. The Plan must address the normal and emergency procedures that will be followed to avoid:

- Any condition, which blocks, hinders or obstructs, in any way the natural or intended flow of surface waters;
- The improper operation of any stormwater retention or impoundment device or any structure or device used for the improvement of the quality of surface runoff;
- Any condition that would damage the City's stormwater collection system or that would harm the quality of the City's waters;
- Any other conditions specifically declared to be a danger to the public health, safety, and general welfare of inhabitants of the City.

Failure to properly operate and maintain stormwater facilities and BMPs in accordance with the Stormwater Management Plan is a violation of the City's Stormwater Ordinance.

3.2 Maintenance Records and Inspections

Once the Stormwater Administrator has accepted the applicant's Stormwater Management Plan and the facilities have been constructed, the Stormwater Administrator will conduct an as-built inspection and will inspect, from time to time but at least annually, the BMP facilities. The Stormwater Permittee shall pay an inspection fee for each inspection in an amount approved by the City and available from the office of the Stormwater Administrator. Whenever inspections are conducted, the Stormwater Permittee shall make available records of the maintenance of all stormwater facilities and BMPs. At a minimum those records shall contain:

- Descriptions, including design drawings, of any structural changes to a BMP and the dates on which construction of those changes were begun and completed.
- Descriptions, including landscape drawings, of any changes in the drainage pathways included in the site's stormwater management plan and in any drainage pathways leading to or from a BMP.
- Descriptions, to include volumes and material descriptions, of any excavation or fill operations to or impacting a BMP or the drainage of stormwater to or

from a BMP and including the dates when those operations were begun and completed.

- Confirmation of completion over the previous year of all the routine maintenance items required by each BMP and documented in the Stormwater Management Plan.

Failure to perform required or emergency maintenance, or to maintain and provide the required records of that maintenance is a violation of the City's Stormwater Ordinance.

4. Riparian Buffers

4.1 Buffer Requirements

The New Bern Stormwater Program requires that 50-foot wide riparian buffers be maintained on all sides of intermittent and perennial streams, ponds, lakes, and estuaries in the City and its extraterritorial jurisdiction.

In order to obtain a Stormwater Permit an owner or developer must meet one or more of the following requirements:

1. Provide certification, acceptable to the Stormwater Administrator, that no development or other land disturbing activities will occur within 50-feet of the banks of a covered stream or other natural waterway as shown on the most recent version of the NRCS Soil Survey map(s) and those shown on the most recent 1:24,000 scale (7.5 minute) quadrangle topographic maps prepared by the USGS.
2. Provide certification, acceptable to the Stormwater Administrator, that the only development or other land disturbing activities that will occur within 50-feet of the banks of a covered stream or other natural waterway are exempt activities as shown within the Table of Uses contained in this manual.
3. Apply to the Stormwater Administrator and obtain a minor or major variance which allows the development or other activity and demonstrate that all the conditions of that variance, including all mitigation requirements will be met and that approval by the North Carolina Department of Environment and Natural Resources Division of Water Quality and/or the North Carolina Environmental Management Commission, has been obtained.

4.2 Riparian Buffer Map

The Stormwater Administrator will prepare, and will from time to time correct and update, a map portraying the riparian buffer areas covered by the New Bern Stormwater Ordinance. The map will be available in the office of the Stormwater Administrator, provided for the convenience of the public. It is the owner's responsibility to verify the accuracy of that map as it relates to development or other land disturbing activities on a specific parcel. The City of New Bern accepts no responsibility for any loss, damage, or injury as a result of the use of that map.

4.3 The Riparian Buffer

The New Bern Stormwater Program's for protection of riparian buffers follow the requirements set forth in the NRBR. The following tables define the two zones of a riparian buffer and set forth the types of exempt, allowable, allowable with mitigation, and prohibited activities that may occur in each zone.

ZONES OF THE RIPARIAN BUFFER. The protected riparian buffer shall have two zones as follows:

(a) Zone 1 shall consist of a vegetated area that is undisturbed except for uses provided for in Item (6) of this Rule. The location of Zone 1 shall be as follows:

(i) For intermittent and perennial streams, Zone 1 shall begin at the most landward limit of the top of bank or the rooted herbaceous vegetation and extend landward a distance of 30 feet on all sides of the surface water, measured horizontally on a line perpendicular to the surface water.

(ii) For ponds, lakes and reservoirs located within a natural drainage way, Zone 1 shall begin at the most landward limit of the normal water level or the rooted herbaceous vegetation and extend landward a distance of 30 feet, measured horizontally on a line perpendicular to the surface water.

(iii) For surface waters within the 20 Coastal Counties (defined in 15A NCAC 2B .0202) within the jurisdiction of the Division of Coastal Management, Zone 1 shall begin at the most landward limit of:

(A) the normal high water level;

(B) the normal water level; or

(C) the landward limit of coastal wetlands as defined by the Division of Coastal Management and extend landward a distance of 30 feet, measured horizontally on a line perpendicular to the surface water, whichever is more restrictive.

Zone 2 shall consist of a stable, vegetated area that is undisturbed except for activities and uses provided for in Item (6) of this Rule. Grading and revegetating Zone 2 is allowed provided that the health of the vegetation in Zone 1 is not compromised. Zone 2 shall begin at the outer edge of Zone 1 and extend landward 20 feet as measured horizontally on a line perpendicular to the surface water. The combined width of Zones 1 and 2 shall be 50 feet on all sides of the surface water, whichever is more restrictive.

DIFFUSE FLOW REQUIREMENT. Diffuse flow of runoff shall be maintained in the riparian buffer by dispersing concentrated flow and reestablishing vegetation.

(a) Concentrated runoff from new ditches or manmade conveyances shall be converted to diffuse flow before the runoff enters the Zone 2 of the riparian buffer.

(b) Periodic corrective action to restore diffuse flow shall be taken if necessary to impede the formation of erosion gullies.

TABLE OF USES. The following chart sets out the uses and their designation under this Rule as exempt, allowable, allowable with mitigation, or prohibited. The requirements for each category are given in Item (7) of this Rule.

	Exempt	Allowable	Allowable with Mitigation	Prohibited
Airport facilities: • Airport facilities that impact equal to or less than 150 linear feet or one-third of an acre of riparian buffer • Airport facilities that impact greater than 150 linear feet or one-third of an acre of riparian buffer		X	X	
Archaeological activities	X			
Bridges		X		
Dam maintenance activities	X			
Drainage ditches, roadside ditches and stormwater outfalls through riparian buffers: • Existing drainage ditches, roadside ditches, and stormwater outfalls provided that they are managed to minimize the sediment, nutrients and other pollution that convey to waterbodies	X			

• New drainage ditches, roadside ditches and stormwater outfalls provided that a stormwater management facility is installed to control nitrogen and attenuate flow before the conveyance discharges through the riparian buffer		X		
• New drainage ditches, roadside ditches and stormwater outfalls that do not provide control for nitrogen before discharging through the riparian buffer				X
• Excavation of the streambed in order to bring it to the same elevation as the invert of a ditch				X
Drainage of a pond in a natural drainage way provided that a new riparian buffer that meets the requirements of Items (4) and (5) is established adjacent to the new channel	X			
Driveway crossings of streams and other surface waters subject to this Rule:				
• Driveway crossings on single family residential lots that disturb equal to or less than 25 linear feet or 2, 500 square feet of riparian buffer	X			
• Driveway crossings on single family residential lots that disturb greater than 25 linear feet or 2,500 square feet of riparian buffer		X		
• In a subdivision that cumulatively disturb equal to or less than 150 linear feet or one-third of an acre of riparian buffer		X		
• In a subdivision that cumulatively disturb greater than 150 linear feet or one-third of an acre of riparian buffer			X	
Fences provided that disturbance is minimized and installation does not result in removal of forest vegetation	X			
Forest harvesting - see Item (11) of this Rule				
Fertilizer application:				
• One-time fertilizer application to establish replanted vegetation	X			
• Ongoing fertilizer application				X
Grading and revegetation in Zone 2 only provided that diffuse flow and the health of existing vegetation in Zone 1 is not compromised and disturbed areas are stabilized	X			
Greenway/hiking trails		X		
Historic preservation	X			
Landfills as defined by G.S. 130A-290				X
Mining activities:				
• Mining activities that are covered by the Mining Act provided that new riparian buffers that meet the requirements of Items (4) and (5) are established adjacent to the relocated channels		X		
• Mining activities that are not covered by the Mining Act OR where new riparian buffers that meet the requirements or Items (4) and (5) are not established adjacent to the relocated channels			X	
• Wastewater or mining dewatering wells with approved NPDES permit	X			
Non-electric utility lines:				
• Impacts other than perpendicular crossings in Zone 2 only[3]		X		
• Impacts other than perpendicular crossings in Zone 1[3]			X	
Non-electric utility line perpendicular crossing of streams				

and other surface waters subject to this Rule[3]: • Perpendicular crossings that disturb equal to or less than 40 linear feet of riparian buffer with a maintenance corridor equal to or less than 10 feet in width • Perpendicular crossings that disturb greater than 40 linear feet of riparian buffer with a maintenance corridor greater than 10 feet in width • Perpendicular crossings that disturb greater than 40 linear feet but equal to or less than 150 linear feet of riparian buffer with a maintenance corridor equal to or less than 10 feet in width • Perpendicular crossings that disturb greater than 40 linear feet but equal to or less than 150 linear feet of riparian buffer with a maintenance corridor greater than 10 feet in width • Perpendicular crossings that disturb greater than 150 linear feet of riparian buffer	X	X X	X X	
On-site sanitary sewage systems - new ones that use ground absorption				X
Overhead electric utility lines: • Impacts other than perpendicular crossings in Zone 2 only[3] • Impacts other than perpendicular crossings in Zone 1 [1,2,3]	X X			
Overhead electric utility line perpendicular crossings of streams and other surface waters subject to this Rule[3] • Perpendicular crossings that disturb equal to or less than 150 linear feet of riparian buffer [1] • Perpendicular crossings that disturb greater than 150 linear feet of riparian buffer [1, 2]	X	X		
Periodic maintenance of modified natural streams such as canals and a grassed travelway on one side of the surface water when alternative forms of maintenance access are not practical		X		

[1] Provided that, in Zone 1, all of the following BMPs for overhead utility lines are used. If all of these BMPs are not used, then the overhead utility lines shall require a no practical alternatives evaluation by the Division.

- A minimum zone of 10 feet wide immediately adjacent to the water body shall be managed such that only vegetation that poses a hazard or has the potential to grow tall enough to interfere with the line is removed.
- Woody vegetation shall be cleared by hand. No land grubbing or grading is allowed.
- Vegetative root systems shall be left intact to maintain the integrity of the soil. Stumps shall remain where trees are cut.
- Rip rap shall not be used unless it is necessary to stabilize a tower.
- No fertilizer shall be used other than a one-time application to re-establish vegetation.
- Construction activities shall minimize the removal of woody vegetation, the extent of the disturbed area, and the time in which areas remain in a disturbed state.
- Active measures shall be taken after construction and during routine maintenance to ensure diffuse flow of stormwater through the buffer.
- In wetlands, mats shall be utilized to minimize soil disturbance.

[2] Provided that poles or towers shall not be installed within 10 feet of a water body unless the Division completes a no practical alternatives evaluation.

[3] Perpendicular crossings are those that intersect the surface water at an angle between 75 degrees and 105 degrees.

	Exempt	Allowable	Allowable with Mitigation	Prohibited
Playground equipment: • Playground equipment on single family lots provided that installation and use does not result in removal of vegetation • Playground equipment installed on lands other than single-family lots or that requires removal of vegetation	X	X		
Ponds in natural drainage ways, excluding dry ponds: • New ponds provided that a riparian buffer that meets the requirements of Items (4) and (5) is established adjacent to the pond • New ponds where a riparian buffer that meets the requirements of Items (4) and (5) is NOT established adjacent to the pond		X	X	
Protection of existing structures, facilities and streambanks when this requires additional disturbance of the riparian buffer or the stream channel		X		
Railroad impacts other than crossings of streams and other surface waters subject to this Rule			X	
Railroad crossings of streams and other surface waters subject to this Rule: • Railroad crossings that impact equal to or less than 40 linear feet of riparian buffer • Railroad crossings that impact greater than 40 linear feet but equal to or less than 150 linear feet or one-third of an acre of riparian buffer • Railroad crossings that impact greater than 150 linear feet or one-third of an acre of riparian buffer	X	X	X	
Removal of previous fill or debris provided that diffuse flow is maintained and any vegetation removed is restored	X			
Road impacts other than crossings of streams and other surface waters subject to this Rule			X	
Road crossings of streams and other surface waters subject to this Rule: • Road crossings that impact equal to or less than 40 linear feet of riparian buffer • Road crossings that impact greater than 40 linear feet but equal to or less than 150 linear feet or one-third of an acre of riparian buffer • Road crossings that impact greater than 150 linear feet or one-third of an acre of riparian buffer	X	X	X	
Scientific studies and stream gauging	X			
Stormwater management ponds excluding dry ponds: • New stormwater management ponds provided that a riparian buffer that meets the requirements of Items (4) and (5) is established adjacent to the pond • New stormwater management ponds where a riparian buffer that meets the requirements of Items (4) and (5) is NOT established adjacent to the pond		X	X	
Stream restoration	X			
Streambank stabilization		X		

Temporary roads: • Temporary roads that disturb less than or equal to 2,500 square feet provided that vegetation is restored within six months of initial disturbance • Temporary roads that disturb greater than 2,500 square feet provided that vegetation is restored within six months of initial disturbance • Temporary roads used for bridge construction or replacement provided that restoration activities, such as soil stabilization and revegetation, are conducted immediately after construction	X	X X		
Temporary sediment and erosion control devices: • In Zone 2 only provided that the vegetation in Zone 1 is not compromised and that discharge is released as diffuse flow in accordance with Item (5) • In Zones 1 and 2 to control impacts associated with uses approved by the Division or that have received a variance provided that sediment and erosion control for upland areas is addressed to the maximum extent practical outside the buffer • In-stream temporary erosion and sediment control measures for work within a stream channel	X X	X		
Underground electric utility lines: • Impacts other than perpendicular crossings in Zone 2 only • Impacts other than perpendicular crossings in Zone 1[3,4]	X X			
Underground electric utility line perpendicular crossings of streams and other surface waters subject to this Rule:[3] • Perpendicular crossings that disturb less than or equal to 40 linear feet of riparian buffer[3,4] • Perpendicular crossings that disturb greater than 40 linear feet of riparian buffer[3,4]	X	X		

[4] Provided that, in Zone 1, all of the following BMPs for underground utility lines are used. If all of these BMPs are not used, then the underground utility line shall require a no practical alternatives evaluation by the Division.

