City of Berea, KY

Stormwater Design Manual

Adopted on February 6th, 2024

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Section 1 Introduction

1.1 Purpose

The Clean Water Act (CWA) was passed in 1972 to help protect and restore the waters in our Nation's streams, rivers, and lakes. In the early 1990s, Phase I of the National Pollutant Discharge Elimination System (NPDES), under authority of the CWA, was passed to regulate stormwater management in large urban areas. Phase II regulations were developed and passed near the turn of the century requiring medium size cities meeting a certain population density and other criteria to develop stormwater initiatives to address pollution associated with urban runoff. In March of 2003, the City of Berea, and numerous other "Phase II Cities and Counties" submitted permit applications to the Kentucky Division of Water outlining a 5-year plan for addressing the Phase II requirements.

The City operates under the requirements of the KPDES general stormwater permit for small municipal separate storm sewer systems (MS4), issued to Berea in 2012. The City has six (6) minimum control measures that are required for implementation to be compliant with the MS4 stormwater permit and a five-year plan for addressing the requirements from DOW. Educating and involving the public on the impacts of urban runoff and how the public can help, managing the storm sewer infrastructure and addressing illicit discharges (discharge of pollution / polluted runoff), implementation of local regulatory authority, development of best management practices (BMPs) for construction and post-construction, and environmentally sensitive and responsible municipal operations. This manual was developed to support Phase II efforts in addressing Construction Site Runoff and Post Construction Runoff as required by the Phase II permit for Berea and numerous other Phase II communities. Additionally, several of the BMPs address municipal operations, and residential issues and can be used for sharing information with the public.

The KY DOW issued the statewide construction stormwater general permit, KYR10. This permit regulates stormwater discharges from construction sites that disturb an acre or more or less than an acre if part of a larger common plan of development. The City's stormwater management program incorporates the requirements of KYR10.

This manual presents a brief introduction to Stormwater Best Management Practices (BMPs). The following types of BMPs are addressed: Site Planning and Design Practices (SPD); Erosion Prevention Practices (EPP); Sediment Management Practices (SMP); Good Housekeeping Practices (GHP); BMPs for Residential and Homeowners (RHP), Stormwater Pollution Prevention Practices (SPP), and Stormwater Pollution Treatment Practices (PTP). The manual describes how BMPs can be selected and contains a series of fact sheets for each type of BMP to be used in the area.

The intent of the Stormwater Manual is to provide guidance on BMP selection, design, and implementation to plan submitters, reviewers, construction site operators, and site inspectors. There are also guidance materials for activities at commercial and industrial facilities.

The fact sheets are categorized, focused, and concise so that they may be used as quick references for design, inspection, and maintenance guidance. In this way, the fact sheets are designed to be stand-alone documents that may be distributed to facilitate discussion about design and/or implementation of the management practice. Many of the practices are considered structural practices in that they involve construction. However, several of the BMPs cover non-structural practices where normal activities are performed in a different manner with stormwater quality in mind. An example site design is used throughout the PTP (Post Treatment Practices) fact sheets to demonstrate their design.

1.2 Goals of the Program

This manual is a compilation of stormwater and floodplain management resources for design and construction of stormwater facilities in the City of Berea.

The City of Berea Stormwater Control Ordinance and the Land Management and Development Ordinance establish the legal framework for reviewing construction plans for stormwater management provisions and for requiring grading permits to control erosion and sedimentation.

This manual provides stormwater management regulations and technical guidelines for developments built within the City of Berea to prevent excessive erosion, to control stormwater runoff quantity, and to reduce pollutants in stormwater runoff to the maximum extent practicable.

1.3 How to Use This Manual

This manual is laid out in sections to aid the designer and site manager in finding pertinent information. Section 1 contains requirements, policies, and procedures. Section 2 contains construction site management techniques and tools. Section 3 contains fact sheets, such as the example below, on different BMPs that can be used on construction sites to manage stormwater and reduce pollutant discharges from construction sites and developed properties. The appendices & Fact Sheets can be found online at bereaky.gov/gis/storm-water-flooding; they contain term definitions, supplemental design information, examples, inspection report forms, and BMP operation and maintenance guidance for your use. Below you will find a breakdown of the provided information in the fact sheets.

As a municipality we strive to be proactive and welcome input from our citizens and developers. If there are suggested additions or corrections to our manual, please address those to the Codes & Planning Administrator or MS4 Coordinator for the City of Berea.

1

Berea, Kentucky
Stormwater Best Management Practices (BMPs)
Sediment Management Practices (SMPs)

Fact Sheet

3

4

PLANNING CONSIDERATIONS:

Design Life:

Acre Needed:

Minimal

6

7

CD

Target Pollutants 8

Significant ♦	Partial ◈	Low or Unknown ◇

Sediment ♦ Heavy Metals ◇ Nutrients ◇ Oxygen Demanding Substances ◇ Toxic Materials ◇

Description	This section provides a general overview of the BMP activity and introduces common niches where it can be applied.
Suitable Applications	Suitable applications direct the user to the general design limitations and site compatibility for the BMP. This section targets situations where the BMP will be most effective and points out situations where the BMP should not be implemented.
Approach	This section contains a suggested plan of action for implementing the BMP. It includes planning considerations respective to the type of materials, construction planning, and suggests BMPs to install in series in order to maximize benefits.
Installation Procedures	This section provides guidance for consideration in the design specific to constructing the BMP and often references the BMP drawing.
Maintenance	Although maintenance is often needed after a significant rain event, this section gives detailed guidance to users for the frequency of maintenance specific to each BMP design. Here, the user can find recommended maintenance techniques, frequency of in-active inspection checks, and key areas to maintain in order to maximize the design life of the BMP.

Legend

1. Logo of City or Agency
2. BMP Activity Title
3. BMP Activity Number
4. Planning Considerations:
   - Design Life – a quantitative measurement of the BMP's effective life given that proper maintenance procedures are followed
   - Estimated Unit Cost – general costs are categorized by Low, Medium, High
   - Monthly Maintenance – approximate frequency of maintenance
5. Typical Photo – photos are included as examples only, and are not meant for use in structural design
6. Suggested BMP symbol to place on ESPC drawings or design plans
7. Suggested BMP planning symbol to place on conceptual drawings or illustrations
8. Target Pollutants Table – likely pollutants to be removed by BMP practice

Section 2
Stormwater Management Requirements

2.1 Coordinating with Other Agencies

Many agencies may need input on development plans. The following table outlines the type of activity that may require approval or information from other agencies. A permit or application cannot be approved until documentation from those agencies has been received.

Table 2.1-1 Other Agency Contact Information (*Subject to change*)

Activity that may require information from another agency	Permit or approval	Contact
Disturbing an acre or more or disturbing less than one acre but part of a larger common development disturbing one acre or more.	KPDES General Permit	**Section Supervisor** Inventory and Data Management Section KPDES Branch, Kentucky Division of Water 14 Reilly Road, Frankfort Office Park Frankfort, Kentucky 40601
Improving the throat of a sinkhole or drilling a drywell	Class V Injection Well	**EPA Region 4** US EPA Ground Water/Drinking Water Branch 61 Forsyth St. Atlanta, GA 30308-8960 404-562-9307
Working in a stream or river	404 Permit	**U.S. Army Corps of Engineers** 3701 Bell Road Nashville, Tennessee 37214 Phone: 615-369-7500 Fax: 615- 369-7501
Stream crossings and riparian area development	401/Water quality certification	**Water Quality Certification** Section 14 Reilly Road Frankfort, KY 40601 Phone: 502-564-3410 Fax: 502-564-0111
Development in a floodplain or flood prone area	LOMR, CLOMR, Elevation Certificate, No-Rise Certification	**KY Energy & Environmental Cabinet** Floodplain Permits & Engineering 300 Sower Blvd Frankfort, KY 40601 Phone: 502-564-3410 Email: DOWFloodplain@ky.gov

2.2 Regulation Compliance

KYR10 – Construction General Permit

The Kentucky Division of Water issued a statewide construction stormwater general permit, KYR10. This permit regulates stormwater discharges from construction sites that disturb an acre or more or less than an acre, if part of a larger common plan of development. The intent of this manual is to provide guidance on BMP selection, design, and implementation to plan submitters, reviewers, construction site operators, and site inspectors.

2.3 Authorization and Title

As authorized by the current version of the City of Berea Stormwater Control Ordinance and adopted by reference by the City Council, the provisions of this document establish the regulations and technical guideline developed by the Codes and Planning Department to enforce the terms of the Land Management Development Ordinance.

In accordance with the Stormwater Control Ordinance and Land Management Development Ordinance, the provisions of this manual shall replace any previous regulations and shall apply to all land alteration and construction within the City of Berea.

This manual, upon approval, is certified by the City of Berea City Council for the requirements of the aforementioned Clean Water Act. Modifications and amendments to this manual shall be brought before the City Council for approval, unless superseded by state or federal law.

2.4 Legal Considerations

2.4.1 Caveat

This manual neither replaces the need for professional engineering judgement nor precludes the use of information not presented in this manual. The user assumes full responsibility for determining the appropriateness of applying the information presented herein. Careful consideration should be given to site specific conditions, project requirements and engineering experience to ensure that criteria and procedures are properly applied and adapted.

2.4.2 Disclaimer of Liability

The degree of flood protection intended to be provided by this manual is considered reasonable for regulatory purposes and is based on engineering and scientific methods of study. Larger floods may occur on occasion, or the flood height may be increased by man-made or natural causes. This manual does not imply that land outside the areas of special flood hazard or uses permitted within such areas will be free from flooding or flood damage. This manual and associated ordinance shall not create a liability on the part of, or a cause of action against, the City of Berea or any duly designated representative for any flood damages that result from reliance on this manual, or any administrative decision lawfully made thereunder.

The City of Berea is required under the NPDES Phase II regulations to develop a stormwater quality program. The goal of this program is to reduce stormwater pollutants in runoff from new development and redevelopment to the maximum extent practicable. The Stormwater Control Ordinance and this manual outline an approach to stormwater quality management that is reasonable and meets the maximum extent practicable, based upon the most current stormwater quality research. This manual shall not create liability on the part of, or cause of action against, the City of Berea or any duly designated representative, for damages that result from reliance on this manual, or any administrative decision lawfully made thereunder.

2.4.3 Severability

If any section, subsection, sentence, clause, phrase or portion of this manual is for any reason held invalid or unconstitutional by a court of competent jurisdiction, such portion shall be deemed a separate, distinct and independent provision, and such holding shall not affect the validity of the remaining portions of this manual.

2.4.4 Compatibility

If any provisions of these regulations and any provisions of law impose overlapping or contradictory requirements or contain any restrictions covering any of the same subject matter, that provision which is more restrictive or imposes higher standards or requirements shall govern. These regulations do not relieve the applicant from provisions of any other applicable codes, ordinances or regulations not explicitly repealed by these regulations.

2.4.5 Saving Provision

These regulations do not abate any enforcement actions in progress pursuant to violations committed under existing stormwater management regulations unless as expressly provided herein.

2.5 Policy and Permitting

2.5.1 Plan Review Process

The plan review process shall be completed as outlined in the City of Berea Land Management and Development Ordinance (LMDO) and applicable appendices, subject to the latest revision. In addition, a detention pond design checklist and thorough summary outlining the water quantity and water quality considerations of the designed system and its components shall be submitted so that a reviewer might discern the designers' considerations in the application chosen and its implications on the City of Berea stormwater infrastructure system as a whole.

2.5.2 Re-Approval Process

Changes made to any approved plans that directly affect the transgress of stormwater and the intended water quality and quantity function, shall be subject to a re-approval process at the requirements of current standards. Re-approval shall follow the plan review process as outlined in the City of Berea LMDO.

2.5.3 Land Disturbance Permit

A land disturbance permit is required for all land disturbing activities, as provided in the Berea Stormwater Control Ordinance. This manual section shall not preclude any provisions as provided in the ordinance.

2.5.4 Applicability

All land disturbing activity, regardless of size, shall be subject to a Land Disturbance Permit as outlined in the Stormwater Control Ordinance Section 34.203 Land Disturbance Activity, unless otherwise exempt.

2.5.5 Exemptions

The following activities are exempt from these regulations as outlined in the Stormwater Control Ordinance:

- Clearing or grading activities that are subject exclusively to State approval and enforcement under State law and regulations;
- Emergencies posing an immediate danger to life or property, substantial flood or fire hazards, or natural resources;
- Underground utility repairs in paved areas, home gardens, minor repairs, maintenance work, sign, telephone, and electric poles and other kinds of posts or poles;
- Agricultural operations required to adopt and implement an individual water quality plan pursuant to the requirements set forth in the Kentucky Agriculture Water Quality Act (KRS 224);
- Usual operations required to adopt and implement an individual agricultural quality plan pursuant to the requirements set forth in the Kentucky Agriculture Water Quality Act (KRS 224);
- Building improvements on existing residential dwellings (garages, additions, porches, etc.); or,
- Any other minor land disturbance activity determined on a case-by-case basis by the City of Berea that does not meet the specifications above.