- Woody vegetation shall be cleared by hand. No land grubbing or grading is allowed.
- Vegetative root systems shall be left intact to maintain the integrity of the soil. Stumps shall remain, except in the trench, where trees are cut.
- Underground cables shall be installed by vibratory plow or trenching.
- The trench shall be backfilled with the excavated soil material immediately following cable installation.
- No fertilizer shall be used other than a one-time application to re-establish vegetation.
- Construction activities shall minimize the removal of woody vegetation, the extent of the disturbed area, and the time in which areas remain in a disturbed state.
- Active measures shall be taken after construction and during routine maintenance to ensure diffuse flow of stormwater through the buffer.
- In wetlands, mats shall be utilized to minimize soil disturbance.

	Exempt	Allowable	Allowable with Mitigation	Prohibited
Vegetation management:				

• Emergency fire control measures provided that topography is restored • Periodic mowing and harvesting of plant products in Zone 2 only • Planting vegetation to enhance the riparian buffer • Pruning forest vegetation provided that the health and function of the forest vegetation is not compromised • Removal of individual trees which are in danger of causing damage to dwellings, other structures or human life • Removal of poison ivy • Removal of understory nuisance vegetation as defined in: Smith, Cherri L. 1998. Exotic Plant Guidelines. Department of Environment and Natural Resources. Division of Parks and Recreation. Raleigh, NC. Guideline #30	X X X X X X X			
Water dependent structures as defined in 15A NCAC 2B .0202		X		
Water supply reservoirs: • New reservoirs provided that a riparian buffer that meets the requirements of Items (4) and (5) is established adjacent to the reservoir • New reservoirs where a riparian buffer that meets the requirements of Items (4) and (5) is NOT established adjacent to the reservoir		X	X	
Water wells	X			
Wetland restoration	X			

4.4 Restrictive Covenant

The protection and maintenance of the required riparian buffer is a condition under which the Stormwater Administrator can issue a City Stormwater Permit. The previous section of this manual set forth the uses and their designation under the Neuse Riparian Buffer Rule as exempt, allowable, and allowable with mitigation. An applicant's stormwater management plan must describe all use and maintenance items pertaining to the Riparian Buffer and the applicant must execute the Covenant Agreement contained in Appendix C of this manual, or other legal instrument acceptable to the Stormwater Administrator, before a City Stormwater Permit may be issued.

5. Controlling Peak Discharge

5.1 Peak Discharge Requirements.

The City, in compliance with the Neuse Stormwater Rule (NSR), requires that there be no net increase in peak discharge leaving a development site from the predevelopment conditions for the 1-year, 24-hour storm. Variance from the requirement may be provided to developments that meet one or all of the following requirements:

- The increase in peak flow between pre- and post-development conditions does not exceed ten percent.
- The proposed new development meets both of the following criteria:
  1. Overall impervious surface is less than fifteen percent, and
  2. The remaining pervious portions of the site are utilized to the maximum extent practical to convey and control the stormwater runoff.

The City also requires that all new development within the jurisdictional limits of the City control water runoff so that there is no net increase in the peak discharge from the predevelopment conditions for the 10-year, 24-hour storm as defined in this Manual. Where this requirement places an undue hardship upon a property owner, variances from the requirement may be granted by the Stormwater Administrator to developments that meet the following requirement:

- The proposed new development appropriately uses the parcel's total remaining total impervious area to the extent practical to convey and control the stormwater runoff, and it is demonstrated, to the satisfaction of the Stormwater Administrator, that no damage to public or private properties, including to the City's stormwater facilities and to the quality of the public waters, will be caused by granting of the variance.

5.2 The 1 year, 24 hour design storm

The 1 year, 24 hour storm is defined to deliver a total volume of precipitation equal to 3.7 inches in 24 hours and having a temporal distribution of precipitation given by an SCS Type III distribution (SCS, 1985). Figure 5.1 presents the cumulative precipitation distribution for the SCS Type III distribution. Table 5.1 includes the ratio for accumulated to total precipitation in 24-hours for 0.2 hour (12 minute) time intervals. For purposes of peak discharge calculations, average antecedent moisture conditions are to be assumed.

5.3 The 10 year, 24 hour design storm

The 10 year, 24 hour storm is defined to deliver a total volume of precipitation equal to 7.0 inches in 24 hours and having a temporal distribution of precipitation given by an SCS Type III distribution (SCS, 1985). Figure 5.1 presents the cumulative precipitation distribution for the SCS Type III distribution. Table 5.1 includes the ratio for accumulated to total precipitation in 24-hours for 0.2 hour (12 minute) time intervals.

Table 5.1 SCS Type III Rainfall Distribution Curve Data							
Time (hour)	Ratio Accumulated/ Total Precipitation	Time (hour)	Ratio Accumulated/ Total Precipitation	Time (hour)	Ratio Accumulated/ Total Precipitation	Time (hour)	Ratio Accumulated/ Total Precipitation
0.0	0.00000	6.0	0.07200	12.0	0.50000	18.0	0.92800
0.2	0.00200	6.2	0.07530	12.2	0.52670	18.2	0.93117
0.4	0.00400	6.4	0.07880	12.4	0.55570	18.4	0.93428
0.6	0.00600	6.6	0.08250	12.6	0.71344	18.6	0.93733
0.8	0.00800	6.8	0.08640	12.8	0.73356	18.8	0.94032
1.0	0.01000	7.0	0.09050	13.0	0.75000	19.0	0.94330
1.2	0.01200	7.2	0.09480	13.2	0.76412	19.2	0.94612
1.4	0.01400	7.4	0.09930	13.4	0.77728	19.4	0.94893
1.6	0.01600	7.6	0.10400	13.6	0.78948	19.6	0.95168
1.8	0.01800	7.8	0.10890	13.8	0.80072	19.8	0.95437
2.0	0.02000	8.0	0.11400	14.0	0.81100	20.0	0.95700
2.2	0.02203	8.2	0.11943	14.2	0.82057	20.2	0.95958
2.4	0.02412	8.4	0.12532	14.4	0.82968	20.4	0.96211
2.6	0.02627	8.6	0.13167	14.6	0.83833	20.6	0.96460
2.8	0.02848	8.8	0.13848	14.8	0.84652	20.8	0.96704
3.0	0.03080	9.0	0.14580	15.0	0.85430	21.0	0.96940
3.2	0.03308	9.2	0.15348	15.2	0.86152	21.2	0.97179
3.4	0.03547	9.4	0.16167	15.4	0.86833	21.4	0.97410
3.6	0.03792	9.6	0.17032	15.6	0.87486	21.6	0.97636
3.8	0.04043	9.8	0.17943	15.8	0.88057	21.8	0.97858
4.0	0.04300	10.0	0.18900	16.0	0.88600	22.0	0.98080
4.2	0.04563	10.2	0.19928	16.2	0.89110	22.2	0.98288
4.4	0.04832	10.4	0.21052	16.4	0.89600	22.4	0.98498
4.6	0.05107	10.6	0.22272	16.6	0.90070	22.6	0.98700
4.8	0.05388	10.8	0.23588	16.8	0.90520	22.8	0.98899
5.0	0.05670	11.0	0.25000	17.0	0.90950	23.0	0.99090
5.2	0.05968	11.2	0.26644	17.2	0.91380	23.2	0.99284
5.4	0.06267	11.4	0.28656	17.4	0.91750	23.4	0.99470
5.6	0.06572	11.6	0.31430	17.6	0.92120	23.6	0.99651
5.8	0.06883	11.8	0.37330	17.8	0.92470	23.8	0.99828
						24.0	1.00000

5.4 Calculating the Peak Discharge

The City requires, for the purpose of computing the peak discharge from the above described design storms, that one of the following methods be used for all development purposes:

Table 5.2 Value of Runoff Coefficient (C) for Rational Formula

Landuse	C Value	Landuse	C Value
Business:		Roofs	0.75-0.95
- Downtown areas	0.70-0.95		
- Neighborhood areas	0.05-0.70	*Lawns:*	
		- Sandy soil, flat, 2%	0.05-0.10
Residential:		- Sandy soil, average, 2-7%	0.10-0.15
- Single-family areas	0.30-0.50	- Sandy soil, steep, 7%	0.15-0.20
- Multi units, detached	0.40-0.60	- Heavy soil, flat, 2%	0.13-0.17
- Multi units, attached	0.60-0.75	- Heavy soil, average, 2-7%	0.18-0.22
- Suburban	0.25-0.40	- Heavy soil, steep, 7%	0.25-0.35
Industrial:		*Agricultural Land:*	
- Light areas	0.50-0.80	Bare packed soil	
- Heavy areas	0.60-0.90	- Smooth	0.30-0.60
- Parks, cemeteries	0.10-0.25	- Rough	0.20-0.50
- Playgrounds	0.20-0.35	Cultivated Rows	
- Railroad yard areas	0.20-0.40	- Heavy soil no crop	0.30-0.60
- Unimproved areas	0.10-0.30	- Heavy soil with crop	0.20-0.50
		- Sandy soil no crop	0.20-0.40
Streets:		- Sandy soil with crop	0.10-0.25
- Asphalt	0.70-0.95	Pasture	
- Concrete	0.80-0.95	- Heavy soil	0.15-0.45
- Brick	0.70-0.85	- Sandy soil	0.05-0.25
- Drives and walks	0.75-0.85	- Woodlands	0.05-0.25

NOTE: The designer must use judgment to select the appropriate C value within the range for the appropriate land use. Generally, larger areas with permeable soils, flat slopes, and dense vegetation should have lowest C values. Smaller areas with slowly permeable soils, steep slopes, and sparse vegetation should be assigned highest C Values.

Source: American Society of Civil Engineers.

For consistent comparison, the same method must be applied for estimation of the pre- and post-development discharges.

Tables 5.3 and 5.4 can be used to determine the time of concentration (Tc) and peak rainfall intensity for the 1-year and 10-year, 24-hour design storms in New Bern, North Carolina.

Table 5.3 Mean Flow Velocity		
Land Cover	Slope (ft/100ft)	Velocity[1] (ft per min.)
Pavement/Concrete	0.25	19.0
Graded/Bare Ground	0.25	15.5
Lawn	0.25	13.1
Pasture / Meadow	0.25	11.4
Woodland	0.25	8.5
Pavement/Concrete	0.5	26.8
Graded/Bare Ground	0.5	21.9
Lawn	0.5	18.6
Pasture / Meadow	0.5	16.1
Woodland	0.5	12.1
Pavement/Concrete	1	37.9
Graded/Bare Ground	1	31.0
Lawn	1	26.2
Pasture / Meadow	1	22.7
Woodland	1	17.1
Pavement/Concrete	2	53.6
Graded/Bare Ground	2	43.9
Lawn	2	37.1
Pasture / Meadow	2	32.2
Woodland	2	24.1
Pavement/Concrete	5	84.8
Graded/Bare Ground	5	69.3
Lawn	5	58.7
Pasture / Meadow	5	50.9
Woodland	5	38.1
Pavement/Concrete	10	119.9
Graded/Bare Ground	10	98.1
Lawn	10	83.0
Pasture / Meadow	10	71.9
Woodland	10	53.9
Pavement/Concrete	20	169.5
Graded/Bare Ground	20	138.7
Lawn	20	117.3
Pasture / Meadow	20	101.7
Woodland	20	76.3

[1]Assumes overland flow of 1-inch depth.

Table 5.4 Peak Rainfall Intensity vs. Time of Concentration		
Time of Conc. (minutes)	1-year (in/hr)	10-year (in/hr)
10	2.46	4.66
20	2.34	4.43
30	1.93	3.64
45	1.57	2.98
60	1.33	2.52
90	1.04	1.96
120	0.58	1.09
240	0.36	0.68
360	0.26	0.50
480	0.21	0.40

Rational Method Sample Calculation

The Rational Method may only be used for single-family residential development where the final built-out development will impact less than 10 acres. A blank form (Form SW-006) for use while using the Rational Method is included in Appendix A. A description of the Rational Method is included in the North Carolina Stormwater Guidance Manual.

Given: Location: New Bern, North Carolina
Drainage area: 2.5 acres
Average slope: 0.5 percent
Maximum Slope Length: 320 feet

Find: For the watershed draining through the development, compute the design peak runoff rate for a 1-year, 24-hour storm and a 10-year, 24-hour storm both before and after the area is developed.

Step 1: Determine the drainage area, A, in acres.
2.5 acres

Step 2: Determine the runoff coefficient, C, for the type of soil/cover in the pre-development drainage area (see Table 5.2)

Pre-Development Conditions

Type of Land Use	C	Area (acre)	C x A
Woodland	0.20	2.0	0.40
Pasture – Heavy Soil	0.40	0.5	0.20
Total		**2.5**	**0.60**

Area-weighted C = 0.60/2.5 = 0.24

Step 3: Determine the time of concentration, Tc, for the drainage area (i.e. the time of flow from the most remote point in the basin to the design point, in minutes) (see Table 5.3).

For an average slope of 0.5 percent and 80 percent woodland, 20 percent pasture land cover the weighted mean velocity is: 0.8(16.1) + 0.2(12.1) = 15.3 feet/minute

Time of concentration = Length of overland flow / weight mean velocity
Tc = 320 feet / (15.3 feet/minute) = 20.9 minutes

Step 4: Determine the peak rainfall intensity (i), (Table 5.4).

Interpolate maximum intensity for 1-year, 24-hour storm,
I_1 = 2.30 inches/hour

Maximum Intensity for 10-year, 24-hour storm,
I_{10} = 4.4 Inches/hour

Step 5: Determine the peak discharge, q (ft^3/sec), by multiplying the previously determined factors using the Rational formula: q=CiA

Peak flow for 1-year, 24-hour storm, q_1 = CiA = 0.24 x 2.3 x 2.5 =1.38 cfs
Peak flow for 10-year, 24-hour storm, q_{10} = CiA = 0.24 x 4.4 x 2.5 = 2.64 cfs

Repeat Steps 2 through 5 for Post-development conditions.