2.6 Permitting Approval

2.6.1 Approval - Site Over 1 Acre or Under in Common Plan Development

A Land Disturbance Permit must be submitted to the city with the following:

- Completed application request;
- Notice of Intent (NOI), with proof of public notice;
- A perimeter control plan (PCP) and Erosion Prevention and Sediment Control Plan (EPSC);
- Stormwater Pollution Prevention Plan (SWPPP);
- Post-Construction Stormwater Pollution Prevention Plan;
- Any required maintenance agreement;
- Any necessary information or documentation as requested by the City; and
- All fees paid according to the established Permitting Fee Schedule.

The City has the authority to reject a land disturbance permit, should any of the items above be incomplete.

2.6.2 Approval - Sites Under 1 Acre and Not in Common Plan Development

A Land Disturbance Permit must be submitted to the city with the following:

- Completed application request;
- EPSC Land Disturbance form; and
- All fees paid according to the established Permitting Fee Schedule.

2.6.3 Non-Compliance

Instances of non-compliance shall be enforced by the authority provided by the City of Berea in the stormwater quality management ordinance. More information shall be found in Chapter 6: Enforcement of this manual.

2.6.4 Surety

The permittee shall be responsible for the installation, good repair and maintenance of all temporary and permanent EPSC BMPs, and ultimate removal of all temporary EPSC measures. Details related to the compliance with the section can be found in the Stormwater Control Ordinance section 34.204 Fiscal Surety.

2.6.5 Digital Submittal Requirements

Digital submittal of documents shall be via the City of Berea's online permitting portal unless otherwise requested by the City of Berea or its representative.

2.6.6 State and Federal Requirements

Compliance with this manual does not preclude the issuance of any applicable permits issued by the Kentucky Division of Water, U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, or any other regulatory authority.

The City of Berea may suspend or revoke a land disturbance permit immediately upon the notification that state or federal permits were denied or applicable permit applications were not made.

2.6.7 Compliance with KY Division of Water KYR10- General Construction Requirements

Complying with the requirements for a land disturbance permit does not exempt the permittee from obtaining coverage from the Kentucky Division of Water (KDOW) for construction activities that disturb sites over one acre. A Notice of Intent (NOi) must be obtained prior to land disturbance activities. A Stormwater Pollution Prevention Plan (SWPPP) shall be submitted with sites that are required to provide stormwater quality as defined in the next section. Requirements for SWPPPs can be found in the Stormwater Control Ordinance, Section 34.303. An example can be found in the latest edition of Best Management Practices (BMPs) for Controlling Erosion, Sediment, and Pollutant Runoff from Construction Sites manual published by the Kentucky Transportation Center Technology Transfer.

2.6.8 Compliance with KY Division of Water Floodplain Permitting

For sites or developments that are in the floodplain, permitting processes must be completed with Kentucky Division of Water (KDOW). Applicable permits shall be obtained, and regulations must be followed prior to land disturbance activities.

2.6.9 Plan Requirements

The following items shall be required in addition to any requirements as set forth in the Land Management Development Ordinance.

- Stormwater Pollution Prevention Plan (SWPPP)
- Construction Erosion Prevention Sediment Control (EPSC) Plan
- Post-Construction Storm Water Quality Management Plan
- In addition, a thorough summary outlining the water quantity and water quality considerations of the designed system and its components shall be submitted so that a reviewer might discern the designers considerations in the application chosen and its implications on the City of Berea stormwater infrastructure system as a whole.

For further detailed information related to the above-mentioned items, please consult the Stormwater Control Ordinance Section 34.206 Plan Requirements.

Section 3
Stormwater Design Standards

3.1 Stormwater Quantity Design

3.1.1 Water Quantity Considerations

Effective stormwater quantity design requires hydrological and hydraulic evaluation of the components (channels, storm sewers, stormwater inlets, detention/retention facilities, and water quality practices, etc.) of the stormwater drainage system of proposed development and redevelopment projects.

Peak Discharge Consideration - The basic standard for design of drainage systems will be to keep runoff characteristics after development as close as possible to the same level as existed prior to development. To achieve this objective, storm water detention/retention facilities will be required in most cases so that the peak discharge from the developed area shall not be greater than the peak discharge from undeveloped conditions.

The peak discharge shall be evaluated for four separate design storms using an approved storm water modeling procedure and approach.

The peak discharge for the undeveloped site shall be expressed as an instantaneous flow rate taking into consideration both the detained storm water and any storm water not captured.

Watershed Over-Compensation -The developer shall provide storm drainage improvements that will prevent the downstream flood level from being raised in a 10-year/24 hour, 25-year/24 hour and 100-year/24 hour storm considering both the instantaneous flow rate and flood elevations caused by the increased quantity of storm water from the development.

Where conditions and engineering calculations indicate benefit from storm water detention/retention facilities would not occur, they may be exempted from the development requirements in favor of channel improvements into or out of the site to improve flow if approved by the City of Berea. Calculations and analysis must be completed, submitted, and approved prior to this exception being granted.

There shall be no over-compensation within one watershed to allow for under-compensated storm water detention in any other watershed. Each watershed must be evaluated separately, and each watershed must meet the requirements as stipulated within the specifications.

Discharge Points -The discharge of the storm drainage facilities shall be into either a natural, well defined drainage path or into a man-made drainage way. For areas proposed to drain onto adjoining properties the drainage must be sheet flow. Point discharges onto adjoining property and public right of ways are prohibited unless the discharge point is into the actual, well-defined path or into a man-made

drainage way. Receiving channel capacity must be confirmed as adequate to convey at least the 5-year/1 hour storm discharge.

Public System Connection -Where an adequate public storm sewer system is available to or at the site boundary, the developer shall construct the drainage system to connect with such storm sewer system. If such a system is not available, the developer may be required to provide for the construction of necessary storm drainage facilities as may be required beyond the immediate boundaries of this subdivision in order to convey runoff to an acceptable point of discharge.

Design Storms -The developer shall provide storm drainage improvements that will prevent the downstream flood level from being raised in a 10-year/24 hour, 25-year/24 hour and 100-year/24 hour considering both the instantaneous flow rate and flood elevations caused by the increased quantity of storm water from the development. Where conditions and engineering calculations indicate benefit from storm water detention/retention facilities would not occur, they may be exempted from the development requirements in favor of channel improvements into or out of the site to improve flow on a case-by-case basis, as approved by the City of Berea. Calculations and analysis must be completed, submitted, and approved prior to this exception being granted.

H&H Methods - following hydrologic models are acceptable (*others with Engineer approval*):

- EPA Stormwater Management Model
- HEC-HMS
- Hydraflow (AutoCAD Civil 3D)
- CivilStorm (Bentley)
- StormCAD (Bentley)
- PondPack (Bentley)
- HydroCad

The Rational Method may be used to compute peak flows for drainage areas less than or equal to 100 acres when designing inlets, storm sewers, culverts, and channels.

3.1.2 Water Quantity Design Criteria

These criteria apply to storm water collection and conveyance system components such as curb inlets, catch basins, drainage swales, and channels.

Storm Sewers must carry 10-YR (10% probability) discharge without surcharging pipes. 100-YR (1% probability) storms must be conveyed through storm sewers with at least 1-FT freeboard in catch basins, manholes and other structures.

Drainage Channels must convey the 10-YR flow within the banks of the channel. The 100-YR flow must remain in the proposed drainage easement.

Curb Inlets or Catch Basins shall be placed at all depressions in such a manner as to prevent storm water from crossing the pavement and at other locations along the curb as necessary to limit the spreading of water onto the pavement to ½ the driving lane with a 5-year/1-hour storm. Curb inlets shall be Lexington-Fayette Urban County Government Type A, Type B, and Type C or Kentucky Department of Transportation Type A, and Type B Inlets. LFUCG Type D, cast iron inlets may be used as auxiliary devices

but may not be used as primary inlets. Storm water shall not be designed to cross over pavement.

Box Culverts Any drainage plan requiring the construction of box culverts shall include reinforced concrete designs from a professional structural engineer to withstand the anticipated loading.

Storm Manholes The storm drainage system shall be designed and constructed with sufficient junction boxes, manholes, and other appurtenances to provide ready access into any section for clean out and maintenance operations. Storm sewer manholes with improved inverts shall be required for pipes smaller than 60" in diameter at any change in direction or junction point and when distances between storm holes exceeds the 400'.

Drainage Swales and Channels When open channel flow in drainage swales is proposed as a method of storm water drainage (natural drainage swales, man-made drainage swales, or drainageways) the developer shall adhere to the following requirements:

- Drainage swales/channels must be of sufficient size to contain the peak runoff from the 25- YR (4% probability) storm.
- Swales/channels shall then be checked using the 100-YR (1% probability) storm. No structure flooding shall be induced by the 100-YR return design storm.
- Channel lining for swales shall be based on the allowable shear stress in accordance with Kentucky Department of Transportation criteria.
- Riprap shall not be permitted.
- The remaining bottom portions of the swales containing a low flow channel shall be sloped a minimum of 2% toward the channel.
- Paved bottoms may be required in swales with slopes less than 2%. The side slopes for paved bottom swales shall not be steeper than 2 to 1. The side slopes for all other swales shall not be steeper than 3 to 1.

Headwalls are required for any pipe within the proposed storm drainage system. Headwalls are also required for any existing pipe within the proposed subdivision. Headwalls pipes and of a configuration to prevent erosion and to reduce the Velocity. Minimum 3' high chain link fencing shall be required along the perimeter of the headwall if the distance from the pipe invert to the top of the headwall exceeds 3.5'. The fence shall consist of galvanized number 9-gauge wire with 2 ½ “diameter core posts. All headwalls designed shall have prior approval of the City of Berea.

Existing Structures The storm drainage system shall consider adjoining subdivision and drainage areas to ensure that the effects of existing structures and or drainage ways have been considered. If existing structures are to be utilized within the storm drainage system, then each existing structure shall meet the design requirements as set forth in the specifications. Additionally, the existing structure shall meet the materials and construction requirements as set forth in the specifications.

Sinkholes, either active or inactive, shall not be used for the storage or transfer of storm water. Sinkholes shall not be considered as a viable part of the storm drainage system. No structure shall be allowed beneath the sinkholes over topping elevation.

Springs either constantly flowing or wet weather flowing, shall be considered within the storm drainage system Spring boxes and piping shall be required to divert the ground water from the spring to the public system. This shall include existing springs and any spring discovered during construction.

Under no circumstances shall a spring be designed, constructed, or connected so that the flow is diverted into any public or private sanitary sewer system.

Private Systems A private storm drainage system shall be defined as a system installed by an individual (i.e., person or company) to fulfill drainage requirements not associated with systems, nor accepted by the City of Berea. The system shall follow the same drainage criteria as outlined in the specifications.

Detention Basins shall be defined as a normally dry, stormwater storage area with a principal spillway and an emergency spillway. Grass bottoms in detention basins shall be designed with minimum slopes of 2%. Basins with slopes less than 2% shall include low flow concrete channels designed with minimum slopes of 0.5% from the basin inlets to the outlets. The concrete channels shall have a minimum 6" depth with side slopes not to exceed 2 to 1 and shall be constructed in accordance with standards outlined by the Kentucky Transportation Cabinet. The bottoms and sides of detention basins shall be sodded. In certain instances, other techniques (underground vault storage) may be considered for private systems on a case-by-case basis, after it has been proven with engineering calculation that traditional detention designs are not feasible. Detention basins shall be excavated, and the principal spillways constructed prior to the construction of the water facilities, streets, and other storm drainage facilities. If basins are to be used as sediment basins, then the basin must be maintained on a regular and ongoing basis and all accumulated sediment must be removed prior to final vegetation. Changes or modifications to the drainage or detention facilities shall require prior approval by the City of Berea or their authorized agent, excluding routine maintenance. If the detention basin is used as a sediment basin, accumulated silt shall be removed prior to final revegetation.

Retention Basins shall be defined as a storm water storage area that permanently stores a predetermined pool of water. Retention basins shall be designed with drainage areas of sufficient size to ensure that the standing water will not stagnate or present health hazards. For the design of retention basins, the static ground water level must be taken into consideration for any and all utilities and the existence or possibilities of nearby basements. The minimum depth for retention basin shall be 3' as measured from the invert of the principal spillway to the invert of the emergency spillway. The storm water piping system used to feed the retention basin shall have the inflow inverts above the normal lake level as dictated by the invert elevation of the principal spillway. Trash racks and rock silt check dams shall be designed at each inflow source to the retention basin to prevent silt and or trash from entering into the permanent pool.

Construction in Flood Plain Detention and retention basins shall not be constructed within the 100-year flood plain as defined by the flood insurance rate maps for the City of Berea unless a permit for such construction is obtained from the Division of Water in Frankfort, Kentucky. In the absence of any such map, the engineer will be required to complete sufficient studies to determine the 100-year flood plain.

Principal Spillway Each detention or retention basin is required to have a principal spillway of a size dictated by the overall storm water detention/retention plan. The minimum size for principal spillways shall be 4" in diameter for either pipe or orifice. More than one principal spillway for each detention or retention basin may be required to ensure compliance with the method as outlined in the specifications. Gabion baskets shall not be used as spillways.

Emergency Spillway Each detention or retention basin must have an emergency spillway of sufficient size to discharge the 100-year/24-hour storm event discharge through the emergency spillway. Gabion baskets shall not be used as spillways.

Embankment Requirements If an earthen berm is used to construct a detention or retention basin, the minimum top width shall be 4', and the maximum slope of the embankment shall be three horizontal for each foot vertical rise. The embankment shall be constructed to a minimum 1' above the crest of the 100-year/24-hour storm event discharge through the emergency spillway.