Step 2: Determine the runoff coefficient, C, for the type of soil/cover in the post-development drainage area (see Table 5.2)

Post-Development Conditions

Type of Land Use	C	Area (acre)	C x A
Woodland	0.20	1.5	0.300
Pasture – Heavy Soil	0.40	0.5	0.200
Lawn – heavy soil, flat	0.15	0.4	0.060
Roof	0.85	0.05	0.043
Driveway	0.75	0.05	0.038
Total		**2.5**	**0.641**

Area-weighted C = 0.641/2.5 = 0.26

Step 3: Determine the time of concentration, Tc, for the drainage area (i.e. the time of flow from the most remote point in the basin to the design point, in minutes) (see Table 5.3).

For an average slope of 0.5 percent and
60 percent woodland
20 percent pasture
16 percent lawn
2 percent roof
2 percent driveway
The weighted mean velocity is:
0.8(16.1) + 0.2(12.1) + 0.16(18.6) + 0.02(26.8) + 0.02(26.8) = 19.3 feet/minute

Time of concentration = Length of overland flow / weight mean velocity
Tc = 320 feet / (19.3 feet/minute) = 16.5 minutes

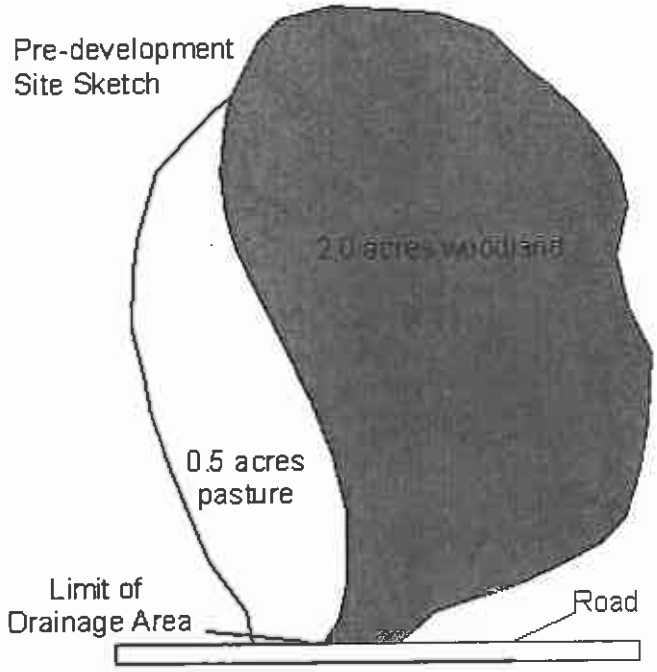
Step 4: Determine the peak rainfall intensity (i), (Table 5.4).

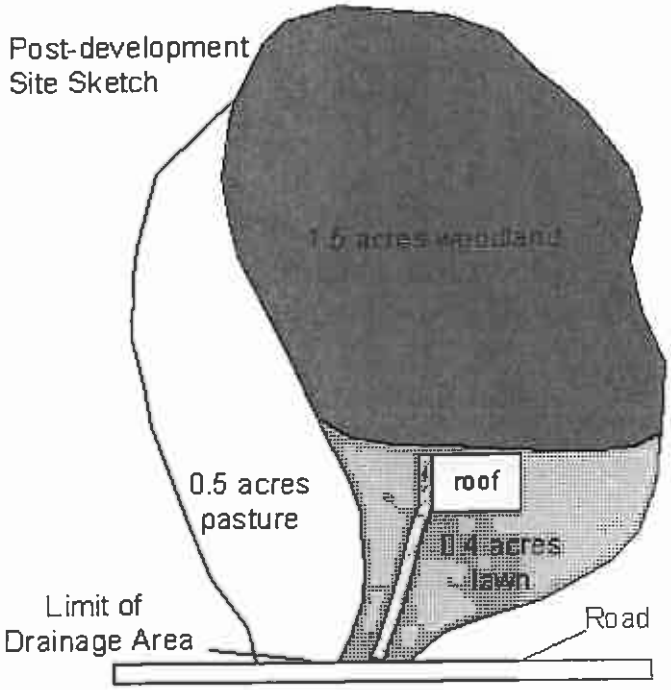
Interpolate maximum intensity for 1-year, 24-hour storm,
I_1 = 2.38 inches/hour

Maximum Intensity for 10-year, 24-hour storm,
I_{10} = 4.51 inches/hour

Step 5: Determine the peak discharge, q (ft^3/sec), by multiplying the previously determined factors using the Rational formula: q=CiA

Peak flow for 1-year, 24-hour storm, q_1 = CiA = 0.26 x 2.38 x 2.5 =1.55 cfs
Peak flow for 10-year, 24-hour storm, q_{10} = CiA = 0.26 x 4.51 x 2.5 = 2.93 cfs


Pre-development
Site Sketch
2.0 acres woodland
0.5 acres
pasture
Limit of
Drainage Area
Road


Post-development
Site Sketch
1.5 acres woodland
0.5 acres
pasture
roof
0.4 acres
lawn
Limit of
Drainage Area
Road

The SCS Peak Discharge Method Sample Calculation

The SCS Peak Discharge Method may be used to calculated peak discharge for any development. The following is a simplified example of the SCS Method. Details of this method are included in USDA-SCS Technical Release 55. Equally acceptable methods are given in the Hydrology section of the National Engineering Handbook and in the TR-20 model, which is described in USDA Technical Release 20 (including its revisions and derivatives). Table 5.4 may be used to determine the area-averaged value of the runoff curve number (CN). A blank form (Form SW-007) for calculating peak runoff using the SCS Method is included in Appendix A.

Given: Location: New Bern, North Carolina
Drainage area: 21 acres
Average slope: 1.0 percent
Maximum Hydraulic Slope Length: 3,000 feet
Hydrologic Soil Group: C

Find: For the watershed draining through the development, compute the design peak runoff rate for a 1-year, 24-hour storm and a 10-year, 24-hour storm both before and after the area is developed.

Step 1: Determine the drainage area, A.
A = 21 acres

Determine the hydraulic length (distance from most remote point to design point).
L = 3,000 feet

Determine the average slope (percent) of the watershed.
S = 1.0 %

Step 2: Calculate the curve number, CN, for the drainage area (see Table 5.5).

Pre-Development Conditions

Type of Land Use	CN	% Imp.	Area (acre)	CN x A	Imp x A
Industrial	91	72	5	455	360
Single Family residential, 1/2 acre lots	80	25	8	640	200
Woodland	70	0	8	560	0
Total			21	1,665	560

Area-weighted CN = 1,665/21 =79.3
Overall percent Impervious = 560/21 = 26.7 %

Step 3: Select design storm and determine the runoff depth and volume.
1-year, 24-hour design rainfall amount: P_1 = 3.7 inches
10-year, 24-hour design rainfall amount: P_{10} = 7.0 inches

Determine runoff depth: $Q = (P - 0.2S)^2/(P + 0.8S)$ for $S = (1000/CN) - 10$

S = (1000/79.3) – 10 = 2.61 inches
Q_1 = (3.7 – 0.2(2.61))^2/(3.7 + 0.8(2.61)) = 1.74 inches
Q_{10} = (7.0 – 0.2(2.61))^2/(7.0 + 0.8(2.61)) = 4.62 inches

Step 4: Determine the peak rate of runoff for the design storm by adjusting for watershed shape.
Equivalent drainage area, Ac for hydraulic length of 3,000 feet: Ac = 90 acres
Total peak runoff rate for equivalent drainage are, Q_{Ac} = 37 cfs/inch runoff:
Q_1 = 37 cfs/inch x 1.74 inch (21/90) = 15.0 cfs
Q_{10} = 37 cfs/inch x 4.62 inch (21/90) = 39.9 cfs

Step 5: Adjust peak discharge to account for impervious area and channel improvements.
Q_1 = 15.0 cfs x 1.12 = 16.8 cfs
Q_{10} = 39.9 cfs x 1.12 = 44.7 cfs
No improved channel adjustment necessary for pre-development conditions.

Step 6: Adjust the peak discharge based on the average watershed slope.
No watershed slope adjustment necessary for pre-development conditions.

Step 7: Adjust the peak discharge for ponding and swampy areas in the watershed.
No ponding and swampy area adjustment necessary for pre-development conditions.

Repeat Steps 2 though 7 for post-development conditions.

Step 2: Calculate the curve number, CN, for the drainage area (see Table 5.5).

Post-Development Conditions

Type of Land Use	CN	% Imp.	Area (acre)	CN x A	Imp x A
Industrial	91	72	6	546	432
Single Family residential, 1/2 acre lots	80	25	8	640	200
Woodland – good stand	70	0	0	0	0
Commercial	94	85	7	658	595
Total			21	1,844	1,227

Area-weighted CN = 1,844/21 = 87.8
Overall percent Impervious = 1,227/21 = 58.4 %

Step 3: Select design storm and determine the runoff depth and volume.
1-year, 24-hour design rainfall amount: P_1 = 3.7 inches
10-year, 24-hour design rainfall amount: P_{10} = 7.0 inches

Determine runoff depth: Q = (P – 0.2S)^2/(P + 0.8S) for S = (1000/CN) – 10
S = (1000/87.8) – 10 = 1.38 inches
Q_1 = (3.7 – 0.2(1.38))^2/(3.7 + 0.8(1.38)) =2.44 inches
Q_{10} = (7.0 – 0.2(1.38))^2/(7.0 + 0.8(1.38)) = 5.58 inches

Step 4: Determine the peak rate of runoff for the design storm by adjusting for watershed shape.

Equivalent drainage area, Ac for hydraulic length of 3,000 feet: Ac = 90 acres

Total peak runoff rate for equivalent drainage are, Q_{Ac} = 37 cfs/inch runoff:

Q_1 = 49 cfs/inch x 2.44 inch (21/90) = 27.9 cfs

Q_{10} = 49 cfs/inch x 5.58 inch (21/90) = 63.8 cfs

Step 5: Adjust peak discharge to account for impervious area and channel improvements.

Q_1 = 27.9 cfs x 1.20 = 33.5 cfs

Q_{10} = 63.8 cfs x 1.20 = 76.6 cfs

No improved channel adjustment necessary for post-development conditions.

Step 6: Adjust the peak discharge based on the average watershed slope.

No watershed slope adjustment necessary for post-development conditions.

Step 7: Adjust the peak discharge for ponding and swampy areas in the watershed.

No ponding and swampy area adjustment necessary for post-development conditions.

Table 5.5 SCS Runoff Curve Numbers (CN)

Land Use/Cover	Hydrologic Soil Group			
	A	B	C	D
	CN			
Cultivated land				
- without conservation	72	81	88	91
- with conservation	62	71	78	81
Pasture land				
- poor condition	68	79	86	89
- good condition	39	61	74	80
Meadow				
- good condition	30	58	71	78
Wood or forest land				
- Thin stand – poor cover, no mulch	45	66	77	83
- Good stand – good cover	25	55	70	77
Open spaces, lawns, parks, golf courses, cemeteries, etc.				
- Good condition: grass cover on 75% or more of the area	39	61	74	80
- Fair condition: grass cover on 50 to 75% of the area	49	69	79	84
Commercial and business areas (85% Impervious)	89	92	94	95
Industrial districts (72% impervious)	81	88	91	93
Residential[1]: Development completed and vegetation established				
Average lot size / Average % Impervious				
1/8 acre or less / 65	77	85	90	92
1/4 acre / 38	61	75	83	87
1/3 acre / 30	57	72	81	86
1/2 acre / 25	54	70	80	85
1 acre / 20	51	68	79	84
2 acres / 15	47	66	77	81
Paved parking lots, roofs, driveways, etc.	98	98	98	98
Streets and roads paved with curbs and storm sewers	98	98	98	98
- gravel	76	85	89	91
- dirt	72	82	87	89
Newly graded area	81	89	93	95
Residential: Development underway and no vegetation				
- Lot sizes of 1/4 acre	88	93	95	97
- Lot sizes of 1/2 acre	85	91	94	96
- Lot sizes of 1 acre	82	90	93	95
- Lot sizes of 2 acres	81	89	92	94

[1] Curve numbers are computed assuming the runoff from the house and driveway is directed toward the street.

Source: USDA-SCS

5.5 Restrictive Covenant

The proper design, installation, and maintenance of a stormwater facility plan is a condition under which the Stormwater Administrator can issue a City Stormwater Permit. This section of the manual set forth the requirements for the computation of pre- and post-development stormwater discharges and the criteria under which the Stormwater Administrator may issue a City Stormwater Permit. In order to ensure that the facilities maintained in a development result in compliance with the plan presented in the application the applicant must execute the Covenant Agreement contained In Appendix C of this manual, or other legal instrument acceptable to the Stormwater Administrator, before a City Stormwater Permit may be issued.

Note:

No summary forms or examples are provided in this manual for developers who want to use Green-Ampt or Horton infiltration functions and Kinematic or Dynamic Wave Routing methods for the calculation of runoff. When submitting calculations based on those methods an engineering summary of the calculations should be prepared and computer input and simulation results should be submitted to the Stormwater Administrator in both printed and electronic forms.

6. Calculating and Controlling Nitrogen Exports

6.1 The Nitrogen Control Program

The City, in compliance with the North Carolina Neuse River Stormwater Rule (NSR), has a goal of reducing the amount of total nitrogen leaving new developments within the City by 30 percent. The NSR expects to achieve this reduction by implementation of total nitrogen-reducing planning considerations and best management practices (BMPs). The NSR requires that all new developments meet a total nitrogen export performance standard of less than or equal to 3.6 pounds per acre per year (lbs/ac/yr). Total nitrogen loads from new developments that exceed the performance standard will be allowed only if one-time offset payments are made to the Ecosystem Enhancement Program in the amount of $850.50/lb/yr for the excess total nitrogen (TN) load. The City also requires payment of a one-time offset fee in the amount of $170/lb/yr for the excess total nitrogen (TN) load. No new development may be permitted where total nitrogen exports exceed 6 lbs/ac/yr for residential developments and 10 lbs/ac/yr for non-residential developments. If planned new development generates greater than the allowable limits, there are options for residential and commercial properties to reduce the total nitrogen load through the implementation and maintenance of wet detention ponds, constructed wetlands, and other BMPs.

In order to ensure that the total nitrogen export reductions occur, the City and the NSR requires a computation of the average potential total nitrogen export from each new development.

For purposes of total nitrogen export control the City defines new development as any activity that disturbs greater than 1/2 acre of land in order to establish, expand or modify a single family, duplex residential, multifamily residential, commercial, industrial, institutional development or a recreational facility. New development does not include agriculture, mining, or forestry activities. Land disturbance is defined as grubbing, stump removal, and/or grading.