Materials, construction methods, and methods of measurement shall conform to the latest edition of the Kentucky Department of Highways Bridge and Highways Specification Manual. Appropriate Kentucky Department of Transportation or Lexington Fayette Urban County Government standard drawings shall be included with all plans.

Erosion and Sediment Control Plan A complete and comprehensive erosion control plan (ECP) shall be prepared for each development submitted to the City of Berea. This erosion control plan shall be based on the criteria listed in the latest edition of the Manual of Best Management Practices for Construction Activities, prepared by the Kentucky Environmental and Public Protection Cabinet, specifically the Division of Conservation and the Division of Water. Erosion and sedimentation controls must be in place prior to the start of construction. The City of Berea reserves the right to inspect erosion and sediment controls and to order and require corrective action if the erosion and sediment controls do not meet approval. Plats and/or plans shall stipulate maintenance responsibilities for the erosion and sediment controls. This plan will contain at the very minimum:

- A discussion of the land-disturbing project including the purposes, location, and size of area to be disturbed.
- A discussion of the topography, land cover condition, soils, percent of impervious area and drainage patterns both before and after development.
- An identification of land use and cover conditions on adjacent property
- The beginning and completion dates of construction activities
- A discussion of construction sequencing, including clearing, grading, and revegetation activities as well as winter shutdowns.
- A listing of erosion and sediment control BMP’s, along with location, installation schedule and the logic for each
- A listing of storm water pollution control and groundwater protection BMPs to minimize pollution during construction (other than erosion) that might result from construction activities
- Current topography from field surveys or aerial photography showing pre-construction topography, drainage ways, property lines, utilities, limits of construction, and trees to be preserved.
- Finished grades, building locations, paved areas, construction entrances, access or haul roads, stockpile areas, and equipment storage areas
- All planned BMPs overlaid on the other features
- Areas that are not to be disturbed
- All hydrologic, hydraulic, structural, and geotechnical calculations

- An operation and maintenance (O & M) plan which provides a schedule for inspection, maintenance, and repair of BMP's during construction activities. A maintenance schedule shall also be provided to ensure that permanent measures such as vegetation are properly established after construction is complete.
- The name, address, and telephone number of the parties responsible for implementing the plan as well as the name of the construction supervisor who will be on-site at all times.

3.2 Stormwater Quality Design

3.2.1 Water Quality Design Criteria

Development within the City of Berea shall be conducted in a manner that minimizes stormwater pollution to the maximum extent practicable. Both structural and non-structural measures shall be used at sites to reduce the potential for stormwater pollution. Measures shall also be used in the long-term, after development ceases, to reduce the potential for stormwater pollution.

Treatment Standards- In urban areas, the first flush of runoff pollutants carries a heavy load of pollutants from impervious areas such as streets and parking areas that can negatively impact receiving streams by altering the water chemistry and water quality. Capturing the 'first flush' of pollutants is one way to improve water quality leaving the MS4. The goal of this stormwater runoff quality treatment standard is to establish the water quality volume (WQV) metric and provide treatment for the WQV. The term water quality volume is generally used to define the amount of storm water runoff from any given storm that should be captured and treated to remove a majority of storm water pollutants on an average annual basis. Therefore, daily precipitation records were retrieved from the UK Ag Weather Station between 1971 and 2010 for the Lexington Climatology station. The data was sorted by depth with zero or trace amounts removed, and the total number of rainfall events was multiplied by 0.8 to determine the event depth at which 80% of the total number of events were equal to or less than. The resulting depth was 0.6 inches.

The water quality volume (WQV) can then be calculated using the formula below:

$$WQ_v = \frac{(A * d)}{43560\ ft^2 * 12in}$$

Where: WQ_v = Water Quality Volume (in acre-feet)

A= Impervious Area (ft^2)

D= 0.6 (in)

The calculated WQV shall be treated in combination or alone, by management measure that are designed, built, and maintained to treat, filter, flocculate, infiltrate, screen, evapotranspiration, harvest, and reuse stormwater runoff, or otherwise manage the storm water runoff quality.

The intent of this section is to provide baseline standards for meeting water quality and water quantity standards. The following statements should be taken into consideration:

- Natural and aesthetically pleasing design practices are encouraged.
- Reduction of pollutants in stormwater runoff should be obtained to the maximum extent practicable.
- Improvements should be made to peak and volume controls for urban sources. Inadequate road culverts should be retrofitted.
- It is discouraged to intrude or develop in the floodplain, as to minimize property damage.
- Functional stormwater management systems should be designed to not result in excessive maintenance costs.

In developing the post construction stormwater quality program, the City considered numerous factors related to the environment and the type of development common to Berea. The City's drainage system, due to karst topography, is somewhat dependent on sinkholes and an underground network of streams. It is the City's goal to protect surface and shallow subsurface drainages while minimizing flooding and maintenance needs.

3.2.2 Stormwater Quality Criteria

Detention areas shall be sized based on the analysis of the prescribed rain events. The maximum discharge shall not exceed the pre-development discharge. Discharge to areas of known flooding hazard shall be subject to approval by the City Engineer.

Retention basins shall also be designed based on engineering analysis of the prescribed rain events. Computed high water elevation shall be recorded on the final plat. In areas where a proposed basin relates to an existing basin, the recorded high-water elevation shall be maintained. Sinkholes and dry wells shall be assumed as having no outflow for purposes of computation.

Redevelopment Standards Construction of water quality best management practices (BMPs) on redevelopment sites requires thoughtful and creative engineering. Water quality shall aim to achieve the same treatment standard as new development. In areas where the design engineer can demonstrate site limitations that do not provide for the treatment standard, water quality standards may be:

- A reduction in site impervious area, of no less than 20%. This information may be based on historical maps or other documentation to be provided by the design engineer or developer. Or,
- Implementation of stormwater quality BMPs for 20% of the site's impervious area, or
- A combination thereof.

The aim is not to achieve the lowest standard, but those of maximum ability. The designation of a lower standard aims to encourage development and allows discretion in approval of redevelopment.

Exemptions Development plans that are part of a regional stormwater plan may be exempt from quality standards. Water quality best management practices (BMPs) are not required for sites with less than 10 percent imperviousness. Exemptions shall be handled on a case-by-case basis by the City Engineer or duly authorized representative for off-site mitigation applicability for sites that are unable to meet water quality standards as previously defined.

Watershed Study Requirements for Exemptions To evaluate the effect on the receiving stream, the design engineer shall conduct a watershed study to determine the flood levels using the 2-year/24 Hour, 10-year/24 hour, 25-year/24 hour and 100-year/1 hour storms storm model. The study area of the receiving stream shall extend downstream to, but no more than, ten times the area of the proposed development.

As Built Certification and Inspections In an effort to ensure that water quality management plans approved by the City are installed and maintained per the approved plans, the City requires certifications of the correct initial installation of BMPs, referred to as as-built certifications, as well as an annual certification of ongoing maintenance and operation of each BMP. This section describes the as built certification requirements. Prior to obtaining a Certificate of Occupancy or approval of a Final Plat, a complete copy of the as-built drawing(s) with the appropriate professional certifications must be provided to City of Berea for approval along with the Post Construction Detention Pond Checklist, also bearing the seal of the appropriate professional. The as-built drawings will be compared to the approved stormwater management plan for any irregularities or non-conformance with the approved plans.

The as-built drawings must reflect the "as-constructed" condition of the development and must include sufficient information to demonstrate conformance with the approved stormwater management plan. The City has the authority to request the submittal of additional information with the as-built plan as necessary to allow a thorough review of the as-constructed conditions. Omission of any required items shall render the plans incomplete, and they will be returned to the applicant, or their engineer, so that they may be completed.

As-Built Certifications must include sufficient design information to show that stormwater BMPs will operate as approved. This must include the existing (or before site development) peak flow discharges, the after-site development peak flow discharges, and/or volumes of stormwater runoff based on the proposed site development, as well as all necessary computations used to determine the reduced peak flow rates for the design storms. Plats, easements, and BMP locations shown in the Operations and Maintenance Plan must be field checked by the property owner or developer prior to submitting the as-built certification to ensure that the field locations are approximately correct.

Structural Stormwater Quality Treatment

Stormwater quality treatment for Berea is defined as a goal of 80% total suspended solids (TSS) removal of the average annual post-development load. All stormwater BMPs shall be designed in a manner to minimize the need for maintenance and reduce the chances of failure, while maintaining the required function. The City's stormwater quality program requires new development and redevelopment to treat the runoff from up to the 85th percentile rain event in Berea to a load reduction goal of 80% of the average annual post-development total suspended solids (TSS) based upon data in the Nationwide Urban Runoff Program. Treatment may be achieved using a single treatment method, such as a wet pond, or by using a treatment train. A treatment train achieves 80% removal of TSS using a combination of pretreatment and/or treatment methods. It is presumed that a stormwater management system complies with this performance standard if:

- It is sized to capture and treat the prescribed water quality treatment volume, which is defined as the runoff volume resulting from the first 1.1 inches of rainfall from a site.
- Appropriate structural stormwater controls are selected, designed, constructed, and maintained according to the specific criteria in this Manual to provide an 80% TSS removal of the average annual post-development load.
- Runoff from hotspot land uses and activities is adequately treated and addressed

through the use of appropriate pre-treatment stormwater controls and pollution prevention practices.

Permanent BMPs should be proposed by the developer early in the planning stage of a project. For most projects, there will be no single BMP which addresses all the long-term stormwater quality problems. Instead, a multi-level strategy will be worked out with Planning Staff, which incorporates source controls, a series of on-site treatment controls, and community- wide treatment controls.

Choosing the Right Permanent Treatment Practice (PTP)

Table 3.3-1 (shown below) is an "at-a-glance" table of all of the Permanent Treatment Practices. Use Table 3.3-1 for initial screening of potential measures based upon site constraints such as drainage area, land use, pollutant removal needed, long term maintenance requirements, and surface area available. Once potential measures have been identified for a site, the design criteria herein shall be followed.

3.2.3 Design Caveat

If a new development or redevelopment project contributes runoff to downstream receiving waters that are impaired or infrastructure that does not have sufficient capacity, the City may, at its discretion, require stormwater management controls greater than the minimum required by this Manual, the Stormwater Control Ordinance, and the Land Management Development Ordinance.

3.3 Permanent Treatment Practices Decision Matrix

Structural BMP Category	BMP Type	Stormwater Treatment		Water Quality Performance		Drainage Area (ac)	Implementation Considerations			
		Water Quality	Water Quantity	TSS/Sediment Removal Rate	Hotspot Application		Residential	Commercial / Industrial	Unit Cost	Maintenance Burden
Fitration Systems	Surface Sand Filter	✓		80	✓	≤10		✓	Moderate	Moderate to High
	Underground Sand Filter	✓			✓	≤5		✓		
	Perimeter Sand Filter	✓			✓	≤2		✓		
	Organic Sand Filter	✓				≤5		✓		
	Pocket Sand Filter	✓			✓	≤5		✓		
	Bioretention	✓				≤5	✓	✓		Low
Open Channel System	Dry Swale	✓		90		≤5	✓	✓	Moderate	Low
	Wet Swale	✓		75		≤5		✓		
Stormwater Ponds	Micropool Extended Detention Pond	✓	✓	80		≥10	✓	✓	Low	Low
	Wet Pond	✓	✓			≥25	✓	✓		
	Wet Extended Detention Pond	✓	✓			≥25	✓	✓		
	Multiple Pond System	✓	✓			≥25	✓	✓		
	Pocket Pond	✓	✓			≥25	✓	✓		
Stormwater Wetlands	Shallow Wetland	✓		75		≥25	✓	✓	Moderate	Moderate to High
	Extended Detention Shallow Wetland	✓				≥25	✓	✓		
	Pond/Wetland System	✓				≥25	✓	✓		
	Pocket Wetland	✓				5-10	✓	✓		
Infiltration Systems[1]	Infiltration Trench	✓		90		≤5	✓	✓	Moderate to High	Moderate
	Infiltration Basin	✓						✓		
Water Quality Units	Hydrodynamic Separators	✓		TBD[2]	✓	Minimal		✓	Moderate	Moderate to High
	Filtration	✓			✓			✓		
	Continuous Deflection	✓			✓			✓		
Grease Management					✓			✓	Low	High
Extended Detention/Retention Dry Basins	Detention Basin with Gravity Outfall	✓	✓	60		≤75	✓	✓	Low	Low
	Retention Basin with Drywell Outfall	✓	✓				✓	✓		
Oil & Grease/Water Separator				40	✓			✓	Low	Moderate

Notes: 1) Limited application due to karst topography; 2) To be determined based upon City-approved testing

3.4 Permanent Treatment Practices (PTP) Fact Sheets

For simplicity, the Permanent Treatment Practices (PTP) Fact Sheets have been omitted from this manual and can instead be found online at bereaky.gov/gis/storm-water-flooding.

3.5 Green Infrastructure

Green infrastructure is an integrated systems approach to stormwater management that mimics natural processes that capture, infiltrate, evaporate, and/or reuse stormwater. It is an innovative approach to urban stormwater management that integrates stormwater controls throughout the urban landscape. The aim of green infrastructure is to design an urban environment that remains a functioning part of an ecosystem. Green infrastructure has the potential to impact stormwater by reducing volume runoff, reducing peaking discharge, and improving water quality for a variety of projects. A systems approach is taken, and multiple green infrastructure practices are often used in multiple ways on a development.