6.2 Calculating Total Nitrogen Exports

The City allows two methods for calculating total nitrogen export.

- *Method 1* – For residential developments where lots are shown, but the actual footprints of buildings are not shown, on site plans. Impervious surface resulting from building footprints is estimated based on typical impervious areas associated with a given lot size.
- *Method 2* – For residential, commercial, and industrial developments when the entire footprint of the roads, parking lots, buildings, and any other built-upon area is shown on site plans. Commercial and industrial developments must use Method 2.

Regardless of which method is used, annual accounting of net changes of total nitrogen export from new developments must be reported to the City in the application for a Stormwater Permit. The accounting must include enumeration of:

- Pre-development total nitrogen export loads.
- Potential post-development total nitrogen export loads without BMPs.
- Estimated post-development total nitrogen export loads with the use of BMPs.
- The difference between potential and actual post-development total nitrogen export loads.
- Total nitrogen load to be paid for by offset fees.

Method 1

This method does not require calculation of the area of building footprints. Rather, the impervious surface resulting from building footprints is estimated based on typical impervious areas associated with a given lot size. This method is shown in Figure 2a, which was reproduced from the *Neuse River Basin: Model Stormwater Program for Nitrogen Control* (Model Program) (1999). The development of these methods is described in Appendix F of the *Appendices to the Neuse River Basin: Model Stormwater Program for Nitrogen Control* (1999).

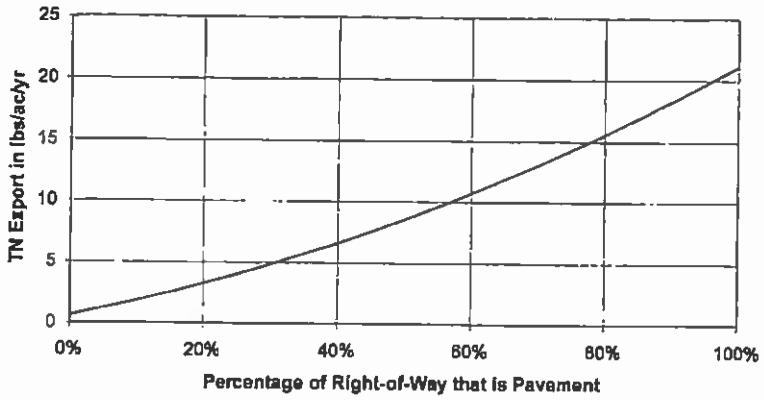
Figure 2a: Method 1 for Quantifying Total Nitrogen (TN) Export from Residential Developments when Building and Driveway Footprints are Not Shown*

Step 1: Determine area for each type of land use and enter in Column (2).
Step 2: Total the areas for each type of land use and enter at the bottom of Column (2).
Step 3: Determine the TN export coefficient associated with right-of-way using Graph 1.
Step 4: Determine the TN export coefficient associated with lots using Graph 2.
Step 5: Multiply the areas in Column (2) by the TN export coefficients in Column (3) and enter in Column (4).
Step 6: Total the TN exports for each type of land use and enter at the bottom of Column (4).
Step 7: Determine the export coefficient for site by dividing the total TN export from uses at the bottom of Column (4) by the total area at the bottom of Column (2).

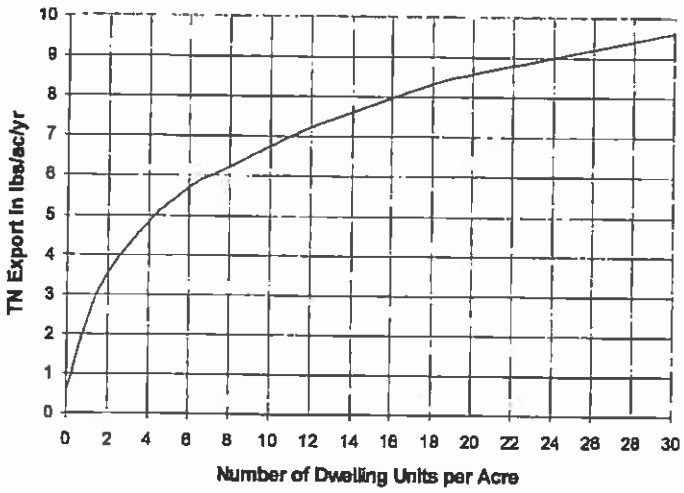
(1) Type of Land Cover	(2) Area (acres)	(3) TN export coeff. (lbs/ac/yr)	(4) TN export from use (lbs/yr)
Permanently protected undisturbed Open space (forest, unmown meadow)		0.6	
Permanently protected managed Open space (grass, landscaping, etc.)		1.2	
Right-of-way (read TN export from Graph 1)			
Lots (read TN export from Graph 2)			
TOTAL		---	

*Reproduced from *Neuse River Basin: Model Stormwater Program for Nitrogen Control* (1999).

Graph 1: Total Nitrogen Export from Right-of-Way



Graph 2: Total Nitrogen Export from Lots



(Graphs 1 and 2 were reproduced from *Neuse River Basin: Model Stormwater Program for Nitrogen Control*, 1999).

Method 2

Method 2 is shown in Figure 2b, which was reproduced from the Model Program (1999).

Figure 2b: Method 2 for Quantifying TN Export from Residential/Industrial/Commercial Developments when Footprints of all Impervious Surfaces are Shown*

Step 1: Determine area for each type of land use and enter in Column (2).
Step 2: Total the areas for each type of land use and enter at the bottom of Column (2).
Step 3: Multiply the areas in Column (2) by the TN export coefficients in Column (3) and enter in Column (4).
Step 4: Total the TN exports for each type of land use and enter at the bottom of Column (4).
Step 5: Determine the export coefficient for site by dividing the total TN export from uses at the bottom of Column (4) by the total area at the bottom of Column (2).

(1) Type of Land Cover	(2) Area (acres)	(3) TN export coeff. (lbs/ac/yr)	(4) TN export from use (lbs/yr)
Permanently protected undisturbed open space (forest, unmown meadow)		0.6	
Permanently protected managed open space (grass, landscaping, etc.)		1.2	
Impervious surfaces (roads, parking lots, driveways, roofs, paved storage areas, etc.)		21.2	
Total		---	

*Reproduced from *Neuse River Basin: Model Stormwater Program for Nitrogen Control* (1999).

The NSR requires that all new developments achieve a nitrogen export of less than or equal to 3.6 lbs/ac/yr. If the development contributes greater than 3.6 lbs/ac/yr of nitrogen, the mitigation options shown in Table 2a are available for residential or non-residential developments.

Table 2a: Nitrogen Export Reduction Options

Residential	Commercial / Industrial
If the computed export is less than 6.0 lbs/ac/yr, then the owner may either: 1. Install BMPs to remove enough nitrogen to bring the development down to 3.6 lbs/ac/yr; 2. Pay a one-time offset payment of $850.50/lb to the State and $170/lb to the City to bring the nitrogen down to the 3.6 lbs/ac/yr; or, 3. Do a combination of BMPs and offset payments to achieve a 3.6 lbs/ac/yr export.	If the computed export is less than 10.0 lbs/ac/yr, then the owner may either: 1. Install BMPs to remove enough nitrogen to bring the development down to 3.6 lbs/ac/yr; 2. Pay a one-time offset payment* per pound to the State and $170/lb to the City to bring the nitrogen down to the 3.6 lbs/ac/yr; or, 3. Do a combination of BMPs and offset payment to achieve a 3.6 lbs/ac/yr export.
If the computed export is greater than 6.0 lbs/ac/yr, then the owner must use on-site BMPs to bring the development's export down to 6.0 lbs/ac/yr. Then, the owner may use one of the three options above to achieve the reduction between 6.0 and 3.6 lbs/ac/yr.	If the computed export is greater than 10.0 lbs/ac/yr, then the owner must use on-site BMPs to bring the development's export down to 10.0 lbs/ac/yr. Then, the owner may use one of the three options above to achieve the reduction between 10.0 and 3.6 lbs/ac/yr.

The table above discusses the option of using offset fees to meet the nitrogen export levels set for new development activities. These offset fees go to the North Carolina Ecosystem Enhancement Program (EEP). The EEP will utilize these fees in accordance

with the EEPs Basinwide Wetlands and Riparian Restoration plans. An additional payment in the amount of $170/lb/yr must be paid to the City before a Stormwater Permit can be issued.

Examples of Total Nitrogen calculations using Methods 1 and 2 are included on the following pages. Blank forms for calculating Total Nitrogen export are included in Appendix A.

Example 1: Single Residential Lot

Given:

- Single Residential Lot
- 0.7 acres total, 2,000 sf house, 20'x30' driveway
- Overall expected Impervious area = 8.5% (0.06 acres)
- Developed as single family residence

Use Method 2 (Form SW-005) because actual impervious area is known.

Land Use	Area (acre)	TN Export Coefficient, (lbs/ac/yr)	TN Export (lbs/yr)
Permanently protected, undisturbed **open space** (forest, existing riparian buffers)	0	0.6	0
Permanently protected **managed open space** (lawns, landscaped areas)	0.64	1.2	0.77
Impervious surfaces (roofs, roads, pavement, parking areas, etc.)	0.06	21.2	1.27
Totals	0.70	———	2.04

Total N export = 2.04 lbs/yr ÷ 0.7 ac = 2.91 lbs/ac/yr

Total N export < 6 lbs/ac/yr (residential limit), no BMP's necessary.
Total N export < 3.6 lbs/ac/yr, no Offset Payments necessary.

Example 2: Residential Multi-Lot Subdivision – Method 1

Given:

- Residential subdivision inside the Extra Territorial Jurisdiction (ETJ)
- 80 acres total, 33 lots, 9 acres in ROW with a 20' pavement width (90 percent impervious)
- Overall expected impervious area = 14% (11.2 acres)
- Length of Stream A = 1000' x 50' riparian buffer x 2 sides of stream = 2.3 acres
- Developed as 1 dwelling unit per 2 acres

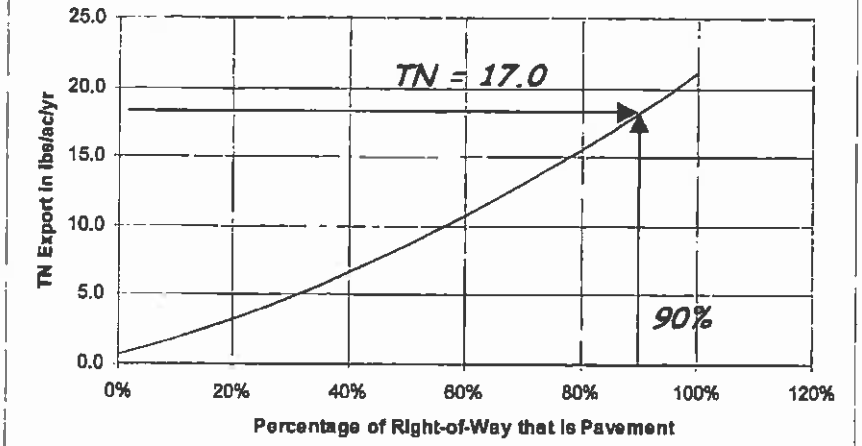
Use Method 1 (Form SW-004) because actual building footprints on lots are not known.

Land Use	Area (acre)	TN Export Coefficient, (lbs/ac/yr)	TN Export (lbs/yr)
Permanently protected, undisturbed **open space** (forest, existing riparian buffers)	2.3	0.6	1.4
Permanently protected **managed open space** (lawns, landscaped areas)	2.7	1.2	3.2
Right of Way (read TN export from Graph 1)	9.0	17.0	153.0
Lots (read TN export from Graph 2)	66.0	1.3	85.8
Totals	80.0	------	243.4

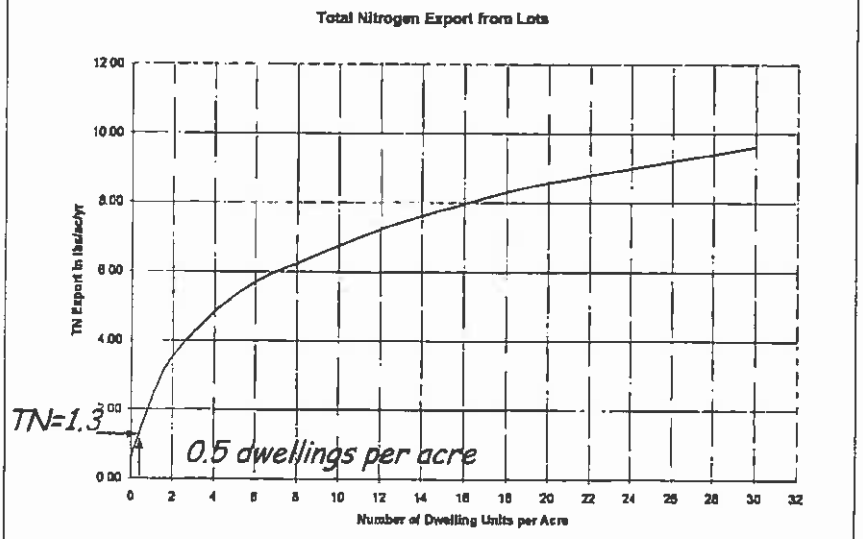
Total N export = 243.4 lbs/yr ÷ 80.0 ac = 3.0 lbs/ac/yr

Total N export < 6 lbs/ac/yr (residential limit), no BMP's necessary.
Total N export < 3.6 lbs/ac/yr, no Offset Payments necessary.

Graph 1: Total Nitrogen Export from Right-of-Way



Graph 2: Total Nitrogen Export from Lots



Example 3: Residential Multi-Lot Subdivision – Method 1

Given:

- Residential subdivision inside the Extra Territorial Jurisdiction (ETJ)
- 80 acres total, 120 lots, 16 acres in ROW with a 20' pavement width (90 percent impervious)
- Overall expected impervious area = 20% (16.3 acres)
- Length of Stream A = 2000' x 50' riparian buffer along one bank = 2.3 acres
- Developed as 2 dwelling units per 1 acre

Use Method 1 (Form SW-004) because actual footprints of buildings on lots are unknown.

Land Use	Area (acre)	TN Export Coefficient, (lbs/ac/yr)	TN Export (lbs/yr)
Permanently protected, undisturbed open space (forest, existing riparian buffers)	2.3	0.6	1.4
Permanently protected managed open space (lawns, landscaped areas)	1.7	1.2	2.0
Right of Way (read TN export from Graph 1)	16.0	17.0	272.0
Lots (read TN export from Graph 1)	60.0	3.5	210.0
Totals	80.0	---------	485.4

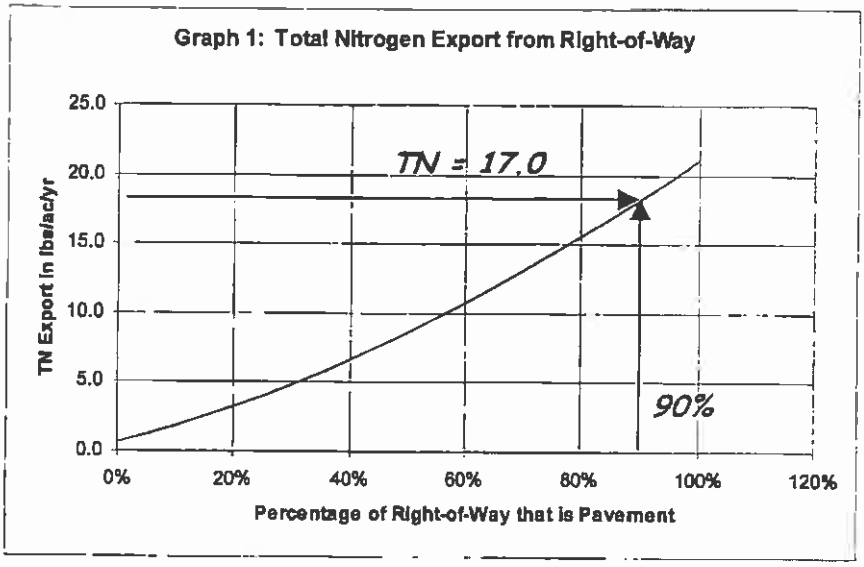
Total N export = 485.4 lbs/yr ÷ 80.0 ac = 6.1 lbs/ac/yr
Total N export > 6 lbs/ac/yr (residential limit), BMP's necessary. Wet pond can be used for both detention and N reduction.

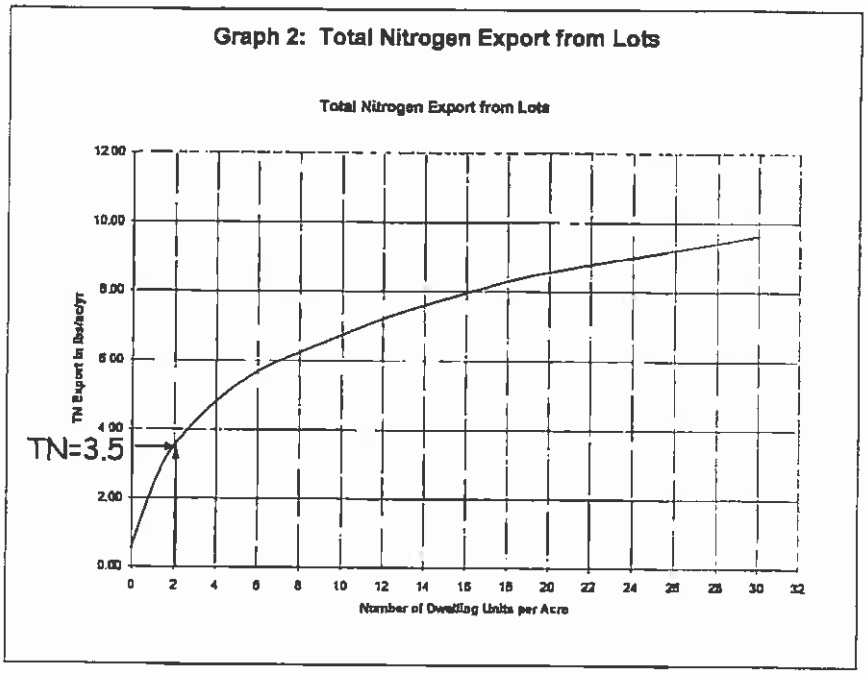
Option 1: Offset payment and wet detention BMP

- Install wet detention, providing 25% reduction of 6.1 = 4.6 lbs/ac/yr
- State Offset payment (4.6 lbs/ac/yr - 3.6 lbs/ac/yr) x $850.50/lb/yr x 80.0 ac = $68,040.00.
- City of New Bern Offset payment (4.6 lbs/ac/yr – 3.6 lbs/ac/yr) x $170 x 80.0 ac = $13,600.00
- **Total Offset Payments: $81,650.00**

Option 2: Offset payment, filter strip BMP, and wet detention BMP

- Install Filter strips, providing 20% reduction of 6.1 = 4.9 lbs/ac/yr
- Install wet detention, providing 25% reduction of 4.88 = 3.7 lbs/ac/yr
- State Offset payment (3.7 lbs/ac/yr – 3.6 lbs/ac/yr) x $850.50/lb/yr x 80.0 ac = $6,804.00.
  City of New Bern Offset payment (3.7 lbs/ac/yr – 3.6 lbs/ac/yr) x $170 x 80.0 ac = $1,360.00
- **Total Offset Payments: $8,164.00**


Graph 1: Total Nitrogen Export from Right-of-Way
TN = 17.0
90%
TN Export in lbs/ac/yr
25.0
20.0
15.0
10.0
5.0
0.0
0%
20%
40%
60%
80%
100%
120%
Percentage of Right-of-Way that is Pavement


Graph 2: Total Nitrogen Export from Lots
Total Nitrogen Export from Lots
TN=3.5
TN Export in lbs/ac/yr
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
Number of Dwelling Units per Acre

Example 4: Residential Multi-Lot Subdivision with Detention – Method 2

Given:

- Residential subdivision inside the Extra Territorial Jurisdiction (ETJ)
- 40.2 acres total, 66 lots, 5.3 acres in ROW with a 20' pavement width
- expected impervious area = 25%
- length of Stream A = 1800' x 50' riparian buffer = 2.1 acres
- developed as 2 dwelling units per acre

Use Method 2 because actual impervious area is known.

Land Use	Area (acre)	TN Export Coefficient, (lbs/ac/yr)	TN Export (lbs/yr)
Permanently protected, undisturbed open space (forest, existing riparian buffers)	2.1	0.6	1.3
Permanently protected managed open space (lawns, landscaped areas)	28.1	1.2	33.7
Impervious surfaces (roofs, roads, pavement, parking areas, etc.)	10.0	21.2	212.0
Totals	40.2	———	247.0

Total N export = 247.0 lbs/yr ÷ 40.2 ac = 6.14 lbs/ac/yr

Requirements: If export > 6 lbs/ac/yr (residential limit), must use BMP's to reduce to < 6.0 lbs/ac/yr.

Option 1: Offset payment and wet detention BMP

- Install Filter strips, providing 25% reduction = 4.6 lbs/ac/yr
- State Offset payment (4.6 lbs/ac/yr – 3.6 lbs/ac/yr) x $850.50/lb/yr x 40.2 ac = $34,190.00
- City of New Bern Offset payment (4.6 lbs/ac/yr – 3.6 lbs/ac/yr) x $170 lbs x 40.2 ac = $6,834.00
- **Total Offset Payments: $41,024.10**

Option 2: Offset payment, wet detention and filter strip (BMP's in series)

- Install filter strips, providing 20% reduction = 4.9 lbs/ac/yr
- Install wet detention after filter strips, providing 25% reduction of 4.9 = 3.68 lbs/ac/yr
- State Offset payment (3.68 lbs/ac/yr – 3.6 lbs/ac/yr) x $850.50/lb/yr x 40.2 ac = $2,735.21
- City of New Bern Offset payment (3.68 lbs/ac/yr – 3.6 lbs/ac/yr) x $170 x 40.2 ac = $546.72
- **Total Offset Payments: $3,281.93**

Example 5: Residential Multi-Lot Subdivision without Detention

- Residential subdivision inside the ETJ
- Given: 101.96 developed acreage, 89 lots, ROW acreage = 6.58
- Site Plan presents impervious area = 15%
- 1100' along buffer regulated stream x 50' riparian buffer along one bank = 1.3 acres

Use Method 2 (Form SW-005) because actual impervious area is known.

Land Use	Area (acre)	TN Export Coefficient, (lbs/ac/yr)	TN Export (lbs/yr)
Permanently protected, undisturbed open space (forest, existing riparian buffers)	1.3	0.6	0.8
Permanently protected managed open space (lawns, landscaped areas)	85.4	1.2	102.4
Impervious surfaces (roofs, roads, pavement, parking areas, etc.)	15.3	21.2	324.4
Totals	102.0	--------	427.6

Total N export = 427.6 lbs/yr ÷ 101.96 ac = 4.2 lbs/ac/yr
Requirements: Offset payment or install BMP's to reduce to 3.6 lbs/ac/yr

Option 1: Offset payments only

- State Offset Payment: (4.2 lbs/ac/yr – 3.6 lbs/ac/yr) x $850.50/lb/yr x 101.96 ac = $52,030.19
- City of New Bern: (4.2 lbs/ac/yr – 3.6 lbs/ac/yr) x $170 x 101.96 ac. = $10,399.92
- **Total Offset Payments: $62,430.11**

Option 2: Open space non-structural BMP and offset payment

- Set aside 20 acres as open space within site to be undisturbed and perpetually protected.

Land Use	Area (acre)	TN Export Coefficient, (lbs/ac/yr)	TN Export (lbs/yr)
Permanently protected, undisturbed open space (forest, existing riparian buffers)	21.3	0.6	12.8
Permanently protected managed open space (lawns, landscaped areas)	65.4	1.2	78.4
Impervious surfaces (roofs, roads, pavement, parking areas, etc.)	15.3	21.2	324.4
Totals	102.0	-------	415.6

- Total N export = 415.6 lbs/ac/yr ÷ 101.96 ac = 4.07 lbs/ac/yr
- State Offset Payment: (4.07 lbs/ac/yr – 3.6 lbs/ac/yr) x $850.50/lb/yr x 101.96 ac = $40,756.98
- City of New Bern Offset payment (4.07 lbs/ac/yr – 3.6 lbs/ac/yr) x $170 x 101.96 ac = $8,146.60
- **Total Offset Payments: $48,903.58**

Option 3: Wet Detention Pond BMP

- Install wet detention pond, providing 25% reduction = 3.15 lbs/ac/yr
- **No Offset Payments Required**

Example 6: Commercial Development

Given:

- Commercial Development inside the Extra Territorial Jurisdiction (ETJ)
- 10.0 acres total
- Site Plans present impervious area = 75%

Use Method 2 (Form SW-005) because it is a commercial development.

Land Use	Area (acre)	TN Export Coefficient, (lbs/ac/yr)	TN Export (lbs/yr)
Permanently protected, undisturbed open space (forest, existing riparian buffers)	0	0.6	0
Permanently protected managed open space (lawns, landscaped areas)	2.5	1.2	3.0
Impervious surfaces (roofs, roads, pavement, parking areas, etc.)	7.5	21.2	159.0
Totals	10.0	---------	162.0

Total N export = 162.0 lbs/yr ÷ 10.0 ac = 16.2 lbs/ac/yr

Requirements: If export > 10 lbs/ac/yr (non-residential limit), must use BMP's to reduce to < 10.0 lbs/ac/yr.

Option 1: Offset payment, wet detention and filter strip (BMP's in series)

- Use two different BMPs for different sections of the development site.
  - Install filter strips along area draining 1/3 of impervious surfaces, reduce 1/3 of 180.2 lb TN/year by 20%.
    - Adjusted TN Export from 1/3 of impervious surfaces = 7.5/3*21.2*0.8 = 42.4lbs/yr
  - Install wet detention for area draining remaining area, reducing TN by 25%.
    - Adjusted TN Export from remaining 2/3 impervious surfaces and permanently protected managed open space= (2.5*1.2+ 7.5*2/3*21.2)*0.75 = 81.8 lbs/yr
  - Total Adjusted TN Export = 48.1 + 81.8 = 129.9 lbs/yr
  - Adjusted TN export per area = 129.9 lbs/yr ÷ 10.0 ac = 13.0 lbs/ac/yr
- Route water from wet detention pond through sand filter (third BMP), reduce TN export by 35%.
  - Total Adjusted TN export = 129.9 * 0.65 = 84.4 lbs/yr
  - Adjusted TN export per area = 84.4 lbs/yr ÷ 10.0 ac = 8.4 lbs/ac/yr
- State Offset payment (8.4 lbs/ac/yr – 3.6 lbs/ac/yr) x $850.50/lb/yr x 10 ac = $40,824.00
- City of New Bern Offset payment (8.4 lbs/ac/yr – 3.6 lbs/ac/yr) x $170 x 10.0 ac = $8,160.00
- **Total Offset Payments: $48,984.00**

6.3 Restrictive Covenant

The proper design, installation, and maintenance of a stormwater facility plan is a condition under which the Stormwater Administrator can issue a City Stormwater Permit. This section of the manual set forth the requirements for the computation of total nitrogen exports and the criteria under which the Stormwater Administrator may issue a City Stormwater Permit. The applicant's stormwater facility plan must specify the areas of impervious surface, undisturbed open space, and managed open space in the development. In order to ensure that the facilities maintained in a development result in compliance with the plan presented in the application the applicant must execute the Covenant Agreement contained in Appendix C of this manual, or other legal instrument acceptable to the Stormwater Administrator, before a City Stormwater Permit may be issued.

7. Site Design Best Management Practices

7.1 Low-Impact Development (LID)

The City encourages developers and property owners to adopt the principles and practices of Low-impact development (LID) to achieve stormwater control and improve the quality of the runoff from developed areas. LID can be described as the effort to create a hydrologically functional landscape in a developed area that mimics the natural hydrologic regime. This objective is accomplished by:

- Minimizing stormwater impacts to the extent practicable. Techniques to accomplish this include reducing imperviousness, conserving natural resource and ecosystems, maintaining natural drainage courses, reducing use of pipes, and minimizing clearing and grading.
- Providing runoff storage measures dispersed uniformly throughout a site's landscape with the use of a variety of detention, retention, and runoff practices.
- Maintaining predevelopment time of concentration by strategically routing flows to maintain travel time and control the discharge.
- Implementing effective public education programs to encourage property owners to use pollution prevention measures and properly maintain the on-lot hydrologically function landscape management practices.