3.5.1 Common Practices & Methods

Common practices and methods of green infrastructure include:

- Permeable Pavement
- Vegetative Roofs/Walls
- Rain Barrels/Cisterns
- Tree Box Filters
- Vegetative Swales
- Rain Gardens
- Reduced Development Footprint
- Increased Site Landscaping

3.5.2 Implementation

Each practice has its own advantages and appropriate applications. When designing and planning these practices it is important to use site data to make the appropriate selection based on suitability, limitations, land area demands, relative costs, and maintenance. The Environmental Protection Agency provides research and guidance for green infrastructure methods related to design, implementation, operations, and maintenance.

Section 4
Erosion Prevention Sediment Control

4.1 Erosion Prevention Sediment Control

All development shall be conducted in a manner that minimizes soil erosion and resulting sedimentation. No sediment shall leave a construction site, under any circumstances, due to inadequately installed or maintained erosion control features. Site-specific variables such as topography, soil erodibility, stormwater management features, and vegetation shall be considered when developing a grading, drainage, and erosion control plan. The exposed area of any disturbed land shall be limited to the smallest practical area for the shortest period of time.

4.1.1 Applicability- All development or land disturbing activities in the City of Berea shall use erosion prevention sediment control (EPSC) practices.

4.1.2 Standards - Standards shall be compliant with the Kentucky Division of Water KYR10 General Construction permit.

4.1.3 Required Methods - Approved methods of erosion control can be found in the latest edition of Best Management Practices (BMPs) for Controlling Erosion, Sediment, and Pollutant Runoff from Construction Sites Manual published by the Kentucky Environmental and Public Protection Cabinet, specifically the Division of Conservation and the Division of Water.

4.1.4 Required Items -The following notes shall be required on all EPSC plans:

- As a minimum, all erosion prevention and sediment control practices will be constructed and maintained according to this manual, applicable ordinances, and as required by state and federal law.
- A copy of the approved EPSC plan shall be maintained at the project site at all times.
- Prior to commencing land-disturbing activities in any area not on the approved ESPC plan, the contractor shall submit a supplementary EPSC plan to the City of Berea for review and approval.
- All EPSC measures are to be installed prior to the first step in clearing and grading. The contractor is responsible for any additional erosion control measures necessary to prevent erosion and sedimentation on the site.
- The contractor shall inspect all erosion and sediment control devices at least once a week. The contractor shall perform any repairs or maintenance prior to the next storm event or as soon as practicable in order to ensure effective erosion and sediment control. Use of the Kentucky Construction Site Stormwater Inspection Report from the Kentucky Best Management Practices Manual is encouraged.
- The contractor shall maintain a record of all inspections and maintenance activities. This

record shall be made available to the City of Berea upon request.

4.1.5 Inspection of Sites

Inspection of sites is vital to the construction process to ensure compliance with federal, state and local regulations. At a minimum, the permittee shall conduct a self-inspection at the following stages:

- Completion of perimeter erosion and sediment controls;
- Completion of clearing and grubbing;
- Installation of temporary erosion controls;
- Completion of final grading and ground stabilization;
- Prior to fiscal security release;
- Monthly, after areas have been temporarily or permanently stabilized;
- Every 7 days, or every 14 days and after each rainfall event that exceeds 0.5 inches.

The City of Berea may increase or decrease the number of required inspections, as deemed necessary to ensure an effective SWPPP and shall have the right to enter the property of the permittee without notice.

The permittee shall prepare an inspection report after each self-inspection and shall keep copies at the job site at all times and may be required to fax or email the inspection report to the City of Berea, if deemed necessary. At a minimum, the inspection report shall include:

- The date,
- Time of day,
- Name of the person conducting the inspection,
- Company represented,
- Scope of the inspection,
- Major observations relating to the SWPPP and BMPs installed,
- Appropriate photographs, and
- Subsequent changes.

The City of Berea has the right to make regular inspections to ensure the validity of the inspection reports. All inspections shall be provided to the City of Berea in a digital format before a Certificate of Occupancy or fiscal surety is released. The permittee shall be self-policing and shall correct or remedy any EPSC measures that are not effective or functioning properly at all times during various phases of construction. All updates to EPSC measures shall be accurately noted in the SWPPP. The SWPPP must be updated throughout the construction project and available for on-site review. The permittee shall maintain a set of as-built drawings for all newly installed stormwater facilities.

4.1.6 Surety

The permittee shall be responsible for the installation, good repair, maintenance of all temporary and permanent EPSC BMPs, and removal of all temporary EPSC measures. Details related to the compliance with the section can be found in the Stormwater Control Ordinance Section 34.204.

4.1.7 Non-compliance

Instances of non-compliance shall be enforced by the authority provided by the City of Berea in the Stormwater Control Ordinance. More information shall be found in Chapter 6: Enforcement of this manual.

4.1.8 Contractor Training

A construction-site operator training program is required by the KPDES permit. As so, the City of Berea uses a one-on-one training model. Prior to any land disturbance activity, site operators shall be provided training related to the requirements of erosion control and development in an MS4 community. For sites that require a land disturbance permit, information will be provided during the permit application process. For sites that do not require a land disturbance permit, training shall be provided on site or in-office. All training will be completed in the manner that is best fit for each site.

4.2 Erosion Prevention Practices (EPP) Fact Sheets

For simplicity, the Erosion Prevention Practices (EPP) Fact Sheets have been omitted from this manual and can instead be found online at bereaky.gov/gis/storm-water-flooding.

4.3 Sediment Management Practices (SMP) Fact Sheets

For simplicity, the Sediment Management Practices (SMP) Fact Sheets have been omitted from this manual and can instead be found online at bereaky.gov/gis/storm-water-flooding.

Section 5

Post Construction Best Management Practices

5.1 Best Management Practices

The term post-construction best management practice (BMP) is a term used to define a group of design and construction techniques that are intended to address water quality and quantity issues after the construction of a project. Maintenance of post-construction BMPs is a significant issue.

5.1.1 Post-Construction Inspection

All storm sewer lines as installed or improved by new development and redevelopment shall be camera inspected at the Developer's expense and certified by the Design Engineer prior to acceptance by the City.