7.1.1 LID Strategies

The City is reviewing its ordinances, operations and practices in order to better manage stormwater from its properties and the City expects developers and property owners applying for Stormwater Permits to use LID strategies in their site designs and stormwater management plans. Some of the strategies that can provide for improved stormwater management and for the reduction of the total nitrogen (TN) export required under the Neuse River Rule, include:

- **Reducing Road and Driveway Widths**

  Reducing road and driveways widths reduces the amount of impervious area of a site. Roads are often designed at widths that are excessive, and sometimes even counterproductive, for vehicular safety. Overly wide roads inadvertently increase impervious area that, in turn, increases storm runoff and the transport of nutrients and other pollutants. Applicants for stormwater permits should show that they have considered road and driveway widths and have appropriately reduced them while maintaining a minimum consistent with health, safety requirements, and the requirements of the City's Land Use Ordinance.

- **Reducing Parking Areas**

  Similar to road and driveway widths, parking areas (both the number and size of spaces) often are designed with no consideration of the stormwater and water quality impacts of those facilities. Some methods that may be used to

reduce the impervious area created by parking facilities are use of angled parking and smaller parking spaces and the use of pervious parking materials.

Parking facilities do not have to be visually unappealing and, fortunately, many of the methods used to reduce the unpleasant visual impacts of parking facilities can be incorporated into its water quality mitigation plans. Depressed, rather than raised, parking lot islands and median strips not only enhance the aesthetic value of the area, but can also serve a functional purpose for water quality enhancement. These interruptions in the impervious parking lots can have vegetative filter strips to receive pavement runoff or contain bioretention areas or other engineered BMPs.

Porous pavements can be used in parking lots to reduce the amount of runoff and decrease the required size of associated BMP structures.

- **Minimizing Use of Curb and Gutter**

  Curb and gutter are often used in areas where they are not required for stormwater control and where alternative designs such as grass swales are feasible. In the application for a Stormwater Permit, the applicant should present information about the development's street design procedures and should show that alternatives to curb and gutter have been considered. Useful alternative approaches include designs that allow sidewalk, driveway, and parking lot flows to drain into grass swales or bioretention areas, away from street gutter and pipe systems. These systems should use flush surface curbstones that allow sheet flow off of the impervious surface while providing lateral support for the pavement. Where both curb and gutter are necessary, the use of frequent curb cuts, which divert a designed portion of the runoff onto vegetated areas, should be considered.

- **Cluster and Open-Space Developments and "Traditional" Neighborhood Developments.**

  Among the strategies listed in the NSR are the uses of innovative community and subdivision designs that can significantly reduce the impact of new development on water quality and on required municipal services. The City will encourage these innovations by review of its current Land Use Ordinance and require stormwater management BMP design review as part of the site review process. The NSR Model Program defines "traditional" neighborhoods as rectangular block development with mixed residential and commercial land use. Such neighborhoods can have the advantage of reducing automobile travel and promoting increased usage of alternative transportation modes, including mass transit and pedestrian.

- **Maintaining Green Space**

  How a development and its residents manage green space has an important impact on water quality. In dense urban settings, rain gardens can be used to reduce runoff from buildings and create a pleasant environment. Rain garden

systems consist of piping roof storm water into a cistern that bleeds the water into a nearby, vegetated area. Filtration through the vegetation and the soil removes pollutants from the water and reduces the impacts of the impervious roof area. Developing City procedures to properly manage the application of fertilizers on City property and publishing guidelines on the use of fertilizers (and other chemicals) for residential and commercial properties are low-cost, highly effective methods of reducing TN exports to local waters.

- **Disconnecting Impervious Surfaces**

  One of the methods that can be used to reduce the amount of runoff from a development site is the disconnection of impervious surfaces. This BMP can be implemented in many ways, including:
  - Leaving a 2 or 3 feet wide pervious strip between the edge of a street and the beginning of driveways.
  - Using pervious pavement stones along strips of a parking lot and in sections of sidewalks.
  - Ensuring that rooftop drain water passes over a pervious strip before running onto a paved lot or into a stormwater collection system.

  These simple techniques are valuable methods for reducing both the quantity of stormwater leaving a project and improving the quality of that stormwater.

- **Other**

  Other areas in which City land use ordinances can have significant impacts on water quality are property setback requirements and lot size zoning. Excessive setback and lot size requirements have the impact of decreasing the compactness of development, which can increase the overall impervious area, decrease the applicability of some BMPs, and increase the use of automobile transportation. While large-lot zoning may be desirable for water quality impacts in some sensitive areas and for other reasons, it can negatively impact water quality when applied as a uniform standard.

References:

Low-Impact Development Design Strategies, An Integrated Design Approach, Prince George's County, Maryland Department of Environmental Resources, January 2000.

Better Site Design, An Assessment of the Better Site Design Principles for Communities Implementing Virginia's Chesapeake Bay Preservation Act, Center for Watershed Protection, Inc, Ellicot City, Maryland 21043.

Principles of Low-Impact Design

Conservation of Natural Areas

1. **Native Plant and Tree Conservation**: Conserve trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native plants. Wherever practical, manage community open space, street right-of-ways, parking lot islands, and other landscaped areas to promote natural vegetation.

2. **Minimized Clearing and Grading**: Clearing and grading of forests and native vegetation at a site should be limited to the minimum amount needed to build lots, allow access, and provide fire protection. A fixed portion of any community open space should be managed as protected green space in a consolidated manner.

Lot Development

3. **Open Space Design**: Promote open space development that incorporates smaller lot sizes to minimize total impervious area, reduce total construction costs, conserve natural areas, provide community recreational space, and promote watershed protection.

4. **Shorter Setbacks and Frontages:** Relax side yard setbacks and allow narrower frontages to reduce total road length in the community and overall site imperviousness. Relax front setback requirements to minimize driveway lengths and reduce overall lot imperviousness.

5. **Common Walkways:** Promote more flexible design standards for residential subdivision sidewalks. Where practical, consider locating sidewalks on only one side of the street and providing common walkways linking pedestrian areas.

6. **Shared Driveways**: Reduce overall lot imperviousness by promoting alternative driveway surfaces and shared driveways that connect two or more homes together.

Residential Streets and Parking Lots

7. **Narrower Streets**: Design residential streets for the minimum required pavement width needed to support travel lanes; on-street parking; and emergency, maintenance, and service vehicle access. These widths should be based on traffic volume.

8. **Shorter Streets**: Reduce the total length of residential streets by examining alternative street layouts to determine the best option for increasing the number of homes per unit length.

9. **Narrower Right-of-Way Widths**: Residential street right-of-way widths should reflect the minimum required to accommodate the travel-way, the sidewalk, and vegetated open channels. Utilities and storm drains should be located within the pavement section of the right-of-way wherever feasible.

10. **Smaller and Landscaped Cul-de-Sacs**: Minimize the number of residential street cul-de-sacs and incorporate landscaped areas to reduce their impervious cover. The radius of cul-de-sacs should be the minimum required to accommodate emergency and maintenance vehicles. Alternative turnarounds should be considered.

11. **Vegetated Open Channels:** Where density, topography, soils, and slope permit, vegetated open channels should be used in the street right-of-way to convey and treat stormwater runoff.

12. **Reduced Parking Ratios:** The required parking ratio governing a particular land use or activity should be enforced as both a maximum and a minimum in order to curb excess parking space construction. Existing parking ratios should be reviewed for conformance taking into account local and national experience to determine if lower ratios are warranted and feasible.

13. **Mass Transit and Shared Parking**: Parking codes should be revised to lower parking requirements where mass transit is available and enforceable shared parking arrangements are made.

14. **Less Parking Lot Imperviousness:** Reduce the overall imperviousness associated with parking lots by providing compact car spaces, minimizing stall dimensions, incorporating efficient parking lanes, and using pervious materials (see lattice paving stones in photo to right) in the spillover parking areas where possible.

15. **Structured Parking:** Provide meaningful incentives to encourage structured and shared parking to make it more economically viable.

16. **Treated Parking Lot Runoff**: Provide stormwater treatment for parking lot runoff using bioretention areas (see photos to right and below), filter strips, and/or other practices that can be integrated into required landscaping areas and traffic islands.

Site Design Resources

Conservation Design for Stormwater Management (1997). Delaware Department of Natural Resources and Environmental Control, Sediment and Stormwater Program, 89 Kings Highway, Dover, DE 19901, Phone: (302) 739-4411.

Conservation Design for Subdivisions: A Practical Guide to Creating Open Space Networks (1996) by Randal Arendt, American Planning Association, Planners Book Service, 122 S. Michigan Avenue, Suite 1600, Chicago, IL 60603, (312) 786-6344.

Low Impact Development Design Manual (1997), Low Impact Development Center, 3230 Bethany Lane, Suite 9, Ellicott City, MD 21042, (410) 418-8476.

Building Greener Neighborhoods: Trees as Part of the Plan (1995) by Jack Petit, Debra Bassert, and Cheryl Kollin, American Forests, PO Box 2000, Washington, DC 20013, (202) 667-3300.

The Wild Lawn Handbook: Alternatives to the Traditional Front Lawn (1995) by Steven Daniels.

Clearing and Grading: Strategies for Urban Watersheds (1995) by Kathleen Corish, Metropolitan Washington Council of Governments, Information Center, 777 North Capitol Street, NE, Suite 300, Washington DC, 20002, (202) 962-3256.

Site Planning for Urban Stream Protection (1995) by Thomas R. Schueler, Center for Watershed Protection, 8391 Main Street, Ellicott City, MD 21043, (410) 461-8323.

Design by Design (1992) by James W. Wentling and Lloyd Bookout, Urban Land Institute, 1025 Thomas Jefferson Street, NW, Suite 500 West, Washington, DC 20007, (800) 321-5011.

Best Development Practices: Doing the Right Thing and Making Money at the Same Time (1996) by Reid Ewing, American Planning Association, Planners Book Service, 122 S. Michigan Avenue, Suite 1600, Chicago, IL 60603, (312) 786-6344.

Flexible Parking Requirements (1984) b Thomas P. Smith, American Planning Association, Planners Book Service, 122 S. Michigan Avenue, Suite 1600, Chicago, IL 60603, (312) 786-6344.

The University of Washington Permeable Pavement Demonstration Project (1997) by Derek B. Booth, Jennifer Leavitt, and Kim Peterson, Center for Urban Water Resources Management, University of Washington, Civil and Environmental Engineering, Box 352700, Seattle, WA 98195. http://depts.washington.edu/cuwrm.

Design of Stormwater Filtering Systems (1996) by Richard A. Claytor and Thomas R. Schueler, Center for Watershed Protection, 8391 Main Street, Ellicott City, MD 21043, (410) 461-8323.

Watershed Determinants of Ecosystem Functioning (1996) by Richard R. Horner, Derek B. Booth, Amanda Azous, and Christopher W. May, (originally published in the conference proceedings of the Engineering Foundation conference, "Effects of Watershed Development and Management on Aquatic Ecosystems," August 4-9, 1996). Subscriber price = $5.00 (publication no. K12), Center for Urban Water Resources Management, University of Washington, Civil and Environmental Engineering, Box 352700, Seattle, WA 98195. http://depts.washington.edu/cuwrm.

8. Structural Best Management Practices

8.1 Use of Structural Best Management Practices

While much can be done by planning and land use control, when development occurs it will generally be necessary to design and construct one or more facilities for stormwater and Nitrogen export control. The above-described Site Planning BMPs are useful in controlling the generation of storm runoff and reducing the concentrations of TN in the runoff. Constructed BMPs may then be used to collect, direct, filter, and biologically treat the runoff. Appendix C of this manual contains Storm Water Technology Fact Sheets on many of the structural BMPs that may be used to control stormwater runoff and quality. Stormwater Permit applicants should use the design criteria given in those fact sheets, in the latest version of the North Carolina Stormwater Management Guidance Manual (North Carolina Cooperative Extension Service and NC DENR), in the Maryland Stormwater Design Manual (Maryland Department of the Environment), and the information given below in their design of structural BMPs.

8.2 Allowable BMPs and Nitrogen Reduction Factors

The following items are among the constructed BMPs that may be used to further reduce and control runoff and nitrogen export and that may be incorporated into a applicant's stormwater facility plan.

8.2.1 Wet Detention Ponds (WDP)

These are ponds designed to have a permanent water pool with a 3-foot minimum average depth and a temporary pool that retains the volume of runoff produced by the first 1-inch of rainfall for a period of 2 to 5 days. When WDPs are incorporated into a project's stormwater management plan there are several health, safety, and aesthetic issues that must be addressed by the plan, including:

- Since a WDP maintains a minimum depth of 3 feet or more, there is the safety concern associated drowning. In some cases, fencing may be required to exclude children from the pond. Because of the requirements for a low-sloped shelf at the edges of a WDP, the safety concerns can often be limited to the pond forebay and outlet.
- Insect breeding within the WDP may create health and nuisance concerns. The Craven County Health Department recommends stocking certain fish species to reduce the number of nuisance insects.
- WDPs often attract wildlife. In many situations that is a positive impact, but it also may become a nuisance. This is particularly a problem with respect to waterfowl and the accumulation of large amounts of fecal matter. In some areas there may be concerns about the attraction of dangerous wildlife.

- Water and wind move debris and trash into the WDP and cause unsightly conditions. Routine maintenance should include a regular cleaning schedule and cleaning after significant storm events.
- For a WDP to continue operating, it is necessary to remove accumulated sediments every two to three years. This operation usually requires large equipment and the safety and noise concerns associated with that equipment should be recognized.

For purposes of computing the Total Nitrogen export reduction due to the installation of a WDP designed to retain the runoff from the first 1" of rainfall, under normal antecedent moisture conditions, for a period of not less than 48 hours, a nitrogen export reduction of 25% may be assumed.

8.2.2 Stormwater Wetlands

A Stormwater Wetland is simply a WDP that has been designed to have longer water detention times and a shallower average depth. All of the health, safety, and aesthetic concerns for WDPs are relevant to Stormwater Wetlands. Despite their similarities, Stormwater Wetlands are generally more costly to design and construct than are Wet Detention Ponds. Much of the additional cost is related to the fact that much care is taken in developing a diverse, healthy, and ecologically stable wetland.

The health and safety issues listed in the above discussion of WDPs must also be addressed for stormwater wetlands.

For purposes of computing the Total Nitrogen export reduction due to the installation of a Stormwater Wetland designed to retain the runoff from the first 1" of rainfall, under normal antecedent moisture conditions, for a period of not less than 72 hours, a nitrogen export reduction of 40% may be assumed.

8.2.3 Extended Dry Detention Ponds

Dry Detention Ponds (DDPs) are a common stormwater management facility. When they are to be used for water quality purposes, the design criteria are modified to provide for longer detention times and for sediment trapping and removal. Extended DDPs are generally less expensive to construct and maintain than are Wet Detention Ponds and Stormwater Wetlands.

When a DDP or Extended DDP is incorporated into a stormwater management facility then the relevant health and safety issues must be addressed by the stormwater management plan.

For purposes of computing the Total Nitrogen export reduction due to the installation of an Extended DDP designed to retain the runoff from the first 1" of rainfall, under normal antecedent moisture conditions, for a period of not less than 48 hours, a nitrogen export reduction of 10% may be assumed.

8.2.4 Bioretention Areas (BAs)

Bioretention Areas use soils and vegetation to detain and reduce runoff volumes, and remove pollutants from storm water runoff. Runoff is conveyed as sheet flow to the BA, where it passes through a sand bed and into a vegetated shallow ponding area that exfiltrates the flow. Excess runoff is diverted away from the BA. BAs can take many forms and can be designed to fit a variety of site layouts. BAs are particularly suitable BMPs for median strips, parking lot islands, and swales where grading or excavation will already be occurring and there will be no additional environmental damage.

The aesthetic value of the BA is substantial, because several varieties of groundcover, bush, and tree species are suitable for different sections of the BA. The BA can provide shade and wind breaks, absorb noise, and improve the area's landscape. Strategic placement of BAs can significantly reduce costs by eliminating the need for extensive storm drainage pipe systems.

Limitations for site selection include avoiding areas with high water tables (< 6 ft below ground surface), unsuitable soils, or large slopes (> 20 percent). Some maintenance is recommended including periodic inspection of the overall condition and the health of vegetation, pruning, application of an alkaline product to counteract soil pH reduction by acidic storm water, and aesthetic maintenance such as weeding and replacing mulch.

Rain gardens are one particularly appropriate BA design for smaller scale areas such as commercial buildings or residential homes. Rain gardens consist of piping roof storm water drainage into a cistern that bleeds the water into a nearby vegetated area. Filtration through the vegetation and the soil removes pollutants from the water and reduces the impacts of the impervious roof area.

For purposes of computing the Total Nitrogen export reduction due to the installation of a Bioretention designed to fully retain the runoff from the first 1" of rainfall, under normal antecedent moisture conditions, a nitrogen export reduction of 30% may be assumed.

8.2.5 Riparian Buffers

A Riparian Buffer established and managed consistent with the NRBR (15A NCAC 2B. 0233) can be used as a nitrogen-reducing BMP. For purposes of computing the Total Nitrogen export reduction due to the establishment of a riparian buffer a nitrogen export reduction of 30% may be assumed for a project area not to exceed the area of the established riparian buffer. In order to qualify for the credit the stormwater management plan must demonstrate that runoff from the serviced project area will be supplied in a diffused manner to the edge of the riparian buffer.

8.2.6 Grassed Swales

Grassed Swales are shallow earthen channels covered with dense growths of a hardy grass. The major impacts of a grassed swale are to slow runoff, increase infiltration, and reduce the transport of solid particles to receiving waters.

For purposes of computing the Total Nitrogen export reduction due to the installation of a grassed swale designed to have a mean residence time of not less than 60 minutes for the runoff from the first 1" of rainfall, under normal antecedent moisture conditions, a nitrogen export reduction of 20% may be assumed.

8.2.7 Filter Strips

Filter Strips share many of the characteristics and concerns of the Bioretention Areas outlined above. They are gently sloping areas of natural vegetation that are designed to provide sheet flow throughout an area. They are used to separate runoff-producing areas from receiving waters and stormwater collection facilities. Runoff is evenly spread throughout the filter strip area allowing for infiltration, sediment and pollutant removal, and flow retardation.

For purposes of computing the Total Nitrogen export reduction due to the installation of a filter strip designed to have a mean residence time of not less than 60 minutes for the runoff from the first 1" of rainfall, under normal antecedent moisture conditions, a nitrogen export reduction of 20% may be assumed.

8.2.8 Sand Filters and other Infiltration Devices

Sand Filters and other Infiltration Devices capture stormwater runoff and allow it to infiltrate into the ground. They may be above or below ground structures with their design parameters being determined primarily from design runoff volumes, available space, and soil and groundwater conditions. Use is limited in areas with soils of low permeability and where the groundwater table is close to the ground surface. It is important to plan for maintenance, which often includes cleaning of sediment trapping forebays, stripping and replacement of sand materials, and vegetation management. Since this BMP depends on the rapid transfer of surface runoff into the ground, it cannot be used where there is a concern for contamination of groundwater drinking supplies.

For purposes of computing the Total Nitrogen export reduction due to the installation of a sand filters and other infiltration devices designed to fully retain the runoff from the first 1" of rainfall, under normal antecedent moisture conditions, and to allow subsurface drainage of that volume in not less than a 24-hour period, a nitrogen export reduction of 35% may be assumed.

8.2.9 Rain Barrels and Cisterns

Rain barrels and cisterns are low-cost, effective, and easily maintainable retention devices applicable to all types of development sites. They operate by retaining a predetermined volume of runoff from rooftops or other impervious areas. In order to receive credit as a nitrogen-reducing BMP the stormwater management plan must demonstrate effective long-term maintenance of the storage unit and an operational plan that empties the storage unit in not less than 2 days following a rainfall event and not more than 10 days.

For purposes of computing the Total Nitrogen export reduction due to the installation of a rain barrel or cistern, the discharge method and location must be considered. If the stored water is applied to a lawn, garden or other Bioretention area then a nitrogen export reduction percentage equal to 30% may be assumed. If the stored water is discharged to a grassy swale then a nitrogen export reduction equal to 15% may be assumed. If the stored water is discharged directly to a storm sewer, gutter, or other impervious device, then no nitrogen export reduction may be assumed.

8.2.10 Porous Pavement

Porous pavement is a special type of pavement that allows rain to pass through it, thereby reducing the runoff from a site and surrounding areas that drain to the pavement. In addition, porous pavement filters some pollutants from the runoff if it is properly maintained. Where appropriate, Stormwater Permit applicants should consider the use of porous pavement to reduce runoff and nitrogen export. Credit for nitrogen export reductions may be obtained for the use of porous pavement. In order for credit to be obtained the design and maintenance specifications of the BMP must be provided to the Stormwater Administrator along with scientific evidence of the degree of TN removal to be expected by the porous pavement system. The Stormwater Administrator may, at his discretion, seek approval of the nitrogen export reduction credit from the NC DENR/DWQ. If approved by NC DENR then the use of porous pavement may be incorporated into the stormwater facilities plan and the approved credit used in the nitrogen export calculations.

8.2.11 Proprietary BMPs

Proprietary BMPs take various forms and are typically designed to accommodate specific pollutant types or site limitations. One example is underground concrete structures for oil or solid separation for high impact land uses, such as City vehicle maintenance yards or industrial locations. Most propriety BMPs are designed for high pollutant removal efficiency, safety, and ease of access for maintenance purposes. Credit for nitrogen export reductions may be obtained for the use of custom designed and other proprietary BMPs. In order for credit to be obtained the design and maintenance specifications of the BMP must be provided to the Stormwater Administrator along with scientific evidence of the degree of TN removal to be expected from that BMP. The Stormwater

Administrator may, at his discretion, seek approval of the BMP nitrogen export reduction credit from the NC DENR/DWQ. If approved by NC DENR then the BMP may be incorporated into the stormwater facilities plan and the approved credit used in the nitrogen export calculations.

8.3 Including BMPS in nitrogen export computations

If more than one BMP is installed in series on a development, then the removal rate shall be determined through serial rather than additive calculations. For example, if a wet detention area discharges through a riparian buffer, then the removal rate shall be estimated to be 47.5 percent. The pond removes 25 percent of the nitrogen and discharges 75 percent to the buffer. The buffer then removes 30 percent of the remaining nitrogen. The total nitrogen removal is calculated as: 25% + (0.75 * 30%) = 47.5%.

8.4 Restrictive Covenant

The proper design, installation, and maintenance of stormwater facility plan is a condition under which the Stormwater Administrator can issue a City Stormwater Permit. This section of the manual set forth the requirements for the computation of total nitrogen export reductions expected to result from structural BMPs and the criteria under which the Stormwater Administrator may issue a City Stormwater Permit. The applicant's stormwater facility plan must specify the details of design, installation and maintenance of all structural BMPs in sufficient detail to ensure the Stormwater Administrator of their proper performance. In order to ensure that the facilities maintained in a development result in compliance with the plan presented in the application the applicant must execute the Covenant Agreement contained in Appendix C of this manual, or other legal instrument acceptable to the Stormwater Administrator, before a City Stormwater Permit may be issued.

8.5 References

Stormwater Management Guidance Manual, North Carolina Cooperative Extension Service and North Carolina Department of Environment, Health and Natural Resources, 1993.

Maryland Stormwater Design Manual, Maryland Department of the Environment, 1998.

Low-Impact Development Design Strategies, An Integrated Design Approach, Prince George's County, Maryland Department of Environmental Resources, January 2000.

9. Fees

9.1 Purpose of Fees

Stormwater plan review fees vary based on the size and complexity of the development. These fees are established to assist in financing the stormwater plan review process and, in some cases, inspection of stormwater management structures.

9.2 Stormwater Permit Fee Schedule

Type of Development or Activity	Disturbed Area	Standard Fee	Additional Fee
Residential-individual single family	<=1/2 acre	Exempt – no fee	
Residential-individual single family	>1/2 acre	$100 per acre or part thereof. $400 maximum.	
Residential – single family subdivision	>1/2 acre	$400	
Residential-multi family	>1/2 acre	$400	
Non-Residential	<=1/2 acre	Exempt – no fee	
Non-Residential	>1/2 acre	$400	
Review of application for minor variance	Any	$100	
Review of application for major variance	Any	$400	$250 per fact-finding meeting
Technical Review of Structural BMPs in Stormwater Plan	Each	$200	
As-Built Inspection	Each	$200	
Annual Inspection of Structural BMP	Each	$400	
Re-inspection Fee	Each	$400	

10. Duties of the Stormwater Administrator

10.1 Appointment of Stormwater Administrator

The New Bern City Manager shall appoint the Stormwater Administrator. It shall be the duty of the Stormwater Administrator to administer and enforce the provisions of the New Bern Stormwater Ordinance and the Stormwater Management Program. That responsibility includes all the duties presented in this section.

10.2 Riparian Buffer Program

It is the duty of the Stormwater Administrator to administer the City's Riparian Buffer Program as that program is described in Section 4 of this manual. Those duties include, but are not limited to, the following:

- Preparing a riparian buffer map and from time to time correcting and updating that map.
- Seeking to have the City's Riparian Buffer Program recognized as a delegated program under 15A NCAC 2B .0241.
- Ensuring, until such time as the City has been delegated the authority under NCAC 15A NCAC 2B .0241, that a City Stormwater Permit is not issued for any new and nonexempt development or activity that is proposed to take place within the first 50 feet adjacent to a waterbody that is shown on either the USGS topographic map or the NRCS Soil Survey maps unless the owner can show that the activity has been approved by DWQ. DWQ approval may consist of the following:
  - An Authorization Certificate that documents that DWQ has approved an allowable use such as a road crossing or utility line. A detailed list of allowable uses is included in Section 4 of this manual.
  - An opinion from DWQ that vested rights have been established for the proposed development activity.
  - A letter from DWQ documenting that a variance has been approved for the proposed development activity.
- Ensuring that all required riparian buffer areas are clearly identified on the site plans and specifications of the stormwater management facilities submitted in application for a City Stormwater Permit and that access to and maintenance of those areas is provided for under a maintenance covenant (see Appendix B).
- Preparing public information about the City's Riparian Buffer Program including the preparation of information that will assist in the operation of the City's Environmental Concerns Hotline.

- Seeking opportunities to protect and improve the City's riparian buffers. Examples of activities that the Stormwater Administrator may undertake in this area include:
  - Recommending that the City accept landowner donations of riparian lands and landowner grants of permanent environmental easements for riparian areas.
  - Recommending that the City purchase parcels that are deemed to be of particular value for stormwater control and water quality improvement.
  - Cooperating with agencies and foundations that may provide methods and funds for riparian protection and enhancement.
  - Using City personnel and equipment to perform improvements on the riparian areas of private properties where such improvements serve the public interests in stormwater control and water quality improvement and where the landowner has provided maintenance and environmental easements, guarantees of maintenance, and other assurances acceptable to the Stormwater Administrator.

10.3 Peak Discharge Calculations

The Stormwater Administrator has the responsibility to ensure that requirements presented in Section 5 of this manual are met before issuing a City Stormwater Permit for any new development exceeding ½ acre within the City's jurisdictional limits. To meet that responsibility the Stormwater Administrator shall:

- Review the information presented in each application for a City Stormwater Permit (see Appendix A: Forms SW-001, SW-006, and SW-007) to verify the accuracy of that information.
- Review all site plans and stormwater management plans submitted in support of a City Stormwater Permit and verify the technical adequacy of those plans.
- Ensure that all site plans, calculations, and other information requiring the seal and signature of a registered professional engineer have been properly executed.
- Consider, and grant or deny, petitions for variance from the requirements of controlling the peak discharge from the 1-year, 24-hour and the 10-year, 24-hour storms consistent with the criteria for variance presented in Section 5.
- Inspect constructed stormwater facilities to ensure that the as-built conditions are equivalent to the design included in the development's stormwater management plan.
- Ensure that the long-term maintenance requirements of all stormwater facilities covered under a City Stormwater Permit are incorporated into the development's stormwater management plan and that the plan is covered by and adhered to by the signing and recording of a restrictive maintenance covenant (Appendix B).
- Inspect, from time to time, developments operating under a City Stormwater Permit to ensure that the stormwater management facilities are properly

maintained and are performing their functions as specified in the development's stormwater management plan.