5.1.2 Maintenance Agreements

Any stormwater management facility or BMP that is not owned by the City of Berea will be required to have a maintenance agreement. Facility types and ownerships can be found in the Stormwater Control Ordinance, Section 34.304 Maintenance Agreements. The maintenance and proper operation of all privately owned stormwater management facilities, including nonstructural practices, shall be ensured through the creation of a formal and enforceable Maintenance Agreement, that must be approved by the City and recorded in the Office of the County Clerk as a deed restriction on the property, prior to final plan approval. This agreement will include any and all maintenance easements required to access and inspect the stormwater management practices and will outline the procedures and schedule to be followed to perform routine maintenance as necessary to ensure proper functioning of the stormwater management practice. Maintenance may include any vegetation clearing, mowing, and removing accumulated trash, debris, sediment pollutants and other forms of pollution. In addition, the legally binding agreement shall identify the parties responsible for the proper maintenance of all stormwater treatment practices and include plans for periodic inspections by the owners, or their designated agent, to ensure proper performance of the facility. The maintenance agreement shall be consistent with the terms and conditions of the Stormwater Management/BMP Facilities Operation and Maintenance Agreement.

5.1.3 Applicability

The applicant or owner of the site must execute a maintenance agreement that shall be binding on the owner, its administrators, executors, assigns, heirs, and any other successors in interest of land served by the stormwater management facility.

5.1.4 Requirements

Requirements for maintenance agreements shall be compliant with the Stormwater Control Ordinance Section 34.304, Item C: Requirements of Maintenance Agreements.

5.1.5 Authority to Inspect

The agreement shall provide for access to the facility at reasonable times for periodic inspection by the City of Berea, or their contractor or agent, to ensure that the facility is maintained in proper working condition to meet design standards and any other provisions established by the Stormwater Control Ordinance and to, if necessary, implement emergency repairs to protect the health, safety and welfare of the public.

5.1.6 Guarantee of Maintenance

Maintenance guarantees of privately-owned facilities shall be found in the Stormwater Control Ordinance Section 34.304, Item E, Maintenance Guarantees for Privately Owned Stormwater Facilities.

5.1.7 Non-compliance

Instances of non-compliance shall be enforced by the authority provided by the City of Berea in the Stormwater Control Ordinance. More information shall be found in Chapter 6: Enforcement of this manual.

A fee for BMP inspections may be assessed to an owner for a structural BMP which is not owner inspected, owner maintained, or where the owner has not maintained written records of inspection of the BMPs on the property. Unlawful acts can be read in entirety in the Stormwater Control Ordinance 34.304, Item G Unlawful Acts.

City of Berea, or their contractor or agent, is authorized to ensure that the facility is maintained in proper working condition to meet design standards and any other provisions established by the Stormwater Control Ordinance and to, if necessary, implement emergency repairs to protect the health, safety, and welfare of the public.

Section 6
Enforcement

6.1 Enforcement

Enforcement for non-compliance with any section of this manual shall be authorized for enforcement per the requirement of the Stormwater Control Ordinance, Section 34.400 Enforcement. These actions shall be carried out by the City of Berea or duly authorized representative.

6.1.1 Right-of-Entry

The City of Berea is granted right-of-entry to private property per the Stormwater Control Ordinance, Section 34.008 Authority and Right of Entry. The City has the right to determine and impose inspection schedules necessary to enforce stormwater management. Inspections may include, but are not limited to, the following:

- Initial inspection prior to stormwater management plan approval;
- Inspection prior to burial of any underground drainage structure;
- Erosion control inspections as necessary to ensure effective control of sediment prior to discharge to the municipal separate storm sewer system;
- Final inspection when all work, including installation of storm management facilities, has been completed; and
- Inspection to determine the effectiveness or operational viability of a permanent or long-term stormwater quality management practice.

6.1.2 Remediation Measures

Remedies available may include the following:

- Verbal warning
- Written warning
- Notice of Violation
- Stop Work Order
- Injunctive Relief
- Civil and Criminal Penalties

Enforcement measures shall be tiered unless the violation is that of a public nuisance or immediate danger. See the Stormwater Control Ordinance, Sections 34.401 through 34.407

6.1.3 Penalties

Violations of the provisions or failure of compliance with this manual shall constitute unlawful activity. Each day of non- compliance shall constitute a separate offense. See Stormwater Control Ordinance 34.403 Penalties for detailed measures.

APPENDIX A

Detention Pond Design Checklist
Detention Pond Post Construction Checklist

DETENTION POND DESIGN CHECKLIST*

Total Drainage Area Into Pond (acres)** = _____

Drainage Coefficient/Curve Number (pre-development) = _____

Drainage Coefficient/Curve Number (post-development) = _____

Pre-Development Runoff

10 year / 24-hour Q (cfs) = _____

25 year / 24-hour Q (cfs) = _____

100 year / 24-hour Q (cfs) = _____

Post Development Runoff

10 year / 24-hour Q (cfs) = _____

25 year / 24-hour Q (cfs) = _____

100 year / 24-hour Q (cfs) = _____

Pond Routing

Outflow

10 year / 24-hour Q = _____

25 year / 24-hour Q = _____

100 year / 24-hour Q = _____

Elevations

Top of Dam Elevation = _____

Water Surface Elevation: 10 year = _____ 25 year = _____ 100 year = _____

Emergency Spillway Elevation = _____

100 year / 24-Hour Storm Water Surface Elevation = _____

Water Quality

Water Quality Volume To Be Treated (acre-feet) = _____

$$WQ_v = \frac{(A * d)}{43560\ ft^2 * 12in}$$

Where: WQ_v = Water Quality Volume (acre-feet)

A = Impervious Area (ft^2)

D = 0.6 (in)

*This checklist to be accompanied by supporting drainage calculations and data.

**Include area outside of the development property if applicable.

DETENTION POND POST CONSTRUCTION CHECKLIST

Development: _____

Location: _____

Date and Time: _____

Inspector: _____

Item	Comments
I. Pond Volume and Pipe/Structure inverts **	
1. Inverts verified with submitted survey data	
2. Volume verified with submitted survey data	
II. Embankment and Emergency Spillway	
1. Vegetation and ground cover adequate?	
2. Embankment erosion present?	
3. Condition of embankment adequate?	
4. Condition of spillway adequate?	
5. Spillway material? (Concrete, riprap, grass)	
6. Slope protection or riprap failure	
III. Outlet Structure and Principal Spillway	
1. Pipe Material	
2. Low flow orifice obstructed/clear	
3. Weir Grate/Opening obstructed/clear	
4. Outlet structure condition - cracks, corrosion, etc.	
5. Silt in outlet structure or pipes?	
6. Pipe(s) condition	
7. Outfall channel condition	
IIII. Miscellaneous Comments	

** An as-built plan sheet with sufficient survey data annotated shall be submitted for volume and invert verifications, signed, and sealed by the engineer.

Design storm:	10-yr/24-hr	25-yr/24-hr	100-yr/24-hr
Design detention volume:	_____	_____	_____
Constructed detention volume:	_____	_____	_____