10.4 Nitrogen Export Calculations

The Stormwater Administrator has the responsibility to ensure that requirements are met as presented in Section 6 of this manual regarding the computation and documentation of the expected reductions in nitrogen exports that occur due to improved site planning and the use of best management practices. To meet that responsibility the Stormwater Administrator shall review the site plans and the nitrogen export calculations prepared by the applicant for a Stormwater Permit. No permit may be issued until the Stormwater Administrator is satisfied as to the technical accuracy of the submitted items and is satisfied that all the requirements of Section 6 have been met. To meet that responsibility the Stormwater Administration shall:

- Review and verify the accuracy of the information provided on forms SW-001, SW-002, and SW-003 (Appendix A) and supplemental submittals.
- Ensure that all required payments of Total Nitrogen Offset Fees have been made to the North Carolina Wetlands Restoration Program and to the City.
- Conduct an as-built inspection to ensure that the facilities and the areas that they service are equivalent to those described in the application and the stormwater management plan.

10.5 BMP Design Review

The design details of any Best Management Practices proposed as part of a development's stormwater management plan must be submitted in the Stormwater Permit application. Those details must be sufficient to determine the accuracy of the design parameters as they relate to stormwater detention and nitrogen removal. The site plan and BMP details must allow the Stormwater Administrator to determine, and the Stormwater Administrator shall verify:

- Areas to be drained to the BMP;
- Volume and geometry of the BMP;
- Inflow volume, peak outlet discharge, and mean hydraulic detention time under the 1 year, 24-hour and the 10-year, 24-hour design storms;
- Volumes and characteristics of filter materials, plant types and densities included in the design;
- Adequacy of outlet works and their operation, emergency spillways and other features effecting the BMPs operability and safety; and
- The signature and seal of a registered professional engineer on the BMP design plans and specifications.

A Stormwater Permit shall not be issued until the above information has been provided to the satisfaction of the Stormwater Administrator.

10.6 BMP Nitrogen Reduction Calculations

Whenever structural BMPs for nitrogen reduction are included in a proposed development's stormwater management plan, the Stormwater Administrator shall verify the accuracy of the applicant's calculation of the estimated nitrogen export reduction consistent with the methods and requirements of Sections 6 and 8 of this manual.

10.7 BMP Operation and Maintenance Plan Review

The Stormwater Administrator shall review the BMP operation and maintenance plan submitted by the applicant and shall determine the adequacy of that plan in providing and maintaining the design functions of the BMP.

10.8 BMP Inspections

It is the duty of the Stormwater Administrator to perform on-site inspections from time to time, but not less than annually, in order to verify the function of BMPs incorporated into a permitted development's stormwater management plan. Inspections shall include:

- Review of stormwater facility maintenance records since the last inspection;
- Observation of the drainage facilities to ensure that they are functionally equivalent to the facilities described on the permitting site plan and stormwater management plan; and
- Verification that all installed BMPs are in a condition to function in both the control of stormwater discharges and the reduction of nitrogen exports substantially as defined in the permitting stormwater management plan.

10.9 BMP Inventory

The Stormwater Administrator shall develop and maintain an inventory of BMPs that exist within the City's jurisdiction, that are installed under the City's Stormwater Permit program, or are otherwise developed in the City, including those installed and owned by the City. That inventory shall contain all the peak discharge and nitrogen export reduction information specified in Sections 5, 6, and 8 of this manual and will record summary information on the maintenance and inspection of each BMP.

10.10 Collection of Fees

The Stormwater Administrator shall collect all applicable fees as described in Section 9 of this manual.

10.11 Restrictive Covenants

Prior to issuing a City Stormwater Permit, the Stormwater Administrator shall verify that all required restrictive covenants have been signed and recorded.

10.12 Illegal Connections and Discharges Elimination Program

The City's stormwater collection system is vulnerable to receiving illegal discharges (even though the person responsible for the discharge may be unaware that it is illegal). Depending on their source, illegal discharges may convey pollutants such as nutrients, phenols, and metals to receiving waters. Table 3a identifies some potential flows to the stormwater collection system that may be allowable. Table 3b identifies some discharges that are not allowed.

Table 10a: Discharges that may be made to the stormwater collection system

Waterline Flushing	Landscape Irrigation	Diverted Stream Flows
Uncontaminated Rising Ground Water	Uncontaminated Ground Water Infiltration to stormwater collection system	Uncontaminated Pumped Ground Water
Discharges from potable water sources	Foundation Drains	Uncontaminated Air Conditioning Condensation
Irrigation Water	Springs	Water from Crawl Space Pumps
Footing Drains	Lawn Watering	Non-commercial Car Washing
Flows from Riparian Habitats and Wetlands	NPDES permitted discharges	Street wash water
Fire Fighting Emergency Activities	Wash Water from the Cleaning of Buildings	Dechlorinated backwash and draining associated with swimming pools

Table 10b: Types of Discharges that are not allowed to stormwater collection system

Dumping of oil, anti-freeze, paint, cleaning fluids	Commercial Car Wash	Industrial Discharges
Contaminated Foundation Drains	Cooling water unless no chemicals added and has NPDES permit	Washwaters from commercial / industrial activities
Sanitary Sewer Discharges	Septic Tank Discharges	Washing Machine Discharges
Chlorinated backwash and draining associated with swimming pools		

The Stormwater Administration is responsible for the administration of a program to detect and eliminate illegal connections to, and illegal discharges into, the City's stormwater system. To accomplish this directive the Administrator shall:

- Collect City Jurisdiction-wide information on the stormwater facilities and the potential for illegal discharges and illicit connections;
- Identify on maps of the City's hydrography and stormwater system the areas that are the most likely locations for illegal discharges;
- Prioritize areas of the City, not less than 10 percent of the City in each year beginning In 2002, in which to conduct dry weather field screening for illegal discharges;
- Complete field screening reports, and keep them on file for a minimum of 5 years, on all outfalls to the stormwater system in which dry weather flow is observed, documenting all of the elements specified in Table 10c;

Table 10c: Field Screening Report Information

General Information	Sheet Number Outfall ID Number Date Time Date, Time and Quantity of Last Rainfall Event	
Field Site Description	Location Type of Outfall Dominant Watershed Land Use(s)	
Visual Observations	Photograph Odor Color Clarity Floatables	Deposits/Stains Vegetation Condition Structural Condition Biological Flow Estimation
Sampling Analysis *	Temperature pH Nitrogen-Ammonia	Nitrogen-Nitrate/Nitrite Fluoride or Chlorine

* Analytical monitoring is required only if an obvious source of the dry weather flow cannot be determined through an investigation of the upstream stormwater collection system.

- Ensure that all detected illicit connections and illegal discharges are removed on a timely basis by following the notification and enforcement procedures specified in the City's Stormwater Ordinance;
- Maintain records of all compliance actions for a minimum of 5 years after complete removal of the illicit connection or illegal discharge;
- Maintain a map and related documentation that includes:
  - Points of identified illegal discharges,
  - Watershed boundaries of the outfalls where illegal discharges have been identified,
  - Summaries of the illegal discharges that have been identified that includes location, a description of pollutants(s) identified, and enforcement status.

The Stormwater Administration shall report to the Board of Aldermen and to the NC DENR/DWQ, at a minimum annually on or before October 30, on the illegal discharge elimination program. Those reports shall contain geographic information at three increasing levels of detail:

- The first, most cursory level is information that shall be collected for the entire jurisdiction. The associated requirements are discussed in this Section 10.13.
- The second level is a more detailed screening for high priority areas within the jurisdiction. The associated requirements are discussed in Section 10.14.
- The third level is a very detailed investigation that shall be done upon the discovery of an illegal discharge. The associated requirements are discussed in Section 10.15.

10.13 Jurisdiction-wide Screening for Illicit Discharges and Connections

The Stormwater Administrator shall compile jurisdiction-wide information about the City's stormwater facilities and shall present that information in a report and on maps on or before October 2002. The information to be mapped and reported shall include:

- Location of sanitary sewers in areas of the major stormwater collection systems and the location of areas that are not served by sanitary sewers;
- Waters that appear on the USDA – Natural Resources Conservation Service Soil Survey Maps and the U.S. Geological Survey 1:24,000 scale topographic maps;
- Land uses. Categories, at a minimum, should include undeveloped, residential, commercial, agriculture, industrial, institutional, publicly owned open space and others;
- Currently operating and known closed municipal landfills and other treatment, storage, and disposal facilities, including for hazardous materials;
- Major stormwater structural controls; and
- Known NPDES permitted discharges to the stormwater collection system.

Written descriptions should be provided for the map components as follows:

- A summary table of municipal waste facilities that includes the names of the facilities, the status (open/closed), the types, and addresses;
- A summary table of the NPDES permitted dischargers that includes the name of the permit holder, the address of the facility and permit number;
- A summary table of the major structural stormwater control structures that shows the type of structure, area served, party responsible for maintaining, and age of structure; and
- A summary table of publicly owned open space that identifies size, location, and primary function of each open area.

10.14 Mapping and Screening in High Priority Areas

As high priority areas are identified the Stormwater Administrator shall prepare maps of those areas. At a minimum the map that is produced shall include the following:

- Locations of the outfalls of any pipes from non-industrial areas that are greater than or equal to 36 inches diameter;
- Locations of the outfalls of any pipes from industrial areas that are greater than or equal to 12 inches diameter;
- Locations of drainage ditches that drain more than 50 acres of non-industrial lands; and
- Locations of drainage ditches that drain more than 2 acres of industrial lands.

The map must have an accompanying summary table listing the outfalls that meet the above criteria that includes Outfall ID numbers, geographic location, primary and supplemental classification of the receiving water, and use-support classification of the receiving water.

Each high priority area shall be dry weather field surveyed. The survey shall report on each outfall in the high priority area and where dry weather flows are identified a screening report shall be completed (See Appendix A, Form SW-020). Screening reports shall be kept on file for a minimum of five years. Where practicable, further field investigation should be used to identify the source of the dry weather flow. A summary of dry weather field surveys shall be incorporated into each annual report to the Board of Aldermen and the NC DWQ.

10.15 Identifying and Removing Illicit Discharges

When a dry weather discharge is identified, potential sources of that discharge should be investigated by systematic field investigation. That investigation may include:

- On-site investigation;
- Additional Chemical Analysis of the discharge;
- Flow Monitoring;
- Dye and/or Smoke Testing; and
- Television Inspection.

Whenever an Illicit discharge or connection is identified the Stormwater Administration shall proceed under the provisions and procedures of the City Ordinance to have the illicit discharge stopped and illicit connections removed. Records of all enforcement actions shall be kept for five years with the associated screening reports and field investigation materials.

The Stormwater Administrator shall prepare and maintain a map that includes the following:

- Points of identified illicit discharges; and
- Watershed boundaries of the outfalls where illicit discharges have been identified.

The map must have an accompanying table that summarizes the illicit discharges and/or connections that have been identified, a description of pollutant(s) identified, and a summary of enforcement and corrective actions. A summary of illicit discharge and connection investigations and enforcement/corrective actions shall be incorporated into each annual report to the Board of Aldermen and the NC DWQ.

10.16 BMP Retrofit Locations

The Stormwater Administrator shall establish a program to identify a minimum of 2 locations annually within existing developed areas that are suitable for retrofitting of stormwater BMPs for the reduction of nitrogen exports. Those retrofit opportunities shall demonstrate:

- The retrofit, if implemented, clearly has the potential to reduce nitrogen loading to the receiving water;
- The watershed is clearly contributing nitrogen loading above background levels;
- The landowner where the retrofit is proposed is willing to have the retrofit installed on his property. Securing the landowner's cooperation is one of the most important tasks for the local government, as this is often the most difficult aspect of implementing a retrofit;
- There is adequate space and access for the retrofit; and
- It is technically practical to install a retrofit at that location.

The Stormwater Administrator shall submit a report on or before October 30 of each year starting in 2001 to the Board of Aldermen and to the NC DENR/DWQ on the identified retrofit opportunities. That report shall contain, at a minimum, the following information about each retrofit opportunity:

- Location description, including directions from a major highway
- Type and description of retrofit opportunity
- Current property owner
- Is the property owner willing to cooperate?
- Land area available for retrofit (sq. ft)
- Accessibility to retrofit site
- Drainage area size (acres)
- Land use in drainage area (percent of each type of land use)
- Average slope in drainage area (%)

- Environmentally sensitive areas in drainage area (steep slopes, wetlands, riparian buffers, endangered/ threatened species habitat)
- Approximate annual nitrogen loading from drainage area (lbs/acre/year) *
- Potential nitrogen reduction (lbs/ac/yr)
- Estimated cost of retrofit
- Receiving water
- DWQ classification of receiving water
- Use support rating for receiving water
- Other important information relevant to the opportunity

The Stormwater Administrator shall update, on or before October 30 of each year starting in 2001, the City's Stormwater Facility maps to show the locations of each reported retrofit opportunity. That mapping shall be adequate to determine, at a minimum, the following information:

- Drainage area to retrofit opportunity site.
- Land uses within the drainage area.
- Location of retrofit opportunity.
- Property boundaries in the vicinity of the retrofit opportunity.
- Significant hydrography (as depicted on U.S.G.S. topographic maps and USDA-RCS Soil Survey maps).
- Roads.
- Environmentally sensitive areas (steep slopes, wetlands, riparian buffers, endangered/ threatened species habitat – where available).
- Publicly owned parks, recreational areas, and other open lands.

10.17 Public Education Program

The Stormwater Administration shall establish and administer a public education program for the purposes of:

- Improving the ways that New Bern citizens manage stormwater on their property;
- Informing citizens of the need to maintain and improve riparian buffers; and
- Soliciting assistance in the identification and removal of illicit connections and illegal discharges to the stormwater system.

The education program shall be consistent with that outlined for the NC Environmental Management Commission in the City's application for delegation of authority under the Neuse River Stormwater Rule. The Stormwater Administrator shall annually update the City's public education program and submit the revised programs plans to NC DENR/DWQ.

10.18 Reports to the NC DENR/DWQ and the City Board of Aldermen

The Stormwater Administrator shall prepare an annual report and submit that report to the Board of Aldermen and to the NC DENR/DWQ on or before October 30 or each year, beginning in October 2001. That report shall document, at a minimum:

- Acres of new development and impervious surface based on plan approvals.
- Acres of new development and impervious surface based on certificates of occupancy.
- Summary of BMPs implemented and the City's use of mitigation offset fees.
- Computed baseline and net change in nitrogen export from new development that year.
- Summary of maintenance activities conducted on BMPs.
- Summary of any BMP failures and how they were handled.
- Summary of results from jurisdictional review of planning issues.
- Elements of the City's Stormwater Public Education Program completed during the year.
- Summary of land and easements or other legal assurances acquired for riparian buffer protection.